ALOS-2 Abstract

Hall 10A

Date	Session	No	Speaker	Research Title	Abstract
Jan. 23 (Tuesday) Hall 10A	Disaster and Earthquake 1	1	Ryoichi Furuta	Development of Automatic Landslides Recognition Algorithms using PALSAR-2 Single and Dual Polarization Data	In order to recognize landslides from PALSAR-2 imagery, we focus to conbination use of interferometric coherence and amplitude image in this research. We proposed MPC (multi-polarimetric coherence mapping) as a visualization technique for image interpretation of landslides. From MPC imagery, landslides scars can be visible than the original SAR imagery, was confirmed. Then we analyzed relationship of each bands of MPC imagery such as HH polarization imagery, VV polarization imagery, and HH-VV interferometric coherence imagery, to develop an automatic landslides recognition technique. On the other hands, polarimetric observation is lare in BOS and/or emergency observation, we also applied single polarization data for landslides recognition. We analyzed relationship of each bands of MTC imagery such as pre-landslides imagery, post-landslides imagery, and pre-and-post interferometric coherence imagery, to develop an automatic landslides recognition technique using single polarization images.
		2	Xuguo Shi	Landslides Monitoring with Phase Based and Amplitude Based Methods in the Three Gorges Areas with Multi-frequency Datasets	Landslides Monitoring with Phase Based and Amplitude Based Methods in the Three Gorges Areas with Multi-frequency Datasets Xuguo Shi1,2, Lu Zhang2,3, Mingsheng Liao2,3, Menghua Li2 1 Faculty of Information Engineering, China University of Geosciences, Wuhan 430074, P.R. China 2 State Key Laboratory of Information Engineering in Surveying, Mapping and Remote Sensing, Wuhan University, Wuhan 430079, P.R. China 3 Collaborative Innovation Center for Geospatial Technology, Wuhan 430079, P.R. China Landslides in mountainous areas generally have characteristics of concealment and paroxysm. This increases the difficulties of landslide prevention and early warnings. With development of new synthetic aperture radar (SAR) satellites and SAR image processing algorithms, the great potential of Space borne SAR in landslides monitoring have drawn great attentions. The Three Gorges Project (TGP) which was constructed from 1994 and completed in 2009 plays important roles in electricity generation, flood control, navigation and irrigation in China. The increased water level decreased the slope and reactivated some preexisted old landslides. According to investigations during 1992 and 1995, there were more than 500 old landslides and 36 unstable landslides. However, the number of unstable landslides significantly increased and about 311 of them were submerged into water since the water level reached to 175 m in 2008. Thus, it is important to closely monitor the state of these landslides. SAR images are sometimes the only useable geodetic data in vast inaccessible mountainous areas. To fully monitor and detect the landslides with different displacement rates, it is important to make full use of SAR images. There are phase information and amplitude information in complex single look SAR images corresponding phase based and amplitude based displacements monitoring methods. The phase based methods, such as interferometric synthetic aperture radar (InSAR), Persistent Scatterer InSAR (PSI) and Small Baseline Subset (SBAS), are very suitable for monitoring slow-moving landslides with precision of millimeters. Besides, split-bandwidth interferometry (SBI) making use of the upper and lower spectrum of SAR images can be used to measure large land displacements. This method can be applied when the coherence maintained at a high level. However, phase discontinuities caused by temporal decorrelation would make the phase based methods loss effect. On the other hand, the amplitude based methods such as pixel offset tracking which are more suitable for large displacement measurement with precision of more than 1/10 pixels. High correlations can hardly be kept in vegetated areas and point-like targets should be made full use to improve the reliability of measurements. One ALOS PALSAR dataset and two high resolution TerraSAR-X datasets were collected for landslide displacement detection and monitoring in Three Gorges area. Differential interferogram with short temporal baseline and perpendicular baseline were generated to investigate the potential active landslides by finding phase distortions. SBAS method with ALOS PALSAR datasets which is more suitable for rural scenarios landslides displacement monitroing was then used to obtain the deformation histories of active slow moving landslide. Point-like targets offset tracking method and azimuth and range SBI method were then employed to obtain the displacement of landslide with large displacements from high resolution TerraSAR-X datasets. By combining these different methods, it is possible to map all the location of active landslide. After we retrieved the time series deformations of landslide, triggering factors of landslide will be analyzed. Water level fluctuation and rainfall are identified as the most two important factors affecting the landslides in Three Gorges areas. Correlations between displacement and water level /rainfall will also be discussed.
		3	Hiroto Nagai	Toward robust and operational methods for rapid hazard awareness using PALSAR-2	PALSAR-2 has great potential for rapid hazard awareness which has been demonstrated on recent natural hazards. Some examples corresponding to the catastrophic earthquake-induced avalanche in Nepal, glacial lake outburst floods in Bhutan, hurricane-induced floods in Florida are presented to discuss how to realize robust and operational methods for hazardous response by means of a space-borne L-band SAR.
		4	Kuo-Lung Wang	Landslide displacement derivation and verification from ALOS/ALOS2 differential interferometry	Landslide hazard potential is a very important issue in Taiwan due to high percentage of mountainous area attacked by typhoon, rainfall and earthquake every year. In order to reduce the loss from landslide, engineering treatment and monitoring system are required. However, the cost for engineering works or monitoring system set up are extremely expensive. Thus a cost-effective method to select active landslides is the first priority before that. Differential interferometry of SAR data can derive displacement trend from few pairs of SAR scenes. Interferometry stacking can be performed in case more SAR scenes are collected. A study area in central Taiwan is selected for this study. ALOS data from 2007 to 2011 and ALOS2 data from 2015 to 2017 are collected for landslide displacement derivation. The combination DInSAR analysis are performed between ALOS and ALOS2. The results are compared with conventional survey method and total station monitoring. More than 10 years data are collected in this area and shows good coincidence with temporal DInSAR series. The analysis results from ALOS/ALOS2 data not only derived sliding velocity of active landslides but also can be provided for superior engineering works or monitoring system.
		5	Andrew Ford	Mass-Movement on the Black Ven landslide complex observed with PALSAR-2 InSAR	Black Ven is a significant landform with the Jurassic Coast World Heritage Site and Europe's largest coastal landslide complex. The temporal evolution of mass-movement at the site is observed with L-band InSAR using PALSAR-2 data and compares favourably with in-situ geodetic measurements. Multi-temporal airborne laser scanning (ALS) data is used to improve the removal topographic phase in this heavily vegetated and geomorphically active site.
		6	Zhe Su	Monitoring interseismic activity on the Ilan Plain (NE Taiwan) using Small Baseline PS-InSAR, GPS and leveling measurements: Partitioning from arc-continent collision and back-arc extension	The Ilan Plain, located in Northeast Taiwan, represents a transition zone between oblique collision (between the Luzon Arc and the Eurasian Plate) and back-arc extension (the Okinawa Trough). The mechanism for this abrupt transition from arc-continent collision to back-arc extension remains uncertain. We used Global Positioning System (GPS), leveling and multi-interferogram Small Baseline Persistent Scatterer Interferometry (SBAS-PSI) data to monitor the interseismic activity in the basin. A common reference site was selected for the datasets. The horizontal component of GPS and the vertical measurements of the leveling data were converted to line-of-sight (LOS) data and compared with the SBAS-PSI data. The comparison shows that the entire Ilan Plain is undergoing rapid subsidence at a maximum rate of -11 ± 2 mm/yr in the LOS direction. We speculate that vertical deformation and anthropogenic activity may play important roles in this deformation. We also performed a joint inversion modeling that combined both the DInSAR and Strong motion data to constrain the source model of the 2005 Ilan earthquake. The best fitting model predicts that the Sansing fault caused the 2005 Ilan earthquake. The observed transtensional deformation is dominated by the normal faulting with a minor left-lateral strike-slip motion. We compared our SBAS-PSI results with the long-term (2005 to 2009) groundwater level changes. The results indicate that although pumping-induced surface subsidence cannot be excluded, tectonic deformation, including rapid southward movement of the Ryukyu arc and back-arc extension of the Okinawa Trough, characterizes the opening of the Ilan Plain. Furthermore, a series of normal and left-lateral strike-slip transtensional faults, including the Choshui and Sansing faults, form a bookshelf-like structure that accommodates the extension of the plain. Although situated in a region of complex structural interactions, the Ilan Plain is primarily controlled by extension rather than by shortening. As the massive, pre-existing Philippines-Ryukyu island arc was pierced by the Philippine Sea Plate, the Ilan Plain formed as a remnant back-arc basin on the northeastern corner of Taiwan.
		7	MINGSHENG LIAO	Mapping Surface Displacements of Jiaju Landslide in Danba, China by Coherent Scatterer InSAR Analyses	Multi-temporal SAR interferometry (MT-InSAR) techniques such as the Persistent Scattterers InSAR (PSI) and the Small BAseline Subset (SBAS) method have been proven to be powerful tools for wide-area land surface deformation mapping at centimeter or millimeter accuracy. However, for landslide monitoring in rural mountainous areas, traditional PSI technique usually fails to achieve satisfactory results because limited number of persistent scatterer (PS) points can be detected due to vegetation coverage and complex terrain condition. Therefore, improving the density of reliable points is a key factor to achieve a better understanding of the landslides' extension and dynamics. Although the SBAS method focuses on the distributed scatterers (DSs) and is more suitable for nonurban environment, the multi-looking operation decreases the spatial resolutions and is likely to induce underestimation of displacements. In this study, inspired by the idea of SqueeSAR method, we developed a new method named coherent scatterer InSAR (CSI) to solve above problems by combining both PS and DS targets. Particularly, two key steps were implemented for the extraction of DS targets. One is the identification of statistically homogenous pixels (SHPs) based on the generalized likelihood ratio test (GLRT). The other is the estimation of optimal phase for each DS target using the phase linking method. DS points obtained in this way will be further processed following the standard PSI procedure together with PS points. To demonstrate the effectiveness of the proposed CSI method, we carried out a case study of Jiaju landslide deformation mapping with both L-band ALOS PALSAR and C-band ENVISAT ASAR data stacks. The results showed that the CSI method can detect coherent scatterers (including PS and DS) of more than 10 times of those by PSI and SABS. Consequently, the problem of displacement underestimation can be largely reduced in the CSI results compared with PSI and SABS. And it is noteworthy that the CSI result derived from PALSAR data is much better than that from ASAR data, showing the advantage of L-band SAR in rural area observation. Furthermore, according to validation with in-situ GPS measurements, sub-centimeter accuracy can be achieved by the proposed CSI method.
		8	Guijie WANG	InSAR-based early detection and monitoring on progressive regional landslides	Due to the influences of the regional topography and satellite attitude parameters, improving the monitoring accuracy of TS-InSAR in detecting the development of regional landslides has become an urgent problem to be solved. In this study, in order to improve the monitoring accuracy of TS-InSAR technology in the regional landslides survey in Wudongde hydropower reservoir, the Ground Local Incident Angle (GLIA) is put forward, which represents the comprehensive factors of the complex topography and the satellite attitude parameters at each ground point of investigation area, and the geometric model of GLIA is established.The synthetic aperture radar (SAR) datum from the ALOS satellite are used and the each point value of GLIA is calculated. And then, the relationships of the GLIA and the interference characteristics of TS-InSAR datum are analyzed, and the reliable interference areas are determined for the ALOS satellite datum in the study area. Finally, detailed times-series moving displacement information is mapped, potentially moving landslide areas and landslide hazard areas are located.and the Jinpingzi landslide, which is in active state, is investigated in detail. The monitoring accuracy based on TS-InSAR is compared with the Levelling investigation result.
		9	Urs Wegmuller	PALSAR-2 multi-mode interferometry and PALSAR-2 Persistent Scatterer Interferometry	Our RA4 project 1058 focuses on displacement mapping using DINSAR. Persistent Scatterer Interferometry, offset tracking and split-beam interferometry, covering applications as subsidence, landslides, glaciers, permafrost, volcanic, seismic and tectonic motion and infrastructure stability. In a first part of our presentation we address multi-resolution SAR interferometry, showing how PALSAR-2 data acquired in different modes (SM1, SM2, SM3, SPT, and ScanSAR) can be combined into interferograms. In a second part we document a „range anomaly“ that we observed in some PALSAR-2 SLC products. Offset tracking indicates for some SM3 mode SLC products anomalous „one-pixel-range“ offsets. Using split-beam techniques permits identifying the presence of such an anomaly and narrows down possible explanations of its origin. In a third part we demonstrate a Persistent Scatterer Processing done using a PALSAR-2 stack of 11 scenes.
		10	Rino Salman	Investigating active deformation of the northern Sumatran Fault	The Sumatran fault is a major right-lateral fault that accommodates trench-parallel component of the oblique convergence between the Australian/Indian and Sunda plates. The fault stretches the entire length of Sumatra and segmented into 19 segments where their locations are mostly close to densely populated cities, and may pose significant seismic threat to local communities. However, we know little about key seismic hazard parameters such as slip rate and locking depth for most of these segments. In this study, we start our investigation by systematically processing PALSAR-1 and PALSAR-2 InSAR data that cover the northern portion of the Sumatran fault. We hope to better understand interseismic deformation pattern of fault segments in northern Sumatra. In addition, we hope to see the postseismic deformation signals of the Mw 9.2 Sumatra-Andaman earthquake that occurred in the neighboring Sumatran subduction zone
		11	Jean-Luc Froger	Indian Ocean InSAR Observatory (OI2) – Routine Interferometric Monitoring of a Volcanic Island, the Piton de la Fournaise	The Indian Ocean InSAR Observatory (OI²) is a component of the French National Services of Volcanological Observations. The main goals of OI2 is the regular production and diffusion of ground displacement measurements, related to volcanic activity at Piton de la Fournaise, La Réunion Island. On this poster, we present some examples of scientific exploitation of the OI2 data, with results related to the recent activity at Piton de la Fournaise, and with a particular focus on the benefits provided by ALOS2 Spotlight data.
		12	Xiaohua Xu	Line-of-Sight deformation along the San Andreas Fault revealed from Sentinel-1 and ALOS-2	The main objective of our research is to measure strain rate along the San Andreas Fault System to an accuracy of better than 100 nanostrain/yr at high spatial resolution (5-10 km) and moderate temporal resolution (2-3 months) using a combination of GPS and InSAR measurements. This information is critical for developing time dependent maps of earthquake forecast. Continuous GPS (cGPS) measurements offer high accuracy (1 mm/yr) vector displacement time series but we show here that the GPS-derived strain rate maps have poor resolution at lengths scales less than about 40 km because of the sparse spatial coverage. The regular SAR acquisitions and accurate baseline control being provided by the Sentinel-1 and ALOS-2 satellites will eventually improve the InSAR accuracy to the 1-2 mm/yr level. This study develops the methods for achieving that objective by optimally combining InSAR data with velocities from cGPS time series. Deformation time-series constructed from this our study show broad-scale tectonic signals that are mainly well resolved by the horizontal GPS measurements. The maps also show numerous hydrologic signals, which we relate to human activities.
		13	Youichiro Takada	Aseismic fold growth in southwestern Taiwan detected by InSAR and GNSS	We detected rapid surface uplift in southwestern Taiwan by using ALOS and ALOS-2 data. We removed long wave-length noise from all the interferograms by GNSS velocity data. The uplift rate detected by ALOS/PALSAR is consistent with leveling data. With PALSAR-2 data, we also detected surface uplift following the 2016 Meinong earthquake (Mw 6.4), which shows similar uplift pattern to that before the earthquake. This rapid uplift would be caused by mud diapir widely distributed in this area.

ALOS-2 Abstract

Hall 10A

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Jan. 23 (Tuesday) Hall 10A	Disaster and Earthquake 1	14	Xiaopeng Tong	Surface creep rate and moment accumulation rate along the Aceh segment of the Sumatran fault from L-band ALOS-1/PALSAR-1 observations	We analyzed the InSAR data from the L-band ALOS-1/PALSAR-1 satellite to image the interseismic deformation and fault creep along the entire Sumatran fault. The coherence-based InSAR time-series method reveals clearly the aseismic creep on the Aceh segment along the Sumatran fault. The spatial extent of the aseismic creep extends for at least 100 km. An analysis of seismic moment accumulation rate shows that this creeping section accumulates moment at less than ½ of the rate of the surrounding locked segments.
		15	Eric Ostrom Lindsey	Coastal subsidence: monitoring the threat of sea-level rise to megacities in Asia	Due to a combination of over-exploitation of groundwater, oil and gas extraction, and natural sediment compaction processes, many of the most densely populated coastal areas of Southeast Asia are suffering from rapid subsidence. This process increases relative sea level, leading to flooding and increased susceptibility to tropical storms and typhoons. In combination with in situ data, high resolution InSAR-based maps of subsidence provide a key tool for understanding the relative contribution of these sources of subsidence, as well as a management tool to forecast and avoid further sinking. In this study we have selected six rapidly developing coastal cities in East and Southeast Asia - Singapore, Jakarta, Semarang (Indonesia), Yangon (Myanmar), Bangkok (Thailand), and Hong Kong and Macau (China) - in which to study their ongoing rates of subsidence. We combine InSAR data from a set of previous and current missions (ERS, ENVISAT, ALOS, ALOS-2, Sentinel-1, and TerraSAR-X) using a modified SBAS time series algorithm to build a complete picture of subsidence in these regions with high spatial and temporal resolution. We detect some subsidence rates exceeding 10 cm/yr; in these areas subsidence poses a significant threat to populations along the coastline. The results are compared with optical satellite images of coastline retreat and GPS observations of point subsidence rates to provide an independent validation of the observations. We compare the maximum subsidence rates to land-use maps and find that industrial areas are the most common sites of the highest rates of subsidence, indicating an anthropogenic source for the majority of the deformation.
		16	Masanobu Shimada	Surface deformation measurement for the Kumamoto Earthquake 2016 using the 3 DinSAR images observed by the ALOS-2/PALSAR-2	This paper measures a 3-D surface deformation map in the Aso area caused by the Kumamoto 2016 Earthquake of April 16 by means of the three passes Differential SAR interferometry technique for ALOS-2/PALSAR-2. We found two features in the map: large areal (several tens km scale) deformations along the Fudagawa faults crossing the Kumamoto prefecture, and several small (several km scale) but sharp deformations in the Aso city. The latter moves in the north direction at 3 m max. in the Uchinomaki Area. The deformation mechanism is under investigation through the ground measurement.
		17	Lei Zhang	Accurate retrieval of coseismic displacements by multi-temporal radar interferometry	Conventional Differential InSAR derived coseismic measurements are often perturbed by topography residuals, long wavelength orbital ramps, potential phase unwrapping errors and atmospheric artifacts. These nuisance components degrade the precision of the inverted fault slips. We outline here a multi-temporal InSAR (MT-InSAR) model to obtain precise coseismic deformation, with application to 6 October 2008 Dangxiong earthquake (Mw 6.3). By analyzing a set of pre-seismic SAR images and at least one post-seismic image our model can jointly estimate the coseismic deformation together with DEM and orbital errors, as well as pre-seismic (and post-seismic) deformation rate. The parameterization of orbital errors in our model is based primarily on its spatially smooth and temporally random characteristics. The joint model makes the separation of long wavelength orbital error, DEM residuals and seismic deformation possible. Furthermore, our method performs linear parameter estimation directly on the wrapped differential phases at arcs (coherent point pairs) implying no phase unwrapping procedure is needed, neither is a solution space searching needed. The slip due to Dangxiong earthquake inverted respectively based on MT-InSAR and DInSAR derived coseismic deformation shows up to 34cm differences indicating the topography error and distortions introduced by application of a best fitting orbital phase plane to the coseismic interferogram can bias the fault slip inversion.
		18	Matthew Garthwaite	Using ALOS and ALOS-2 InSAR to monitor volcanoes in the densely vegetated environment of Papua New Guinea	In this presentation we will validate surface deformation revealed by ALOS InSAR with GPS time series from the Rabaul Caldera in Papua New Guinea. We have found that L-band data from ALOS and ALOS-2 is essential for InSAR analysis in the highly vegetated environment of PNG in order to overcome temporal decorrelation that affects shorter wavelength SAR data such as Sentinel-1. We will also discuss our progress in applying ALOS and ALOS-2 InSAR to other high risk volcanoes in PNG with the ultimate goal of developing an operational remote volcano monitoring system for the country.
		19	Matthew Garthwaite	Australian experience of ALOS-2 interferometry	In this presentation we will show examples of the use of ALOS-2 InSAR data for measuring and modelling surface deformation caused by earthquakes and subsurface resource extraction in Australia. We will also show ALOS-2 results for the 3rd September 2017 North Korean Nuclear test, where L-band was essential for measuring a coherent deformation field.
		20	Tomohiro Narumi	Application of SAR/GNSS Positioning to Civil Infrastructure Monitoring	SAR is supposed to have a great potential for detecting wide-range deformation or construction management of civil infrastructure. We applied to that system for the measurement of the real construction site to verify the validity. It was confirmed that the observation had several problems such as permeability, backscattering, resolution, accuracy. In order to solve the problems, we introduced GNSS which can survey position more accurately, and simultaneous observation data from different types of satellites were synchronized complementally.
		21	Xiaoli Ding	Correction of Ionospheric Artifacts in Estimating Coseismic Deformation	It is well known that the ionosphere is inhomogeneous and anisotropic and its condition may vary with such factors as the solar radiation energy, cosmic rays and seismo-ionospheric coupling. Variation in the condition of the ionosphere can significantly degrade the accuracy of InSAR deformation measurements when SAR data from a repeat orbit sensor is used. The ionospheric effects are often misinterpreted as orbital errors or surface deformation in InSAR data processing. We apply ALOS PALSAR data from the 2009 southern Sumatra earthquake and 2010 Maule earthquake to evaluate the effects the ionospheric artifacts on the estimated earthquake slip distributions. The split-spectrum method is applied to mitigate the ionospheric disturbances on InSAR measurements. The results in the Sumatra case indicate that the estimated motion magnitude changes from Mw=6.8 to Mw=6.6 after the correction is applied. The results are in better agreement with those estimated from other approaches such as the USGS moment tensor solution. The results also confirm that both the estimated magnitudes and distributions of the slips of the Sumatra and Maule earthquakes can be improved after correcting the ionospheric artifacts using the proposed method.
		22	Fumitaka Ogushi	Monitoring of Sakurajima volcano, Japan, with PALSAR-1 and 2: from small displacements measurement to modelling and forecast	Sakurajima volcano caused the most powerful eruption in Japan in the last century (1914) and recently erupted in May 2017. Interferometric analysis exploited PALSAR1/2 data to obtain the caldera displacement over the observed period. Displacement evolution is derived to investigate its correlation with eruptions and diking. The time series, validated through GPS measurements, are used as basis for geophysical modelling of the magmatic chamber beneath the caldera. The evolution of the caldera deformation is considered to possibly exploit this measure for eruptions forecast.
		23	Michael Poland	Tracking global volcano deformation using ALOS-2	ALOS-2 PALSAR data have exceptional value for volcano surveillance due to their ability to penetrate vegetation, thus enhancing interferometric coherence. This capability is key for global volcano monitoring initiatives and facilitates reconnaissance efforts to detect surface deformation as well as focused study of specific volcanoes. Examples of volcanoes where ALOS-2 data have proven critical include Cordon Caulle (Chile), Kilauea (Hawaii), Masaya (Nicaragua), and Agung (Indonesia).
Jan. 24 (Wednesday) Hall 10A	Disaster and Earthquake 2	24	Paul R. Lundgren	Application of ALOS-2 InSAR to volcano deformation processes	We present a survey of volcano deformation from several areas in the circum-Pacific using ALOS-2 ScanSAR interferograms and InSAR time series analysis. Where possible we compare the ALOS-2 time series and deformation time series with InSAR time series from other sensors, including Sentinel-1, Radarsat-2, and COSMO-SkyMed. The primary areas we focus on are the southern and northern Andes in South America, Kamchatka, Russia, and the recent Agung volcano unrest in Bali, Indonesia. We use the ALOS-2 350 km wide-swath ScanSAR and apply split-spectrum ionospheric corrections.
		25	Taku Ozawa	Surface deformation around the Shinmoe-dake volcano detected by PALSAR-2/InSAR	Recent eruptions of the Shinmoe-dake volcano occurred in 2011 and 2017. Miyagi et al. (2014) analyzed TerraSAR-X and Radarsat-2 data acquired after the 2011 eruption and found continuous inflation in the crater. We analyzed PALSAR-2 data to investigate surface deformation after that. Although inflation had continued, it almost stopped in the end of 2016. After that, it changed to deflation, and eruptions occurred in October 2017. After the 2017 eruption, surface deformation was insignificant.
		26	Manabu Hashimoto	Ground deformation in the Kobe-Osaka areas during 22 years after the Kobe earthquake	We analyzed SAR data spanning 22 years after the Kobe earthquake to detect ground deformation in the Kobe and Osaka area. Substantial subsidence was found between two strands of active faults, one of which is the northeastern extension of coseismic fault, even 10 years after the event. However this subsidence is not recognized in ALOS-2 images, implying that significant post seismic deformation was over till 2014. We will discuss its possible mechanism in relation to the Kobe earthquake.
		27	Daisuke Sango	A study of predictive monitoring of landslides with ALOS-2 time series InSAR after 2016 Kumamoto earthquake	We tried a predictive monitoring of landslides using time series InSAR with 2016 Kumamoto earthquake. As a result, we detected a phenomenon which is considered as a sign of landslide that started from the rainy season after the earthquake. As a result of the field survey, it was confirmed that a sign of landslide actually occurred in the found area.
		28	Qiming Zeng	Mapping the Building Collapsed in Kumamoto Earthquake by using ALOS PALSAR Polarimetric Data	On Apr. 14 and 16, 2016, two strong Earthquake (respectively Ms. 6.2 and Ms. 7.3) stroke Kumamoto, Japan. We have collected ALOS PALSAR quad polarimetric data acquired pre-event and post event, and BJ 2 high resolution data. We mapped the building collapsed by several methods, (1)optimum polarimetric contrast enhansment;(2)combination of coherence and optimum polarimetric contrast enhansment; (3) combination of texture and generalized optimum polarimetric contrast enhansment. We validated the result with BJ 2 optical image visual interpretation and the information issued by Tokyo University and AIT. We found good agreement between them.
		29	Fumio Yamazaki	Extraction of collapsed buildings in the 2016 Kumamoto earthquake using multi-temporal PALSAR-2 data	The 2016 Kumamoto earthquakesbrought significant damage to buildings and infrastructures. Two sets of ALOS-2 PALSAR-2 images taken before and after the earthquake were used to extract the areas of building collapse. Three representative change indices, the co-event coherence, the ratio between the co- and pre-event coherence, and the z-factor combining the difference and correlation-coefficient, were adopted to extract the collapsed buildings in the central district of Mashiki Town. The result of building-by-building damage survey in the target area was used to investigate the most suitable threshold value for each index. The extracted results were evaluated by comparing with the reference data from filed surveys.
		30	Tomokazu Kobayashi	SAR-revealed slip partitioning on a bending fault plane for the 2014 Northern Nagano earthquake	By applying conventional InSAR and MAI techniques with ALOS-2 data for the 2014 Northern Nagano, central Japan, earthquake, a 3D ground displacement field has been successfully mapped. The full picture of the displacement field shows contraction in the northwest–southeast orientation, but northeastward movement along the fault strike direction is prevalent in the northeast of the fault. We inverted SAR data to construct a slip distribution model; the preferred model shows a combination of reverse and left-lateral fault motions on a bending east-dipping fault plane.
		31	Eric Fielding	Imaging Deformation of Large Earthquakes with ALOS-2 ScanSAR	We use standard and multiple-aperture InSAR analysis of ALOS-2 ScanSAR pairs to measure deformation in range and azimuth directions for large earthquakes, including corrections for ionosphere. This enables imaging of the three-dimensional surface deformation and better understanding of the fault slip at depth. Examples include 2018 Tehuantepec earthquake in Mexico, 2016 Kumamoto earthquake in Japan, and 2016 Kaikoura earthquake in New Zealand.
		32	Josaphat Tetuko Sri Sumantyo	Analysis of Coastal Sedimentation Impact to Jakarta Giant Sea Wall using PSI ALOS-2	Jakarta province proposed the Jakarta Giant Sea Wall (JGSW) as waterfront city for new urban settlement zone, and deep seaport for new economic zone along coastal area at northern Jakarta. This research investigated land deformation at eleven watersheds of West Java Mega Urban Region (WJMUR) using Persistent Scatterer Interferometry (PSI) technique of ALOS PALSAR data. The result shows that land deformation at study area, especially Bandung city area gives significant impact to sedimentation velocity along eastern Jakarta strait, especially deep seaport for 43 years later. This research recommends to evaluate land conservation at upland watersheds, and well management of artificial canals to reduce the impact of sedimentation at Jakarta strait, especially new depth seaport.
		33	Sang-Ho Yun	Global Rapid Damage and Flood Mapping using ALOS-2 SAR	The ARIA team at JPL and the Caltech used SAR data from JAXA's ALOS-2 satellites to produce damage/flood maps of the Amatrice earthquake in Italy in 2016, the 2016 Louisiana floods, and the 2017 Texas floods. On 28 August 2017, we generated and delivered the flood map using the PALSAR-2 imagery acquired on 27 August. The flood map, delivered to FEMA and the state of Texas, provided a synoptic cloud-free view of the flooded areas when no aircrafts were able to fly due to the strong wind, and no space-based optical sensors were able to image the area due to the lingering clouds of Harvey.
		34	Guang Liu	West China Glacier Surface Movement Monitoring with remote sensing data	Glacier activities are usually treated as one of the most sensitive indicators of the Earth's climate change, which has always been characterized by natural variability such as global annual air temperature and average precipitation. In this study we studied the glacier changes with PALSAR, TerraSAR and other remote sensing data, which reveals that satellite remote sensing observations offer the possibility to characterize these changes.

ALOS-2 Abstract

Hall 10A

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Jan. 24 (Wednesday) Hall 10A	Disaster and Earthquake 2	35	Hyung-Sup Jung	Three-dimensional Observation of the 2017 North Korea Nuclear Test Using Satellite Radar Offset-tracking	North Korea conducted the sixth nuclear test in Punggye-ri on 3 September 2017. An artificial earthquake of Mw 6.3 was reported near North Korea's Punggye-ri nuclear test site. Several minutes later, a second smaller earthquake followed the initial event, and it was characterized as a collapse of the cavity. The large and complex deformations related to the earthquakes occurred in the ground surface. It is very important to measure the artificial earthquake-related deformations, because it enables us to estimate the location, depth and cavity radius of the nuclear test. We observed the three-dimensional surface deformations related to the sixth North Korea nuclear test using the ascending and descending ALOS-2 PALSAR-2 radar offset-tracking. We used the multi-kernel offset tracking method to improve the precision of the offset-tracking measurement. The maximum deformation of more than 3 m was observed in the horizontal direction. We estimated the location, depth and cavity radius using the Mogi model. The estimated depth and cavity radius are about 600 m and about 52 m, respectively. The satellite offset-tracking observation will enable us for the North Korea nuclear test monitoring and characterization.
Jan. 25 (Thursday) Hall 10A	Oceanography and Coastal Zone	1	Kazuo Ouchi	A Novel Theory of Multi-Aperture Along-Track Interferometric Synthetic Aperture Radar for Measurements of Ocean Current Velocity Vector	In the present paper, a new theory is described for estimating the velocity vector of ocean currents by multi-aperture along-track (MA-ATI) synthetic aperture radar (SAR) using the conventional ATI SAR data. In the proposed method, the range velocity is computed by the standard ATI processing. The direction of motion is estimated from the forward- and backward-looking interferograms produced by the multi/sub-look processing of the raw data acquired by the fore and aft antennas. The theory is tested by numerical simulation, yielding satisfactory results.
		2	Leonid M. Mitnik	Oceanic dynamic phenomena and sea ice study in the Northwest Pacific Ocean and in the Eastern Arctic using L-band and C-band SAR and ancillary data	Research of the oceanic and atmospheric phenomena and processes in the Northwest Pacific based on ALOS-1/2 PALSAR, Sentinel-1A/-1B images and passive microwave data was conducted. The study was focused on the coastal zones and open areas of the Asian Marginal Seas and Eastern Arctic seas. Analysis of the ALOS-1/2 PALSAR, Sentinel-1A/-1B SAR, GCOM-W1 AMSR2, GPM and Meteor-M No. 2 data, Terra and Aqua MODIS and Landsat-8 visible and infrared images, the SST, chlorophyll-a concentration and weather maps, etc. allowed to reveal the signatures caused by oceanic fronts, current boundaries, eddies of different origin, internal waves, natural and anthropogenic films, sea ice as well as by the sea surface wind variations in the areas of atmospheric fronts, convective rolls and cells, atmospheric gravity waves, rain cells, etc.
		3	Osamu Isoguchi	Detection of ocean surface wave spatial pattern by PALSAR-2	Synthetic aperture radar (SAR) can detect information on ocean wind and wave with high spatial resolution (~10m). For c-band SARs, algorithms to retrieve wave parameters have been developed and the detected information is operationally assimilated into wave models. Also an algorithm for L-band SAR has been developed using PALSAR/PALSAR-2. Recently these algorithms were applied to SAR images to detect the spatial pattern of wave fields. Their spatial information gives a detailed description of waves near the coast, which can be achieved by only high resolution SAR data. They are also used to estimate bathymetry near the coast using information on wavelength changes. Based on the algorithm, we detect spatial pattern of ocean surface wave field using PASLAR-2 Ultra fine-Beam Single (UBS) data. First, a FFT is applied to the sub-images to calculate a 2D SAR spectrum. Dominant wave direction (DWD) and period (DWP) are estimated from the spectrum peak. A significant wave height (SWH) is estimated from the integration of the spectrum using the empirical algorithm. The detected 2D wave fields are compared with in-situ buoy data from Nationwide Ocean Wave information network for Ports and HArbourS (NOWPHAS) operated by Ports and Harbours Bureau, Ministry of Land, Infrastructure, Transport, and Tourism (MLIT) and Costal Wave Model (CWM) operated by Japan Meteorology Agency (JMA). Although their large spatial distribution is overall consistent with each other, there are some discrepancies in terms of absolute values and fine spatial structure, which might be related to wind field. We also tried to detect wave patterns affected by a strong typhoon and over strong currents to aim to investigate the current-wave interaction.
		4	Teruhisa Komatsu	MAPPING AQUACULTURE FACILITIES IN SANRIKU COAST USING ALOS-2 FOR SUSTAINABLE DEVELOPMENT	Coastal ecosystems such salt marshes, mangrove, seagrass and seaweed beds, and coral reefs provide important ecosystem services for supporting human welfare. On the other hand, human population are concentrating on land near the coast and causing environmental deterioration all over the world. The world bank estimated that three quarters of the world population will live within 100 km from the coast till 2025 and threaten coastal ecosystems (World Bank, 2003). In Agenda 21 and SDGs, it was agreed to perform an action for integrated management and sustainable development of coastal areas. Coastal ecosystems form productive ecotones between land and the sea and indispensable habitats for many organisms. Thus, it is needed to conserve them. Recently, aquaculture production is increasing in the world corresponding to increase in the world population. However, aquacultures have sometimes degraded natural coastal environments by covering coastal habitats and/or organic pollution through feeding for fin fishes or feces of cultured shells. For sustainable development of coastal waters, it is necessary to manage aquaculture facilities in an environmental capacity which is within a healthy and sustainable level and from a point of view of marine spatial planning. To achieve these objectives, we need to establish database and information networks to collect, share and disseminate data of aquaculture facilities to manage coastal zones (Komatsu et al., 2012). In Japan, aquaculture facilities in coastal areas are deployed in a common fishery right area designated and permitted by a prefectural governor. The common fishery right area is only waters where fishermen belonging to a fishermen's cooperative near the area can use exclusively for aquaculture or other permitted coastal fisheries under common fishery rights. Although the fishermen's cooperative manages the number and places of aquaculture facilities on behalf of a prefectural government, its secretary office doesn't map the facilities. Some researches try to detect the actual situation of aquaculture facilities using satellite remote sensing (e.g. Komatsu et al., 2002; Sugimoto et al., 2013; Won et at al., 2013). From these studies, large-sized aquaculture facilities are detected. However, typical types of small-sized aquaculture facilities used in Japan are not successfully detected. In Sanriku Coast, a lot of small-size aquaculture facilities such as oyster, scallops, sea pineapple and seaweed are deployed. Images obtained by PLASAR-2 on ALOS2 have high spatial resolutions for detecting objects on the sea surface, where clouds prevent from observations, without an influence of clouds. This study aimed to detect aquaculture facilities using PALSAR-2 on ALOS2 in Sanriku Coast where aquacultures are very active, and develop suitable observation methods to detect and map aquaculture facilities. In addition, we monitored the recovery of aquaculture facilities from the huge tsunami on 11 March 2011, which crashed all aquaculture facilities there. We used single polarization, dual polarization and full polarization data and compared their performance for detecting the facilities.
		5	Tomohito Asaka	Sand and rock coast detection method using ALOS-2/PALSAR-2 data	ALOS-2/PALSAR-2 data is expected to continue updating the data archives related to national land and infrastructure information. In this study, we aimed to evaluate ALOS-2/PALSAR-2 data observed with quad (HH+HV+VH+VV) polarization mode for sandy and rock coast detection. We applied the canny edge detection algorithm to detect boundary between sandy or rock coast and sea area in the ALOS-2/PALSAR-2 image.
		6	Kyung-Ae Park	Application of PALSAR-2 SAR Winds to Understanding of Air-Sea Interaction and Ecosystem Response	Sea surface wind is one of the important factors in the study of waves, currents, ocean circulation, and atmosphere-ocean interaction, and provides us with a comprehensive understanding of complex marine phenomena. As the importance of the coastal use increases in many respects, accurate calculation of the high-resolution coastal wind field becomes increasingly important. When the wind blows in the outer sea and approaches the coast, the wind field is transformed by the complex coastline, scattered islands and shallow water depth. The change in wind field plays an important role not only in physical process but also in marine biological processes. In this study, we calculated the wind fields from ALOS-2 SAR data and compared the accuracy with the Korean Meteorological Administration (KMA) ocean meteorological buoy data around the Korean peninsula. Land masking was performed using Shuttle Radar Topography Mission (SRTM) Digital Elevation Model (DEM) data. In order to eliminate the influence of the double scattering of ship on wind field, ship removal process was performed using adaptive threshold method, and to remove speckle noise in the SAR data itself, we performed a preprocessing that set up a moving window and apply an ensemble average. To understand the ecosystem impact of the coastal wind field, we collected the chlorophyll-a concentration data of COMS / GOCI and analyzed short-term variations of chlorophyll-a concentration by wind field. In addition, the air-sea interaction mechanism is presented by analyzing the stability change in marine-atmospheric boundary layer which varies with the sea surface temperature. Lastly, we present response of ecosystem due to the wind field and discuss its potential causes.

ALOS-2 Abstract

Conference Room 10A

Date	Session	No	Speaker	Research Title	Abstract
Jan. 22 (Monday) Conference Room 10A	Poster Session	1	Marina Lebedeva	Application of the ALOS-2/PALSAR-2 data for research of contemporary deformations of the Baikal rift system	PALSAR-2 dataset allowed us to continue studies of the surface tectonic deformations located in junction zone of sublatitudinal Mondy basin, and submeridional Khubsugul basin (the southwest part of Baikal rift system). New indications of landslide processes near Kazankan station of the Baikal-Amur mainline (BAM) and surface deformations located in east part of the Muyakan basin (the northeast part of Baikal rift system). Our investigation also focuses at the manifestation of the consequences of the earthquake swarm that have occurred at 2014-2017 on Muyakan ridge.
		2	Maryam Pourshamsi	A Machine Learning Approach to Polarimetry and LiDAR Data Fusion for Estimation of Tropical Forest Canopy Height Using UAVSAR and LVIS	This study investigates the benefits of integrating radar polarimetric variables with LiDAR measurements using Support Vector Machine (SVM) approach in order to obtain improved forest canopy height estimates. Multiple polarimeric variables are required as an input in order to ensure consistent height retrieval performance across a broad range of tree heights. We train the SVM with LiDAR samples using the NASA's LVIS and different polarimterc variables including entropy (H), anisotropy (A), alpha (α) extracted from the H/A/α decomposition and the full polarimetry channels (HH, HV, VH and VV), using ALOS-2 datasets for a small subset, imaged by the ALOS-2. The trained SVM will be applied to the rest of ALOS-2 image using the same variables but excluding the LiDAR samples. The development and test of such approach based on integration between radar polarimetry and LiDAR is in particular high demand as the NASA's forthcoming Global Ecosystem Dynamics Investigation (GEDI) datasets with the launch date in early 2019 will be available soon. GEDI uses a sampling system (25 m nominal footprint, 60 m space along-track and ~500 m space cross-track). In order to better quantify Earth's forest structural parameters, a combination of GEDI footprints with radar missions will be paramount.
		3	Ana Maria Pacheco Pascagaza	The use of multi-frequency SAR data for assessing forest degradation.	Forest degradation is a serious problem that is significantly contributing to greenhouse emissions, but quantifying their carbon stocks and emissions is still challenging. SAR data can be very promising for monitoring forest degradation considering its sensitivity to above ground biomass and forest structure. Our results shows the potential of multi-frequency SAR data: Alos 2, Sentinel 1 and TanDEM-X, in combination with field data to classify different levels of degradation due to selective logging and gold mining. Methods include the use of support vector machine for the multi-frequency data classification.
		4	Polyanna da Conceiç ão Bispo	Mapping tropical forest aboveground biomass using full polarimetric ALOS-PALSAR 2 and Lidar data	The accurate quantification and spatial distribution of forest aboveground biomass (AGB) in tropical areas is still a challenge. Synthetic Aperture Radar datasets have become the main source of AGB estimation over complex and large areas. We used field plots, Airborne Lidar and coherent and incoherent polarimetry metrics derived from ALOS PALSAR 2 to estimate the AGB and analyse the propagation of the uncertainty. The methods included multiple regression analyses and support vector machine
		5	Philippe DURAND	ALOS2 data use for the Kalideos proof-of-concept project for applications based on crossed remote sensing data	Since 2000, the CNES Kalideos scientific programme (www.kalideos.fr/drupal/) aims at: facilitating the use of optical and radar remote sensing data developing efficient methods for information extraction supporting academic research and service offer To achieve those goals, databases were built on four Kalideos sites, Adam (Romania), La Réunion Island, Littoral (Arcachon basin, France) and OSR MiPy (South West of France). Free access to databases content, temporal series of optical and radar satellite images, ancillary and ground truth data (maps, physical parameters, land occupation, etc.) is granted to registered scientists and French public institutions for non-commercial activities. The highest quality data pre-processing is guaranteed: registration, ortho-rectification, absolute calibration, inter-calibration. In 2015, CNES selected new Kalideos sites and added the objective to stimulate the development of operational methods and applications to the benefit of the institutional sector. Three new Kalideos sites (Alsace, Alps, Brittany) and one former site (La Réunion Island) were selected. In this context, CNES answered in 2013 the ALOS-2 Announcement of Opportunity to include ALOS-2 data in the Kalideos database for the benefit of so-called sites OSR-Mipy and La Reunion. From 2016-dec, acquisitions over OSR-Mipy have been replaced by acquisitions over Alsace, Alps and Brittany. The poster proposed aims at presenting ALOS2 data use leaded in the frame of Kalideos. This poster will emphase a variety of thematics and projects, some of which are still in progress (especially for new Kalideos sites): •Alsace thematics : Land cover and water surfaces classification. The purpose is to statistically analyse the polarimetric SAR scattering mechanisms on several land cover classes (forest, agricultural and urban) with the objective to validate or improve land cover classifications from optical images. For continental water surfaces detection, ALOS2 will contribute to the validation of C-band SAR method (water bodies and/or floods). A comparison of the detection accuracy on Sentinel1 and ALOS-2 PALSAR will be carried out. •Alps thematics : Risk management (e.g. gravity risks, avalanche risks) and study of cryosphere (e.g. snow cover and properties, glacier mass balance). The purpose is to better understand the effect of soil and some snowpack properties on the backscatter coefficients derived from ALOS-2 observations and to perform inter-comparison studies with a focus on the added-value of L band with respect to C band (from Sentinel1) and X-band (from TerraSAR-X). This is a prerequisite to derive relevant snow products from SAR observations (dry/wet snow extents, avalanche debris identification...) and to work toward the assimilation of SAR observations into a physically based snow model. •Brittany thematics : Study of land cover and land use. This study still represents a major environmental and scientific issue : presence or absence of intercrops, length of intercrop-periods, and type of intercrop having an impact on pollutant transfers to water bodies. Characterizing spatio-temporal dynamic
		6	Chiyuki Narama	Glacial lake studies in the Asian Mountains using ALOS-2 PALSAR-2 data.	We examine the seasonal variability of glacial lakes in the Issyk-Kul Basin, Kyrgyzstan, during 2013–2016 based on optical satellite images (Landsat7 ETM+ and 8 OLI). The glacial lakes are classified into six types based on their annual variations in area: stable, increasing, decreasing, appearing, vanishing, and short-lived. A short-lived lake is transient, occurring through sudden expansion and then lasting a few months until a large drainage, which may create a damaging flooding event. Some short-lived lakes recur over several years. Our data showed that lakes in the Teskey Range vary significantly more than those in the Kungoy Range. The appearing, vanishing, and short-lived types are not simply related to glacier recessions, but instead to a complex interplay of regional environmental conditions involving ground ice, debris bodies, water bodies, recent glacial history, and their changes under climate impact. To understand the role of regional environmental conditions on these glacial and periglacial lakes, we apply DInSAR analysis using ALOS-2 PALSAR-2 data to both ranges. In the Teskey Range, many debris landforms have ground ice, as indicated by coherent surface displacement, whereas in the Kungov Range, the number is smaller. The variations of glacial lakes between both ranges are related to differences in regional environmental conditions.
		7	Tohru Takahashi	Development of the education program "Let's appear in the ALOS-2 data" with the Young Astronauts Club Japan	Based on the software "EISEI" and a corner reflector (CR) which is easy for children to build, we established an education program called "Let's appear in the ALOS-2 data". Children set their CRs on the ground. Then they find their CR's image in the ALOS-2 data by using the software "EISEI". This program provides children with the experience of making contact with satellites in space far from the ground on which they stand. Recently, we are developing more simple procedure for children in which the reflector consists of only vertical sheet which is set to be parallel to the satellite orbit.
		8	Atsuko Nonomura	Building coverage estimation by using PALSAR and PALSAR-2 data	The author proposed a method for estimating building coverage ratio by using the backscattering coefficients calculated from ALOS PALSAR and ALOS-2/PALSAR-2 polarimetry images registered at cross polarization HV data. We applied the proposed method to an area along the Ishinomiki Bay acquired before and after the Great East Japan earthquake, respectively. After the earthquake, the estimated building coverage ratio was decreased where the buildings were swept away by the tsunami.
		9	Hiroshi Suzuki	Geoglyphs production using ALOS-2 and the radio wave reflection plate	We will report our achievement of "Constellation of the Earth" project, which draws geoglyphs by placing a number of plates on the ground and taking image by ALOS-2. The plates are ISO A2 size and able to reflect microwaves from SAR. Hundreds of citizens and students have participated in our activities held in Japan and abroad. We conclude that this project functions not only for the creation of art works but also for education of science and technology.
Jan. 23 (Tuesday) Conference Room 10A	Polarimetry and Interferometry / Ionosphere Research	1	Fumitaka Ogushi	Monitoring of the Kanto plane in Japan with PALASR-1 and PALSAR-2 with Small baseline subset (SBAS)	InSAR interferometric stacking techniques (InSAR stacking) are becoming a standard method to obtain very precise measurement of displacement in the last decades, and in particular subsidence phenomena. Due to the high frequency of the observation and stable operation of the satellite orbit, the expectation of having very accurate displacement with PALSAR-2 is quite high. However, in order to complete the InSAR stacking process, there are a lot of parameters needed to be set during the process, and we have found that these parameters largely impact the output of the InSAR stacking. The Kanto plane in Japan is one of the famous sites where the displacement is occurred, and in our previous study, the displacement can be measured with PALSAR-1 data by using SBAS technique. In this study, the measurement of SBAS displacement for the Kanto plane with PALSAR-2 is shown, and the potential feasibility of PALSAR-2 for InSAR stacking measurement is discussed.
		2	Jun Su Kim	Estimation of TEC and ionospheric altitude using Faraday rotation across low latitude region	Using the Faraday rotation (FR) estimates on the ALOS/ALOS-2 quad-pol SAR data can map the absolute TEC in high resolution. But its application is infringed at low latitude region due to the insensitive geometry of FR to TEC. This presentation shows that steering the squint of the azimuth sub-band expands the observation space of the SAR, and both of the TEC and the ionospheric altitude can be estimated also at low latitude zones. Verification follows using ALOS-2 data across Kalimantan Island.
		3	Junichi Susaki	Land subsidence monitoring by using PSI technique from PALSAR and PALSAR2 images observed on ascending and descending orbits	Persistent Scatterers Interferometry (PSI) is the land subsidence measurement method by using multi-temporal synthetic aperture radar (SAR) images. However, the estimated displacement is obtained only along the radar line-of-sight (LOS) direction. Therefore, we examined a method for measuring three dimensional (3D) displacements by combining multi-directional observation. In the experiments, we used PALSAR and PALSAR2 images observed on ascending- and descending-orbits, and analyzed the land subsidence in Kansai International Airport.
		4	Hongyu LIANG	Characterization of Deformation History at Tatun Volcano Group by Temporarily Coherent Point InSAR	The Tatun Volcano Group (TVG), consisting of over twenty Quaternary volcanoes, is located at the northern Taipei Basin. Although there has been no Plinian eruption occurring in human history, but a recent study shows that a phreatic eruption may have occurred at approximate 6000 years ago. Moreover, the highly active geothermal and seismic activities imply that TVG might be dormant active and of potential to erupt in the future. Since TVG is only a few kilometers north of the Taipei metropolitan area and northeast of two nuclear power plants, the possibility of eruption necessitates monitoring precursor phenomenon related to the volcanic activities. Interferometric Synthetic Aperture Radar (InSAR) has been successfully applied in mapping ground surface deformation in volcano zones to analyze the latent geophysical dynamics. In this study, we make use of the newly developed Temporarily Coherent Point InSAR (TCPInSAR) to exploit the spatial and temporal surface evolution over TVG. Considering the densely vegetated and mountainous cover, 17 L-band ALOS/PALSAR-1 images spanning from 2011 to 2013 are used retrieve the displacement history. The stratified tropospheric delay is well considered and corrected by employing a patch-based method based on joint estimation. The derived deformation results are validated by comparing with GPS measurements and have a good agreement, which confirmed the reliability of TCPInSAR technique. The observed uplifts indicate that TVG in recent years has undergone active geothermal activities. The results demonstrate that InSAR has the capability of monitoring surface deformation over volcanic zones.
		5	Howard Zebker	ALOS PALSAR 2 Data Products for InSAR: Delivering User-friendly Data Sets	Analyzing InSAR data remains difficult for the non-specialist, despite its utility. It requires users to be considerably familiar with the detailed SAR imaging geometry for each acquisition, and also experienced in InSAR processing techniques. In addition, differential interferometric SAR techniques for investigating temporal evolution of surface deformation, such as the small baseline subset (SBAS) and persistent scatterers approaches are typically based on a large number of SAR acquisitions and an even larger number of interferograms. Recognizing all of these restrictions, applying topographic corrections to all interferograms in a given analysis can require significant computational resources. Also, for many users the range-Doppler radar coordinate system is perplexing, so that it is difficult to ingest even useful products in their own customary analyses. Our goal here is to make access to InSAR methods and data easy for most users, relieving them of the burden of understanding the processing details and the need for large computational resources. We show how raw radar data, or partially processed single look complex images may be precorrected for imaging geometry so that formation of the hundreds of interferograms from an observation sequence is both reliable and efficient. In our approach we resample products such as ALOS PALSAR-2 SLCs directly to a latitude/longitude grid with automatic viewpoint and topographic correction. We fully compensate for the viewing geometry and topographic phase terms so that simple cross multiplication yields the needed interferograms directly in map coordinates.
		6	Masato Furuya	Dispersive Phase in the L-band InSAR Images: Ionosphere and Heavy Rain	In contrast to GNSS, SAR imaging is based on a single carrier frequency, and thus no operational ionospheric corrections have been performed in the interferometric SAR (InSAR) data analyses. Recently, Gomba et al (2016) detailed the processing strategy of split-spectrum method (SSM) for InSAR, which splits the finite bandwidth of the range spectrum and virtually allows for dual-frequency measurements. We apply the SSM to the L-band ALOS1/2 InSAR data to examine the contributions of dispersive and non-dispersive components. Maeda et al (2016) succeeded in detecting the sporadic-E (Es) signals in both GNSS/TEC and ALOS/PALSAR InSAR data. Meanwhile, Kinoshita and Furuya (2017) detected phase anomaly in ALOS/PALSAR InSAR data associated with heavy rain over Niigata area, Japan. Here, we apply the SSM to the L-band InSAR data that detected both Es and heavy rain episodes. Originally, we expected no anomalies in non-dispersive phase for Es and in dispersive phase for heavy rain.However, we notice the presence of phase anomalies in both dispersive phase in heavy rain and non-dispersive phase in Es. We discuss its geophysical implications.

ALOS-2 Abstract

Conference Room 10A

Date	Session	No	Speaker	Research Title	Abstract
Jan. 23 (Tuesday) Conference Room 10A	Polarimetry and Interferometry / Ionosphere Research	7	Tazio Strozzi	ALOS-2 PALSAR-2 for the survey of landslides activity, rock glaciers movement and glaciers velocity	Glaciers, rock glaciers and landslides are shaping the landscape of mountainous regions and have a special relevance as climate indicators or natural hazards. Repeat-pass differential SAR interferometry and offset-tracking are powerful techniques for mapping land surface deformation from space at fine spatial resolution over large areas. As already demonstrated with past and current missions, L- band SAR data are specially suited for geophysical applications because of the reduced temporal coherence and enhanced capability to map rapid displacements. The crucial factor related to loss of coherence is the acquisition time interval, with a significant improvement of short-time acquisition intervals for rapidly moving landforms. Although the global PALSAR-2 Basic Observation Scenario does not include many repeat-pass acquisitions with a 14 days time interval at high resolution, scattered acquisitions were found in the archive over various regions worldwide. In our contribution we will present significant results regarding the mapping of landslides activity, rock glaciers movement and glaciers velocity with 14-days ALOS-2 PALSAR-2 image pairs and highlight the advantage and complementarity with respect to longer time intervals and other satellite SAR missions. We conclude that a more consistent acquisition strategy of ALOS-2 PALSAR-2 image pairs with a 14 days time interval would enhance the unique significance of this satellite sensor for geophysical applications in mountainous areas.
		8	Hiroshi Kimura	Fully 3-dimensinal surface deformation mapping of the 2016 Kumamoto earthquakes by PALSAR-2	Differential SAR interferograms show displacements in only the line-of-sight direction. In order to map fully 3-dimensional surface deformations, multi-interferograms from more than three directions are required. JAXA's PALSAR-2 onboard ALOS-2 has a capability to observe the Earth surface in either of right or left direction from ascending and descending tracks. In PALSAR-2 data archives, there are several interferometric pairs with different looking directions covering the suffered areas by the 2016 Kumamoto earthquakes. Fully 3-dimensional surface deformation mapping is demonstrated and a good agreement with GNSS measurements is shown.
		9	Ryo Natsuaki	Temporally coherent radio frequency interference observed by ALOS-2	Radio frequency interference (RFI) violates the quality of SAR image. Generally, RFI does not have temporal coherence and appears as noise in an interferogram. However, we found some kind of RFI has temporal coherence and thus appears as if there is a deformation in the interferogram. We report this phenomenon and its features.
		10	Natsumi Yokoya	ALOS-2 interferometric closure phases and moisture variations: first analyses and inversions	In Synthetic Aperture Radar Interferometry closure phases are still not well understood even if they can be observed in many datasets and at different frequencies. Understanding closure phases is important for correcting unwanted effects in SAR Interferometry and possibly to extract additional information. In this contribution we study their correlation with moisture variations, land cover and precipitation patterns. Early experiments indicate that it may be possible to invert moisture variations from closure phase data using some limited external information. We will show preliminary inversion results based on ALOS-2 L-band SAR data and validations with independent observations.
		11	Yoshio Yamaguchi	Web archive of ALOS-2 fully polarimetric data for utilization and monitoring the earth	The purpose is to make a web archive for utilization of fully polarimetric ALOS-2 SAR data. By using complete scattering power decomposition for fully polarimetric data, it is possible to create full color images based on scattering powers. The RGB color images are easy to understand and interpret actual phenomena for everyone. It is our purpose to create a web-based archive using ALOS2 Quad Pol. Data over worldwide and Japan. More than 2300 scenes have been registered up to now in the web-site: http://www.wave.ie.niigata-u.ac.jp/. The web-based archive will serve to utilization of polarimetric data worldwide.
		12	Hao Chen	ALOS2 and Radarsat-2 Polarimetry for Burned Areas Mapping in Northwest Territories, Canada	NWT has ~80 million ha of forestlands, distributed across vast regions largely inaccessible. We use ALOS2 and Radarsat-2 polarimetric SAR data for large burned areas mapping in NWT. Our techniques include an entropy/alpha approach to assess data quality and information, polarimetric decompositions and classifications, and image mosaics of radar products. We compare the radar results against fire polygons from the Canadian National Fire Database and from other remote sensing sources. We discuss potential problems and benefits of using polarimetric radar for such application.
		13	Aleksey Dmitriev	Polarization signature development of radar backscattering variations for azimuthal anisotropy estimation of forest by PALSAR-1 and PALSAR-2 data	A new approach for estimating of volume target heterogeneity from polarimetric synthetic aperture radar (PolSAR) images was proposed. The approach is based on the analysis of novel type of polarization signature, which we call fractal polarization signature (FPS). This signature is a result of polarization synthesis of initial fully polarimetric data and subsequent fractal analysis of synthesized images. It is displayed as a 3D plot and can be produced for each point in an image. It is shown that FPS describes backscattering variations or image roughness at different states of polarization. Fully polarimetric data of ALOS PALSAR-1 and PALSAR-2 at ascending/descending orbits were used for testing the proposed approach. The azimuthal dependence of the radar backscattering variations is discovered when analyzing backscattering from a pine forest. It correlates with the results of a field survey of the trees branches distribution.
		14	Ryoichi Sato	Monitoring of seasonal change of paddy field and wetland using quad-pol ALOS-2/PALSAR-2 data	We carry out monitoring of seasonal change of paddy field and wetland using quad-pol ALOS-2/PALSAR-2 data based on PolSAR image analysis. Here model-based scattering power decomposition and the related polarimetric analysis methods are used in the image analysis. We try to determine useful polarimetric markers features for making clear the seasonal changes, by additionally carrying out the numerical simulations for the simplified target models.
		15	Feng Xu	Ship Detection, Discrimination and Classification on ALOS2 Polarimetric SAR Images	We studied ship detection and discrimination in complex background from ALOS2 polarimetric synthetic aperture radar (SAR) images. It first implements a pixel-level land-sea segmentation with the aid of a global 250-meter water mask. Then, an efficient multi-scale constant false alarm rate (CFAR) detector with generalized Gamma distribution (GΓD) clutter model is designed to detect candidate targets in the sea. At last, Eigen-ellipse discrimination and maximum likelihood (ML) discrimination are designed to further exclude false alarm non-ship objects in nearshore and harbor area. The proposed land-sea segmentation method is compared with multi-level Otsu method. The proposed multi-scale ship detector is compared with a conventional CFAR detector. Finally, we tested deep learning-based approach to classify different types of detected ships and further exclude nonship false alarms. Experiments show the efficacy of the proposed approach in detecting nearshore ship targets in a complex coastal environment.
		16	Akira Hirose	PolSAR Land Classification Using Quaternion Neural Auto-Encoder and Self-Organizing Mapping	We discuss the advantages in quaternion neural auto-encoder and self-organizing map in polarimetric synthetic aperture radar (PolSAR) land classification.
		17	Haipeng Wang	Applying Deep Learning to ALOS2 PolSAR Image Classification	Terrain classification is one of the most important applications of the polarimetric SAR (PolSAR) data, and many effective approaches have been proposed. This presentation, following the great success of deep convolutional neural network (CNN) in computer vision, apply CNN to PolSAR image classification and also proposes a complex-valued CNN (CV-CNN) specifically for synthetic aperture radar (SAR) image classification. It utilizes both amplitude and phase information of complex SAR imagery. All elements of CNN including input/output layer, convolution layer, activation function and pooling layer are extended to the complex domain. Moreover, a complex backpropagation algorithm based on stochastic gradient descent is derived for CV-CNN training. The proposed CV-CNN is then tested on the typical polarimetric SAR image classification task which classifies each pixel into known terrain types via supervised training. Experimental results show that deep learning algorithms can achieve high performance in PolSAR image classification.
Jan. 24 (Wednesday) Conference Room 10A	Sensor Calibration and CVST	1	Alexander Zakharov	Oil platforms as SAR calibration targets in C and L bands	An analysis results of the PALSAR-1, PALSAR-2 and Sentinel-1A SAR observations of oil platforms in Caspian Sea are presented. The RCS level and variations of about 200 oil platforms area were measured over 4 years interval in L-band and over 2.5 years interval in C-band. It was discovered that the platforms seem to be more stable scatterers in L-band having systematically higher RCS than in C-band. The analysis results confirm the idea that the platforms may be treated as acceptable calibration targets for the monitoring of spaceborne SAR systems radiometric stability.
		2	David Sandwell	Time Series Analysis of ALOS-2 ScanSAR InSAR over the Central Valley of California	We have analyzed 21 repeat ScanSAR images from ALOS-2 to assess the accuracy and resolution of a 2.8 year time series. The GMTSAR InSAR code was modified to construct seamless unwrapped phase across the 5 subswaths. A coherence-based SBAS method was used along with common point stacking to form InSAR time series over a 350 km by 350 km area of Central California. Significant long-wavelength > 40km ionospheric phase distortions are mitigated using the continuous GPS data in the area. Quantitative results will be provided at the meeting.
		3	Ridha Touzi	Polarimetric PALSAR2 Calibration	L-band PALSAR-2 offers the possibility of providing PLR measurements at various beams (5 beams), with incidence angle varying from 25º to 35º. In this study, PALSAR-2 calibration parameters are measured using CRs deployed in the Amazonian forest [1]. The Amazonian forest near the geomagnetic equator provides ideal sites for unbiased measurement of PALSAR-2 antenna parameters, at free Faraday rotation, as previously shown for PALSAR [2]. The extended Freeman-Van Zyl calibration method, introduced in [2], is adopted. The latter leads to unbiased estimation of antenna cross-talks even at the presence of azimuthally symmetric reference target of low HV return in comparison with HH, VV, and the HH-VV cross-correlation. Six data sets collected over the Amazonian forest (with CRs) are used to assess PALSAR-2 distortion matrix for five beams (FP3 to FP7). It is shown that PALSAR2 antenna is highly isolated with low cross-talk (lower than -40 dB). These results are in agreements with the ones obtained in [3] with different calibration method. It is shown that diagonal distortion matrix with antenna cross-talk set up to zero can be used for accurate calibration of PALSAR2. A low HV backscattering application, subsurface permafrost mapping, is considered for the promotion of the excellent NESZ of PALSAR-2 (about -38dB at 25 degree incidence angle). ALOS-2 (FP6-4) data are collected in August 2014 over peatland with discontinuous permafrost (North Alberta). A first analysis of the data quality of the FP6-4 images revealed a residual calibration error of about -33dB. The image is re-calibrated with a diagonal distortion matrix leading to a significant reduction of the residual error (-43 dB). The Touzi decomposition [4] is used for optimum extraction of polarimetric PALSAR2 information. It is shown that Touzi scattering type phase permits full exploitation of the excellent PALSAR2 NESZ for characterization of deep (up to 40 cm) peatland subsurface permafrost indicators, and effective mapping of discontinuous permafrost in peatland regions [5]. The requirement of -34dB NESZ is setup for the design of future Polarimetric L-band SAR missions, equipped with digital antenna (such as PALSAR4), which will permit large scale and operational mapping of peatland subsurface water flow and permafrost distribution in subarctic regions and monitoring their accelerated transformations due to the global warming. [1] R. Touzi and M. Shimada, "Calibration and validation of polarimetric ALOS2", Proc. of IGARSS' 15, Milan, Italy, July15 [2] R. Touzi and M. Shimada, "Calibration of Polarimetric PALSAR", IEEE Trans. Geoscience Rem. Sens, ALOS special issue, Vol. 47, No.12, Dec. 2009. [3]M. Shimada, "Calibration and validation of PALSAR-2", Proc. of IGARSS'15, Milan, Italy, July15 [4]Touzi R., A. Deschamps and G. Rother, "Wetland characterization using polarimetric Radarsat-2 capability", Can. J. Rem. Sens., Vol. 33, No. 1:S56–S67, 2007 [5] R. Touzi and S. Pawley, "Investigation of polarimetric ALOS-2 for discontinuous permafrost mapping in Northern Alberta", EO-Summit Conference, Montreal, June 2017

ALOS-2 Abstract

Conference Room 10A

Date	Session	No	Speaker	Research Title	Abstract
Jan. 24 (Wednesday) Conference Room 10A	Sensor Calibration and CVST	4	Ridha Touzi	PALSAR2 Compact Calibration: Preliminary Results	The Compact (CP), introduced in the 1960's and recently resuscitated by J.C. Souyris [TGRS 2005] and R.K. Raney [2007] is a simplified architecture of the conventional dual circular polarization. Compact Radar transmits circular polarization while receiving mutually coherent orthogonal linear polarizations. This offers the capability of SAR imaging at large swaths, and provides complementary information to conventional dual-pol HH-HV and VV-VH [1]. Unfortunately, the actual technology of antenna design cannot permit the generation of a perfectly circular polarization using a dual-polarized (H and V) antenna [1]. This was noted with the lunar mini-radiofrequency (mini-RF) missions Chandrayaan-1 (2008-2009), and NASA Lunar Reconnaissance Orbiter (LRO, 2009). Both transmit a non perfectly circular polarization with a polarization axial ratio (AR) that can reach 3dB. The Canadian Radarsat Constellation Mission (RCM) planned for launch in 2018, will operate a CP mode with an AR that is expected to vary between 1.4 dB (50km swath) and up to 3 dB for the most raising beams of the 350 km ScanSAR [1]. Since all the methods developed for CP calibration assume the transmitted polarization to be perfectly circular [5], the significant errors that might be induced by the non-circularity of the transmitted polarization cannot be corrected for [2]. Therefore, there is an immediate requirement for the development of new advanced calibration methods that will be able to correct for the non-circularity of transmitted polarization in addition to the removal of the radiometric and phase errors induced by the actual antenna polarimetric distortion matrix. ALOS-2, which was launched on the 24th of May 2014, is equipped with an experimental CP mode [3, 4]. JAXA has collected CP (50km swath) over various sites of calibration , in the context of ALOS2 Cal-Val working group (CVST), and provided to the CVST members experimental "uncalibrated" CP images. This should provide an excellent opportunity for the development and validation (with real CP data) of new calibration methods that would take into account the non circularity of transmitted polarization and its variations with incidence angles. Several CP PALSAR2 data were collected in 2014 over the CCRS calibration site in Ottawa. In this study, theses images are used for the assessment of PALSAR2 CP calibration parameters and data quality. Polarimetric and CP PALSAR2 data collected over the Amazonian forests are also used for the investigation of the impact of Faraday rotation on L-band ALOS2- CP calibration. [1] R. Touzi, "Hybrid versus matched antenna for Dual- and Fully Polarimetric SAR", PolinSAR'13, Frascatti, Italy, Jan. 2013 [2] R. Touzi and F. Charbonneau, "Requirement on the calibration of Hybrid-Compact SAR", IGARSS' 14, Quebec, Canada, July 2014 [3] Y.Okada et al.. Hardware performance of L-band SAR system onboard ALOS2. IGARSS'11, Vancouver, Canada, 2011. [4] M. Shimada. PALSAR-2 beam calibration. ALOS2 Cal-Val meeting CVST2, Tsukuba , Japan, Nov. 2013. [5] A. Freeman, P. Dubois-Fernandez, and M.-L. Truong-Loi. Compact polarimetry at longer wavelengths Calibration. In EUSAR 2008 Proceeding, volume , Germany, 2008
		5	Youhei Kinoshita	The five years research outcomes in meteorological applications of L-band InSAR water vapor information	Interferometric Synthetic Aperture Radar can provide unique water vapor information that has unprecedentedly high spatial resolution and clund-free, day-and-night characteristics. Recently there are increasing number of InSAR researches. For example, Pichelli et al. (2011) and Mateus et al. (2015) conducted experiments assimilating InSAR water vapor information to high-resolution numerical weather models by the three-dimensional variational assimilation. Kinoshita et al. (2013) detected water vapor distribution during a heavy rain event and succeeded to reproduce the InSAR phase delay signal by the Weather and Research Forecast (WRF) model simulation. Subsequent to this research, Kinoshita and Furuya (2017a) detected the second case of water vapor delay signal due to the convective system by InSAR and showed that the four-dimensional variational data assimilation of GNSS zenith total delay data improved the WRF reproducibility. Kinoshita et al. (2017b) detected water vapor fluctuations due to mountain lee waves by ALOS-2 ScanSAR InSAR and suggested that the planetary boundary layer scheme in the numerical weather model affected the model reproducibility in terms of wavelengths and wave attenuation rate. These researches strongly indicated that the InSAR observation of tropospheric water vapor distribution is a powerful tool for meteorological researches. In the presentation, the author will show the five-years research achievement under the framework of the ALOS-2 RA4 collaborative research.
	Vegetation, Forestry and Wetland 1	1	Akira Kato	Forest disaster monitoring using ALOS 2 and Terrestrial Laser Scanner	Forest disaster is an emerging issue due to global warming. To understand the frequency or the intensity of forest disaster, ALOS 2 is used to characterize the structural change. For example, forest structure is a key for forest fuel accumulation. In this study, radar coherency is used to detect the change and terrestrial laser 3D data is used to quantify the change on the ground. Tropical and boreal forest are our study area to monitor windthrow and forest fire. In our framework, the wide scale monitoring achieved by ALOS 2 is validated with 3D data derived by terrestrial laser scanner.
		2	Manabu Watanabe	DEPENDENCY OF FOREST BIOMASS ON FULL POLARIMETRIC PARAMETERS FROM L-BAND SAR FOR NATURAL FOREST IN INDONESIA	Correlations between forest biomass and full polarimetric parameters, including Sigma_0, four-component decomposition, eigenvalue decomposition (entropy/alpha/anisotropy), and coherence values between polarization were analyzed. Polarimetric and interferometric airborne synthetic aperture radar with L-band type-2 (Pi-SAR-L2) data were examined to identify prospective parameters for estimating the above ground biomass (AG-biomass) of a dense forest in the Riau province of Indonesia. The Sigma_0-AG biomass curve showed saturation at ~100 tons/ha. In contrast, several full polarimetric parameters such as entropy and coherence between polarizations showed correlations up to 200 tons/ha. Similar results were derived in the Peruvian Amazon, where PALSAR (phased array type L-band synthetic aperture radar) /full polarimetric data were analyzed. Larger entropies observed for the higher biomass areas imply that more randomness was introduced in the scattering mechanism. These results indicate that the L-band SAR signal observed over higher biomass areas is approaching the random signal level.
		3	Vladimir Elsakov	Combination of radar and optical data for monitoring of vegetation and permafrost changes at European Russian Arctic	The synergetic using of ALLOS/PALSAR and optical data is extensively develop in vegetation cover analysis in present. The vegetation cover is a main indicator of cryogenic landscapes of European Russian Arctic because closely related with climate, land morphology and permafrost effects. We analyzed dynamic of vegetation/soil/permafrost relations per period of 2007-20016 years use Palsar/optical data of different years. The field verification of results was done on long term monitoring site of Polar Ural region. Some results were used for reindeer husbandry land management.
		4	Wenjian Ni	Algorithm development for the forest height mapping using data fusion of PALSAR/PALSAR-2 InSAR and PRISM data	Forest biomass estimation over large area and in higher accuracy becomes more and more important for the research on global climate change and carbon cycle. Many researchers found that the forest height information is useful for the forest biomass mapping. Photogrammetry and Interferometric Synthetic Aperture Radar (InSAR) are two techniques that can be used to extract the digital surface model of earth (DSM). Photogrammetry mainly works on the stereo-images acquired by optical sensor. The DSM from photogrammetry should be mainly from the forest canopy top over forested area because optical data are mainly reflected by forest canopy top. Many researchers found that the DSM from InSAR at L and P band should be lower than forest canopy top. Therefore the data fusion of PALSAR InSAR data and PRISM stereo images is a potential information source of forest canopy height. This study investigate the feasibility to extract the forest height through the data fusion of PALSAR InSAR data and PRISM stereo images.
		5	Rajesh Bahadur Thapa	Improving aboveground forest carbon stocks estimation method using ALOS 2/PALSAR-2 data	This research aims to improve aboveground forest carbon stocks (AFCS) estimation method by developing new PALSAR-2 based algorithm and to create accurate high resolution AFCS maps in tropical region. In this research, two study sites are selected, they are: Riau Province in Sumatra, Indonesia and Terai region, Southern Nepal. Riau province comprised of tropical forests while Terai region comprised of subtropical forests. Preliminary results from Riau Province will be presented.
		6	Motofumi Arii	Rice paddy monitoring by L-band MIMP SAR approach	SAR remote sensing has been expected as an efficient rice crop monitoring tool due to its flexible operability with wide swath. Though many researchers have intensively analysed the backscatter, there still exist non-negligible mysteries to extract physical parameters. To solve the problems, it is essential to conduct theoretical characterization of experimentally obtained radar backscatter from rice paddies. In this paper, rice paddies in Niigata city, Japan, were observed by the second version of L-band Polarimetric and Interferometric Airborne SAR (Pi-SAR-L2), by systematically varying the observation parameters such as incidence angle and polarization. Bragg scattering was obvious in the SAR imagery at L-band, and it was theoretically modeled. Then, backscatter from the rice paddy suppressing the Bragg scattering effect was obtained by utilizing the model.
		7	Alexander Zakharov	Effect of snow precipitation on L-band phase centers displacements in forest	The paper aims at estimating displacements of effective phase centers of forest in winter. According to double differential approach, interferometric phase of forests under study was corrected for the phase of nearby fields. Phase delay in snowpack on the fields as well as in snow layers intercepted by trees was taken into account. The phase centers displacements were discovered to be less than 2 cm/14 days, and the displacement velocity decreases in the middle of winter.
		8	Ridha Touzi	INVESTIGATION OF POLARIMETRIC ALOS-2 FOR DISCONTINUOUS PERMAFROST MAPPING IN NOTHERN ALBERTA	Northern Alberta contains a significant component of discontinuous permafrost, which is distributed within wooded palsa bogs and peat plateaus that form part of heterogeneous mosaic of non-permafrost wooded bogs, fens, swamps and other upland forest types. Permafrost distribution and ongoing degradation affects peatland structure, hydrology, and vegetation, and has been linked with environmental changes including increased stream runoff, greenhouse gas fluxes, and forest fire severity. However to date in Alberta, there has been limited mapping or monitoring of permafrost at a scale sufficient for these purposes, with previous airphoto-based interpretations providing only a small-scale delineation of the forest-covered permafrost terrain. Cost-effective permafrost characterization and monitoring should be possible due to advances in the technology of earth observation satellites. In particular, the long-penetration capabilities of L-band ALOS2 PALSAR should permit large scale mapping of discontinuous permafrost in peatland areas. Recently, it has been shown that the long penetrating polarimetric L-band ALOS is very promising for monitoring peatland subsurface water flow. The use of the phase of the scattering type provided by the Touzi decomposition permits the demonstration of the unique capability of polarimetric ALOS for detecting subarctic and boreal peatland subsurface water flow, and monitoring bog to fen transformations related to climate warming. Polarimetric L-band ALOS collected over subarctic peatlands (in Wapusk National Park, Canada) and boreal peatlands (in the Athabasca oil sand region) have been used for the demonstration of the excellent capabilities of the long penetrating PALSAR for peatland mapping and monitoring. In this study, the Touzi scattering phase is investigated for mapping discontinuous permafrost using a series of Polarimetric ALOS-2 (FP6-4) collected over discontinuous distributed within wooded palsa bogs and peat plateaus near the Namur Lake (North Alberta). A first analysis of the ALOS2 (FP6-4) data quality has revealed a residual calibration error of about -33dB. The ALOS2 data are recalibrated to reduce the residual error down to -43 dB. This permits fully exploiting the excellent ALOS2 performance in term of low noise floor (NESZ about -38 dB). The Touzi decomposition is applied on the polarimetric ALOS2 data collected with the high-sensitive PLR mode of about 4.4mx5.1m resolution at FP6-4 (about 27 degree incidence angle). It is shown that the information provided by the scattering type phase is very promising for detection of relatively deep peatland subsurface permafrost (up to 40 cm). The results obtained are validated jointly with Alberta Geology Survey (AGC) using field data collected they collected during the 2014 summer. A permafrost classification obtained by S. Pawley (AGS) using a combination of Lidar and Landsat data is also used for the ALOS2 result validation. The excellent NESZ capability of polarimetric ALOS2 permit the promotion of ALOS2 as a very promising source of information for efficient mapping of discontinuous permafrost distribution and monitoring its on going transformations due the global warming.
		9	Veraldo Liesenberg	Evaluating SAR Polarization modes at L-band and the Influence of both Moisture and Geometry Effects for Forest Classification Purposes in Eastern Amazon, Brazil	Multitemporal single (HH) and dual-polarization (i.e., HH, HV) L-band spaceborne synthetic aperture radar (SAR) scenes were evaluated under different moisture conditions caused by precipitation prior to data acquisition at varying incidence angles. The changes affecting backscattering intensity, polarimetric decomposition, backscattering mechanism, and land use/land cover classification performance were evaluated. The study area is a shifting-cultivation environment in the eastern Amazon (Brazil). Several data input scenarios were proposed in the classification scheme (i.e., backscattering intensity alone and combined with alpha/entropy decomposition parameters, band ratios, and textural parameters) using a random forest classifier framework. Integration with optical data was also examined. The classification accuracy scores were then compared with accumulated precipitation data. The results showed that the variation in both the vegetation moisture and incidence angle increases the backscattering intensity for pasture, riparian forest and young regenerated forest by at least 1 dB compared with old successional forest stages due to its more uniform vertical structure and the landscape's increased dielectric constant. The overall classification accuracy proved low for each SAR acquisition date compared with the performance of the Landsat data. Based on SAR data, misclassification occurs for the young successional forest stages and increases in scenes with higher moisture conditions. The classification performance benefits from data integration only for one SAR scene acquired in the dry season. The results highlight the importance of selecting proper temporal intervals for the different SAR polarization modes of the forthcoming SAR missions. Further investigations should address both multitemporal at a single frequency as well as multifrequency SAR approaches.
		11	Jörg Haarpaintner	Forest and forest loss mapping from ALOS PALSAR to ALOS-2 PALSAR-2 in the Mai-Ndombe District, DRC.	The Mai-Ndombe district in the Dem. Rep. of Congo is the demonstration area for REDD as well as in the ESA DUE Innovator III project SAR for REDD. The aim is to increase synthetic aperture radar (SAR) processing capabilities in African REDD countries. ALOS-PALSAR (2007-2010) and ALOS-2 PALSAR-2 (2014-2016) Fine-Beam-Dual data were acquired and used for forest and forest change mapping. The maximum forest cover from the ALOS-PALSAR period served as a baseline for a 5 –year forest loss detection between the ALOS and ALOS-2 data as well as for the 2015-2016 forest loss detection with ALOS-2.
		12	Choen Kim	Improvement of Topographic Normalized Backscattering Coefficient over Forested Terrain.	We present a new approach to improve the gamma-nought values obtained from mountainous using ALOS PALSAR-2 data. In comparison with the fore-slope appearing higher the gamma nought values and the far-slope appearing lower its values on the same tree volume, the gamma nought values corrected by the local incidence angle are almost similar on the above volume.

ALOS-2 Abstract

Conference Room 10A

Date	Session	No	Speaker	Research Title	Abstract
Jan. 25 (Thursday) Conference Room 10A	Vegetation, Forestry and Wetland 2	12	Shoko KOBAYASHI	Feasibility study on monitoring of tropical bird diversity using full polarimetric L-band SAR data	Application of microwave satellite remote sensing to biodiversity monitoring is less well understood. It is known that vegetation complexity is one of the important factors that generate diversity of organisms inhabiting the forests. We studied retrieving vertical vegetation structures such as layer complexity and understory vegetation coverage, using ALOS/PALSAR fully polarimetry data, which influence bird community in Indonesian tropical forests. The analysis showed that the complex vegetation structure would lead to higher diversity of forest-dependent species.
		13	Renaud Mathieu	Mapping and assessing changes of woody structure in southern African forest with C-band and L-band sensors	Savannahs and woodlands are open forests (<60T/ha), and are the largest forested biome in South Africa, accounting for 35-45% of the land mass. Only 2% of the South African land mass is covered by dense indigenous forests or commercial plantations. Savannahs are threatened by excessive harvesting (fuelwood), and clearing for settlement or agricultural development, and most importantly by bush encroachment (affecting 10-20 million ha) perceived as a major environmental issue due to the potential impact on food security. Despite these drastic changes and the legal requirement to report on the forest status every three years at national scale (Forest Act 1998, SA), there is yet limited information on spatial patterns and changes of forested landscapes. The Council for Science and Industrial Research has been developing for a few years a program for mapping national forests and structural attributes (woody cover, height, above ground biomass) using Earth Observation technologies. Research is undertaken to assess the use of multi-frequency / multi-temporal Synthetic Aperture Radar (SAR) and optical datasets. Imagery includes X-band TerraSAR, C-band RADARSAT-2 and ENVISAT ASAR, L-band ALOS PALSAR, and Landsat. The approach is based on the integration of field data, airborne LiDAR, and satellite imagery. The research led to the development of a LiDAR/SAR-based national mapping system, and the production of unique 1-ha maps of woody cover/biomass for the entire land mass of South Africa and Namibia, totalling 2 million km2. They are a significant improvement on the global products which were until recently the only available datasets in the region. Change assessment is also under investigation using the ALOS PALSAR global mosaics and C-band ASAR and Sentinel-1 data.
		14	LU ZHANG	Improved topographic mapping in mountainous area by synergistic use of high-resolution SAR interferometry and stereoscopy	SAR interferometry (InSAR) and SAR stereoscopy (StereoSAR) are two major approaches for topographic mapping with SAR data. InSAR makes use of interferometric phase information to extract terrain height accurately, but its application is usually limited by the low coherence in rural areas. In contrast, StereoSAR exploits only amplitude information and is robust to temporal decorrelation. Hence StereoSAR can be a good complementary for terrain mapping in the incoherent areas. In order to generate high-precision and complete DSM in the difficult areas, such as densely vegetated mountainous areas, we propose to combine the coherent interferometric phase information provided by InSAR and incoherent parallax information provided by StereoSAR to perform topographic mapping in this article. Plenty of StereoSAR sample points are selected automatically to calibrate the InSAR unwrapped topographic phase, which not only do not need any ground control points (GCP), but also can achieve a higher calibration accuracy. As to evaluate the relative height measurement accuracy of StereoSAR and InSAR, the corresponding theoretical height accuracy formula are derived and comparatively analyzed. High height precision points are selected from StereoSAR DSM to fill the voids in InSAR DSM based on the theoretical height accuracy metrics. As a showcase, an ALOS-2 InSAR pair and a TerraSAR-X StereoSAR pair covering Mount Song area are used as experimental data. The corresponding InSAR DSM, StereoSAR DSM and fused DSM are generated with spatial resolution of 10 m. A photogrammetric DSM acquired in 2009 is used as reference DSM with height accuracy better than 1m and spatial resolution of 1m to evaluate the accuracy of the generated DSM.
		15	Fang Shang	Optimization of window size for ALOS2-PALSAR2 data interpretation	In fully polarimetric synthetic aperture radar data interpretation field, incoherent interpretation methods are widely used in many applications. In such methods, window size in spatial averaging calculation is an important parameter which has significant effect on the final interpretation accuracy. In conventional methods, the window size is experimentally determined without a clear criterion. In this work, we test parameters such the degree of polarization (DoP) to find the most effective criterion for optimizating the window size
		16	Feng Gu	Classification of Polarimetric SAR Image Integrating SLIC Superpixel Segmentation and Convolution Neural Network	This paper proposes a hybrid framework for classification of ground objects from polarimetric SAR image. The main idea of the framework is to guide the convolution neural network (CNN) to classify superpixel instead of single pixel. The image is firstly divided into small homogeneous superpixels by simple linear iterative clustering (SLIC) method. Then, patch sample is produced according to the centre of each superpixel and subsequently imported into CNN for classification. The proposed framework can get a significant boost in computation efficiency, extract smooth objects'edge with little burrs and particals compared to traditional CNN as well as reduce the influence of the inherent layover in SAR image.
		17	Ake Rosenqvist	The Global Mangrove Watch (GMW) - a status update	Co-authors: Pete Bunting and Richard Lucas (Aberystwyth Univ/UK) The Global Mangrove Watch (GMW) is an international collaborative project undertaken as part of the JAXA Kyoto & Carbon Initiative. The GMW is set out to map the extent and changes of the worlds mangrove forests between the years 1996, 2007, 2008, 2009, 2010 (baseline year), 2015 and 2016 using primarily JERS-1 SAR, ALOS PALSAR and ALOS-2 PALSAR-2 data. The GMW is a contribution to the Ramsar Wetlands Convention.
		18	Ariel Blanco	Assessment of Recovery of Mangroves Damaged by Typhoon Haiyan Using ALOS-2 and Planet images	The impacts of Typhoon Haiyan in Calauit in northern Palawan are examined using ALOS-2 and Planet images. Equally important is the assessment of how fast or slow the recovery of damaged mangroves is. This can enable the formulation of measures for mangrove rehabilitation. The use of ALOS-2 data provided complementary information to explain the changes detected using Planet images.

ALOS-2 Abstract

Conference Room 10B

Date	Session	No	Speaker	Research Title	Abstract
Jan. 23 (Tuesday) Conference Room 10B	Public Health and Atmospheric Environ.	1	Sumiko Anno	Predicting dengue fever outbreaks in Taiwan using deep learning techniques and remote sensing data	The number of dengue fever patients has increased in Taiwan in recent years, and measures are urgently needed to prevent a dengue fever epidemic. The mechanisms underlying the outbreaks must be clarified in order to develop a predictive model and take appropriate precautions. Unfortunately, these mechanisms are complex, and the factors involved in the generation, propagation, and spread of dengue fever have yet to be fully elucidated. However, the outbreaks are known to be influenced by the interplay of factors that include rising temperatures, including rising sea surface temperatures (SSTs); increasing rainfall due to global warming; and rapid urbanization. These factors contribute to inadequate water and sewage treatment systems. Subsequently, water storage containers, as well as discarded automobile tires and other containers that fill with rainfall, allow mosquito breeding and vector dispersion. In addition, rising temperatures and rapid urbanization result in human displacement and travel and contribute to the spread of dengue virus-infected mosquitoes. Here I explain how deep learning techniques and remote sensing data can be used to clarify the contribution of these factors dengue fever outbreaks in Taiwan. I also present our current and ongoing research findings.
		2	Chris Fook Sheng Ng	Active fire products from MODIS to assess the level of air particulate matter attributable to landscape fires in a tropical city	Epidemiological studies investigating the health effects of air particulate matter (PM) often relied on data from land-based air quality monitoring stations as surrogate to personal exposure. These ground stations measure the total level and provide no information on source. In locations frequently affected by landscape fires, the assessment of health risk due to fire smoke is difficult. We proposed an approach to estimate the daily contribution of PM by landscape fires using the measurements of fire radiative power (FRP) from the Moderate Resolution Imaging Spectroradiometer (MODIS). The derived fire-related PM data can be used to estimate the risk of premature mortality associated with landscape fire smoke. We collected daily averages of PM with aerodynamic diameter 10µm or less, sulfur dioxide, nitrogen dioxide, and oxide of nitrogen from ground monitors, and wind information from GDAS dataset for Kuala Lumpur, Malaysia, 2000-2006. We extracted the daily number of fire pixels and FRP at increasing buffer distance (0 to 2000km) with boundary information from the MODIS active fire products. We estimated an FRP cut-off value that yielded the smallest PM difference using a stepwise search algorithm at 5-FRP increment. The cut-off value, estimated by regressing the PM differences on the natural spline of FRP, was used to produce a reduced dataset without fire-contributed PM. We then predicted the non-fire-related PM time-series for the study period, and subtracted this time-series from the original data to obtain fire-related PM measurements for risk assessment. We constructed daily fire indicators according to boundary (within or outside Malaysia) at various FRP intensity, and used these indicators to decompose the health effects of air PM pollution. Using time-stratified case-crossover study design, we estimated the risk of premature mortality attributable to fire smoke in the city.
		3	Emilie Takahashi	Climate Change and Schistosomiasis mekongi and Maraia in Lao PDR: Spatial epidemiological analysis using earth observation satellite	住血吸虫症は、特に貧困な途上国等で問題になっている顧みられない熱帯病の一つで、死亡率は高くはないものの、感染により労働力や生産性の低下を招き、流行国に多大な経済的損失を与えている。WHOは、2012～2020年のラオスのメコン住血吸虫症対策ガイドラインで、重症感染者数を1%以下にすることを目標としている。本研究では、これまで不明であったメコン住血吸虫症のラオス国内での感染エリアおよびrisk factorを把握するために、南部メコン河沿いの県でヒトと媒介貝の感染調査を行うと共に、地球観測衛星データを用いた空間疫学解析を行っている。その成果をもって、ラオスのメコン住血吸虫症排除政策に寄与することを目的とする。また、地球観測衛星データとマラリアの分布との関連の解析研究では、森林面積が増加したエリアではマラリア患者数が増加していることが分かった。これは、ラオスのマラリアの感染パターンの理解に大きな示唆を与え、流行対策へのヒントとなる。
		4	Hiroshi Hayasaka	Development of prediction method for occurrence of large-scale forest fire around the world by using multiple satellite data and environmental and health impact assessment on wildland fires	Fire regions in which large-scale forest fires occur frequently around the world are becoming evident by the accumulation of hotspot (fire) data by satellite observations of 15 years or more. The relationship between the occurrence of forest fires and meteorological conditions in these areas has also become clear. This study aims to develop forecasting method of forest fire occurrence based on research results on large-scale forest fire in the boreal forest and the southern tropical forest. We report the results of research on recent large-scale forest fires and discuss how to use information from multiple satellite data.
		5	Osamu Kozan	Monitoring of Greenhouse Gasses and Particulate Matters and Assessment of health impact of haze pollutants caused by peatland fires in Indonesia	In this research, we will evaluate the health impacts of smoke haze caused by peatland fires in Indonesia. Specifically, we will conduct air quality monitoring during haze seasons for proper exposure assessment and epidemiological studies. In the epidemiological studies, we will 1) examine the association between the number of hospitalization and haze pollutants from forest fires in Palangka Raya, Central Kalimantan, 2) examine the association of respiratory symptoms and pulmonary function measured by peak flow meter for schoolchildren during the haze season in Pekanbaru, Riau. Our goal of this study is to conduct a monitoring campaign and epidemiological studies and to evaluate the health effects of smoke haze caused by peatland fires in Indonesia. We also apply the results from epidemiological studies and assess the health impacts of haze caused by peatland fires. This study will be conducted with interdisciplinary research collaboration. To complete the present study, we will conduct the following air pollutants monitoring and epidemiological studies in Palangka Raya and Pekanbaru.
	Agriculture	1	Chinatsu YONEZAWA	Rice field extraction using PALSAR-2 full polarimetric data in the Sendai Plain	ALOS-2 PALSAR-2 data observing the Sendai Plain in the full polarimetric mode during the rice growing and maturing season were analyzed. Eigenvalue-eigenvector and four-component decompositions were used to classify the PALSAR-2 data. Vector data for agricultural land-use areas were overlain on the analyzed images. Quantitative comparison of the classification results allowed determination of the most efficient decomposition components for discriminating paddy rice fields from those of other crops; alpha angle and double bounce scattering component ratio.
		2	Genya SAITO	Determination of Planting Crops Using ALOS2 at Shonai Plain In Japan	Shonai Plain was set up as a test field area. We try to determination of planted crops using satellite data. Recently, in Asian countries, GIS is spread widely and agricultural field polygon is commonly used. Crop determination using the polygon is becoming popular. Normally, fields are used without changing, but sometimes, one field is divided two or three fields, and two or three fields are integrated one field. It is necessary to overlay satellite image and the polygon and to check with fitting or not. In case of mismatch, field polygon must be corrected. Simultaneously with this confirmation work for each field polygon, we classify 4 degrees in the SAR image, as small scattering of the water surface '0', scattering slightly larger than the water surface '1', larger than the water surface '2', and large scattering '3'. The crop determinations were performed according to the following standard using to the time series data. Rice: Almost water surface at rice planting time and following several weeks. In summer, there is large vegetation. Wheat: There is large vegetation at rice planting time and small vegetation at summer. Soybean: There is small vegetation at rice planting time and large vegetation in summer. Grasses: There is large vegetation at rice planting time and at summer. Using these evaluation criteria, we performed the crop classifications in Shonai Pain, and the correct answer rates are more than 95%
		5	Bo Zhang	Crop classification using Alos-2 and Radarsat-2 fully polarimetric SAR images	With the economy development of China, the crop types in the autumn season are becoming diversified and comprise rice, corn, soybean, grass, louts and so on. How to map their cultivated area and predict their productive are very promising for the application of SAR remotes sensing. To investigate the ability of crop classification by fully polarimetric (FP) SAR image, several campaigns along with filed surveying were conducted in Wuqing district of Tianjin, north China. The main crops in this area are summer sowing corn, soybean, and rice. When the corn was growing from jointing stage to harvest, four Radarsat-2 Fine Quad mode images with 10 meters resolution were acquired continuously between July 26th and October 6th 2017. In addition, to compare the performance of crop classification using L-band and C-band, an ALOS-2/PALSAR-2 FP image covering this region acquired on 9th June, 2016, was also adopted. Firstly, the backscattering characteristics of those crop types at both bands are investigated respectively. Then, indicators of scattering mechanisms defined by Stokes parameters are analyzed, and comparisons are made between Radarsat-2 and ALOS-2 SAR data on backscattering coefficients as well. Finally, Random Forest (RF) classifier is employed to find out which of the polarimetric features are more superior at the both bands according to their importance rank. In order to validate the selected superior factors in this paper for crop classification, at the same time, SVM classifier was also employed.
		6	Diego Domingos Della Justina	Sugarcane growth monitoring through spatial and temporal signal analysis using C-band SAR, L-band SAR and optical remote sensing images	In this research, the remote sensing signals from space-based SAR and optical sensors are investigated for their sensitivity to sugarcane biomass development and rain conditions. For this, an extensive set of biophysical parameters was collected at several fields in São Paulo state, Brazil. Also, per sensor, the signal quality is assessed, which is used to obtain the consistency of the signals over time. Temporal windows of maximum signal agreement are identified on intra-sensor and inter-sensor level.
		7	Takanori Nagano	Development of classification technique of agricultural fields in Japan by use of medium resolution SAR imageries	The aim of this research is to develop a cost effective and robust satellite image analysis technique that accurately distinguishes major agricultural land use (rice, second major crop, abandonnnement) throughout Japan. For enabling wide spatial coverage with low cost, medium resolution SAR imageries (Alos-2 and Sentinel-1) were used in time-series. For detecting small farm plots, Agricultural Farming Area Data distributed by Midori Net (Japan) was used in combination. In FY2016 and FY2017 land use survey was carried out in Sasayama City (Hyogo) and in Joetsu city (Niigata), using drones. SAR images from March to October were used for analysis. After the pretreatment (geometric correction, speckle noise removal), backscatter images were overlaid on vector files of each field, and only the value of the pixel unique to each field area was averaged and used for classification. Rice fields were detected with higher accuracy due to lower backscatter after transplanting. If the field was larger than 16.1 a, the extraction accuracy was 98.0%. Second major crop (soybeans) could be detected in fields larger than 26.3 a. However in smaller fields distinction between soybean fields and abandoned fields was often difficult. It also became clear that additional features from optical sensor images are necessary to improve the accuracy of detection.
		8	Hasi Bagan	Combination of PALSA-2 and multispectral images for land cover classification	PALSAR-2 data and optical data provide complementary information, and their combination leads to increased classification accuracy. In this study, we evaluated the potential of combined full polarimetric PALSAR-2 data and multispectral images (Sentinel-2 and Landsat 8) and for land cover classification. The full polarimetric PALSAR-2 is particularly important for target classification, because quad-polarization PALSAR-2 data and its polarimetric parameters contain additional real physical target information. As a consequence, by combining optical data and polarimetric parameters into single data set, land cover classification accuracy may be further improved. For efficient and convenient handling of the combined multi-source data, we used a subspace method for the classification and estimated its classification capability for various combinations of optical, PALSAR-2, and polarimetric parameter data sets at different spatial resolution. Our results shows that 3 m resolution classification map is better than 30 m classification map. Subspace method is promising as a tool for classification using optical+SAR images.
Jan. 24 (Wednesday) Conference Room 10B	Hydrology, Snow, Ice and Polar Research	1	Hyongki Lee	Absolute water storages in the Congo River floodplains from integration of InSAR and satellite radar altimetry	Floodplains delay the transport of water, dissolved matter and sediments by storing water during flood peak seasons. Estimation of water storage over the floodplains is essential to understand the water balances in the fluvial systems and the role of floodplains in nutrient and sediment transport. However, spatio-temporal variations of water storages over floodplains are not well known due to their remoteness, vastness, and high temporal variability. In this study, we propose a new method to estimate absolute water storages over the floodplains by establishing relations between water depths (d) and water volumes (V) using 2-D water depth maps from the integration of Interferometric Synthetic Aperture Radar (InSAR) and altimetry measurements. We applied this method over the Congo River floodplains and modeled the relation using a power function, which revealed the cross-section geometry of the floodplains as a convex curve. Then, we combined this relation and Envisat altimetry measurements to construct time series of floodplain's absolute water storages from 2002 to 2011. Its mean annual amplitude over the floodplains (~7,777 km2) is 3.860.59 km3 with peaks in December, which lags behind total water storage (TWS) changes from the Gravity Recovery and Climate Experiment (GRACE) and precipitation changes from Tropical Rainfall Measuring Mission (TRMM) by about one month. The results also exhibit inter-annual variability, with maximum water volume to be 5.90.72 km3 in the wet year of 2002 and minimum volume to be 2.010.63 km3 in the dry year of 2005. The inter-annual variation of water storages can be explained by the changes of precipitation from TRMM.

ALOS-2 Abstract

Conference Room 10B

Date	Session	No	Speaker	Research Title	Abstract
Jan. 24 (Wednesday) Conference Room 10B	Hydrology, Snow, Ice and Polar Research	2	Christian Koyama	ALOS-2 bridging the gap - soil moisture estimation from sub-field scale to catchment scale to regional-scale by using dual-polarization Stripmap and ScanSAR data	With various low-resolution soil moisture missions (e.g. GCOM-W, SMAP, SMOS) in orbit today, the monitoring of global-scale soil moisture distribution is operational at a very advanced stage. However, the gap between global-scale moisture distribution and distributions at smaller scales, ranging from regional-scale over catchment scale down to sub-field scale, still poses a major challenge in hydrological remote sensing. For the first time we present soil moisture maps derived from 50 m ScanSAR data using the dual-polarization vegetation corrected retrieval algorithm. Our results demonstrate that ALOS-2 well has the potential to close this scale gap by combined use of Stripmap and ScanSAR modes allowing to study and understand the scaling properties of soil moisture on all spatial scales.
		3	Claudia Notarnicola	Testing ALOS-2 satellite data and a data-driven approach for soil moisture retrieval in agricultural areas under different geographical conditions	The main objective of this study is to investigate the capabilities of L-band data and to develop robust data –driven approaches based on machine learning techniques to derive accurate soil moisture mapping over main agricultural areas under different geographical conditions The proposed algorithms will be tested on three main test sites located in Italy, Argentina and Japan. Preliminary results are available over the Italian test site, located in Mazia valley (Trentino Alto-Adige, Italy), where ground stations are available together with measurements from several field campaigns. The comparison with ground data (SMC) shows encouraging results. For SMC estimates, we get R=0.91 with a RMSE of 0.04 cm3/cm3. In this initial step, we also tried to estimate Vegetation Water Content providing with the following figures of merit: R=0.81 and RMSE of 0.07 Kg/m2.
		4	Zhen Liu	Imaging tectonic and anthropogenic processes in central and southern California using ALOS-2 ScanSAR observations	The L-band ALOS-2 satellite has been acquiring data globally since 2014. Its dominant ScanSAR imaging mode has a 350km wide swath, with good burst alignment since February 2015, allowing for reliable interferogram formation. Its nominal repeat interval of 14 days (though typically acquired at coarser sampling intervals) and long wavelength has proven very useful at imaging large scale tectonic and non-tectonic deformation signals. We present initial InSAR time series results in central and southern California region using ALOS-2 ScanSAR data. The pervasive existence of ionosphere artifacts in ALOS-2 ScanSAR interferometry makes it crucial to properly correct them for accurate deformation measurements. We applied a split-spectrum based approach developed at JPL [Liang et al., 2017] to correct ionospheric noise and show that this correction is able to remove ionospheric features successfully while still retaining long-wavelength deformation signals. Our results in central California reveal the large-scale ground subsidence in the San Joaquin Valley due to over-exploitation of groundwater along with localized near-fault creep across the central San Andreas Fault. Groundwater related deformation is spatially and temporally variable and is composed of both recoverable elastic and non-recoverable inelastic components. Our ALOS-2 ScanSAR velocities across the southern San Andreas fault system show that they agree well with GPS velocities, with an RMS error ~4-5mm/yr. The consistency between ALOS-2 and GPS over large areas suggests that ALOS-2 data have great potential in mapping long-wavelength deformation signals accurately without reliance on using GPS as ground control points.
		5	Sang-Eun Park	Observation of permafrost environment in Eastern Siberia with ALOS PALSAR polarimetric data	The permafrost active layer undergoes repetitive seasonal freezing/thawing processes affecting subsurface geo-hydrological processes. This study evaluated L-band scattering characteristics in permafrost ecosystem and their temporal variations. Experimental results with ALOS PALSAR data demonstrate that fully polarimetric SAR observations help understanding seasonal variations of radar backscattering power and signal penetration property caused by the large contrast in the dielectric constant.
		6	Tumen Chimitdorzhiev	ALOS PALSAR-2 interferometry of snow cover: first results of experiment with corner reflector.	An applicability of ALOS PALSAR-2 interferometry for the measurements of snow layer thickness and snow water equivalent was studied. Experimental dataset in the measurements of thickness and snow water equivalent consisted of two datasets from ALOS PALSAR-2 observations made in snow free conditions and in the presence of snow cover. An essential feature of the experiment was the deployment at the test field of the reference corner reflector having stable level of radar cross section and scattered signal phase center location. Its interferometric phase difference was used as reference in calculations of the phase differences induced by snow cover on the test field. The deployment of the corner reflector with 2 meters leg on the smooth surface of the test field provided high corner signal to surrounding clutter ratio, exceeding 34 dB, and respective accurate measurements of the corner signal phase difference. At the same time, overall accuracy is determined by signals of the test field covered with snow layer. Direct measurements of snow parameters are: snow thickness 20 – 30 cm, snow density 0.2 – 0.21 g/cm3.
		7	Camilla Brekke	Classification of Fram Strait Sea Ice by Synthetic Aperture Radar	Space-borne synthetic aperture radar (SAR) systems are essential for operational monitoring of sea ice in polar regions. Radar polarimetry is a powerful niche within remote sensing, allowing investigations of various sea ice types' scattering properties. Full-polarimetric and compact polarimetry SAR measurements may hence allow improved sea ice type characterization and discrimination capabilities aiding operational sea ice services. In this talk, we disseminate results from remote sensing measurements of sea ice collected under the Norwegian Young Sea Ice 2015 (N-ICE2015) field campaign that took place January to June 2015 in the Fram Strait. In particular, we focus on multifrequency SAR studies, involving acquisitions from ALOS-2 (L-band), Radarsat-2 (C-band), and TerraSAR-X (X-band), and give some directions for future research. First, an analysis of full-polarimetric L-, C-, and dual-polarization (HH/VV) X-band SAR data recorded over lead ice revealed that by combining the scattering entropy and co-polarization ratio we can successfully separate newly formed sea ice from open water and thicker sea ice within all three frequencies throughout the winter and spring season. The polarization difference exhibits less incidence angle dependency and shows to provide additional discrimination support. X- and L-band SAR acts complementary to the more regular acquisitions in C-band in terms of characterizing the newly formed sea ice types and surface structure. Second, a semi-coherent backscatter model is used to interpret the space-borne SAR data acquisitions of the Fram Strait sea ice. Specifically, full-polarimetric L-, C-, dual-polarization (HH/VV) and full-polarimetric X-band SAR is compared to model output. Constrained to simultaneous in-situ observations from the campaign, the model is able to reproduce the backscatter from lead ice and ice floes well for the individual frequency bands. For open water leads, unexpectedly high backscatter values are observed in L-band compared to C-band. Possible explanations relating to the sea ice formation process are discussed. Third, an automatic sea ice classification algorithm developed for near real-time services on full-polarimetric SAR measurements has been tested for X-, C-, and L-band data. Spatial and temporal coincident sea ice freeboard measurements of an airborne laser scanner as well as sea ice thickness data were used to validate the classification results. It was found that the number of multipolarization SAR parameters could be reduced from 18 to 9, for all three frequencies, whilst still maintaining the 96.9% sea ice classification accuracy. The set of parameters that were found most useful in L-band was slightly different compared to those for the other two frequencies. Next, exploring a supervised classification scheme, we which to include more full-polarimetric ALOS-2 L-band SAR scenes from the N-ICE campaign. Our goal is to investigate which multipolarization SAR parameters that are most useful for operational services, aiming at high accuracy sea ice classification under various environmental conditions and imaging geometries.
		8	Mohammed Dabboor	Improving sea ice characterization using PALSAR-1/2 SAR imagery	Characterizing different sea ice regimes is typically undertaken using C-band SAR imagery at either HH or VV polarization. There have been suggestions (mostly theoretical) that use of L-band SAR and its longer wavelength and subsequent increased penetration capability could be beneficial for improving sea ice characterization. Here, we present the results of several studies that demonstrate the improvement of discriminating between sea ice types and resolving sea ice motion, especially during the melt season when using L-band SAR imagery from PALSAR-1/2 compared to C-band SAR.
		9	Juha Antero Karvonen	Arctic Sea ice detection and classification based on dual-polarized L-band SAR data from ALOS2/PALSAR2	We have studied detection and classification of Arctic sea ice in the Arctic using ALOS2/PALSAR2 data acquired during the winter season 2016-2017. The data set consists of about 150 PALSAR2 dual polarized (HH/HV) ScanSAR images. For detercting and classifying sea ice we have computed several texture features in addition to SAR sigma0. The results were compared to results for C-band dual-polarized (HH/HV) data from SENTINEL-1.
		10	Chunxia Zhou	Seasonal and interannual ice velocity changes of Antarctic outlet glaciers based on multisource remote sensing data	Changes of ice flows, outlet glaciers in particular, can reflect climate change. By mapping time-series ice-flow velocity, we are also able to investigate the relation between dynamics of the Antarctic ice sheet and global environmental change. We use SAR data to complement the measurements obtained from optical data, and L-band data to complement C-band data. ERS, Landsat 7, ALOS, Landsat 8, ALOS-2 and Sentinel-1 data are utilized for ice velocity determination of outlet glaciers in Antarctica based on feature tracking and offset tracking. Interannual and seasonal changes of ice-flow velocity are investigated in this study.
		11	Tsutomu Yamanokuchi	Detection of grounding line change in East Antarctica by time series InSAR analysis	Climate change in recent years has a strong influence on the Antarctic ice sheet. In the west Antarctica, severe ice thinning progresses, on the other hand, it does not have much impact in East Antarctica. In this study, time series change of grounding line on the East Antarctic ice sheet was analyzed as a parameter representing ice sheet fluctuation. The analysis of grounding line position by InSAR was conducted and we will report the present status,advance or retreat of grounding line.
	Geology	1	Andrea Manconi	ALOS PALSAR and World3D datasets in support of landslide mapping in the high Himalaya of Bhutan	We combined classical geological and geomorphological approaches with remote sensing analyses on satellite data acquired from different optical and radar sensors, to assess large rock instabilities in the High Himalaya of Bhutan. We investigated high resolution optical imagery, high resolution digital terrain models ALOS World 3D DEM (5m) and space-borne SAR interferometry (ERS 1-2, Envisat, ALOS 1-2 PALSAR). We generated an inventory map of past rock slope deformation phenomena and failures.
		2	R.S. Chatterjee	Land Surface Deformation due to Groundwater Depletion induced Aquifer System Compaction and Seismicity in the Himalaya in Northern India	Groundwater depletion hotspots in Northern India were identified and DInSAR analyses of ALOS-1 and ALOS-2 data were carried out. Collateral DInSAR and precision levelling observations were compared with groundwater depletion induced aquifer system compaction. Similarly, DInSAR analysis across the Himalaya was carried out to identify strain accumulation areas. Co-seismic and post-seismic deformations (e.g., Nepal Earthquake) were studied to characterize surface displacement due to the earthquake and damage assessment in the Indian region.
		3	Yixian Tang	ALOS-2 PALSAR-2 SCANSAR INTERFEROMETRY FOR GROUND DEFORMATION MONITORING IN COASTAL AREA OF JING-JIN-YI, NORTHERN CHINA	Differential interferometric synthetic aperture radar (DInSAR) has developed fast over the past decades and gradually been an effective technique to investigate surface deformation with a centimeter to millimeter accuracy since it was successfully applied first to study the displacement caused by large earthquake event. This technique is based upon the analysis of the phase difference between pairs of synthetic aperture radar (SAR) images over the same area, which is often affected by atmospheric delay, and changes in the scattering behavior and look angle between image dates. In order to overcome these temporal and spatial decorrelation, several kinds of advanced time series InSAR techniques, such as PSI, SBAS and StaMPS, are proposed to produce very accurate temporal deformation profiles by inversion of a stack of DInSAR interferograms. There is a great demand for deformation monitoring of very large areas by exploiting several SAR data frames, which makes the wide swath mode of SAR an attractive imaging mode for large scale geophysical studies. It can provide a wide coverage with more than 300km range swath and short repeat cycle, which is significant for seismic displacement and large scale land subsidence study. A land deformation map over 300×300km area can be obtained by using only one wide swath data pair instead of processing several tracks of SAR data from stripmap mode based on DInSAR technique. The research of Wenchuan earthquake is a good example to see the advantages of ScanSAR interferometry. With the recent successful operation of Sentienel-1 and ALOS-2 mission, there is increasing interest in exploiting the wide-swath mode of SAR for measuring surface topography and deformation over large area. By using TOPS data from Sentienl-1, the land subsidence of Mexico city over 39000km2 area is obtained. And the line-of-sight displacement of Nepal earthquake is studied by using ALOS-2 PALSAR ScanSAR mode data. Due to groundwater over-exploitation, the coastal area of Beijing-Tianjin-Hebei (Jing-Jin-Yi) has been suffered from land subsidence during last two to three decades, where InSAR technique has also been applied to monitor ground subsidence in some local areas of the region. Until recently, a complete survey of ground subsidence over the whole region has been done by using stripmap mode SAR data from several paths and frames. In this study, based on 3-pass DInSAR technique, the ground subsidence over the coastal of Jing-Jin-Yi is studied by using two adjacent frames 2800 and 2850 in track 31 of PLASAR-2 ScanSAR mode data from 2015 to 2016. The result shows that the ground deformation over large area can be benefit from ScanSAR interferometry greatly.

ALOS-2 Abstract

Conference Room 10B

Date	Session	No	Speaker	Research Title	Abstract
Jan. 24 (Wednesday) Conference Room 10B	Geology	4	Rou-Fei CHEN	Monitoring of deep-seated landslide activity with ALOS/PALSAR imagery in Taiwan: Recent results and future prospects	During Typhoon Morakot in 2009, the deep-seated landslide in Hsiaolin Village transformed into a catastrophic landslide and killed over 450 people. How to find deep-seated landslides on the main island of Taiwan and assess their activity have since then become a significant task for the government for disaster prevention and mitigation. In the past few years, our research team has, according to topographic signatures of landslide, identified over 2,000 deep-seated landslides using airborne LiDAR derived 1 m resolution DEM. Among these landslide, we need to know which landslides have the potential to become a catastrophic landslide in order to make a reasonable landslide mitigation plan. Temporarily coherence points (TCPs) are points that remain coherent in one or several interferograms of SAR acquisitions (Zhang et al. 2012). This TCP-InSAR analysis is based on ALOS/PALSAR images acquired from Dec. 2006 to Mar. 2011 with a satellite recurrence cycle of 46 days. The annual deformation rate calculated is acquired from more than 20 satellite images. In this study, we applied to construct the annual deformation in 135 deep-seated landslide sites. Our analysis is an alternative solution for constructing a deep-seated landslides inventory. We estimated and detected their activity, separate stable and unstable areas, and define the location of deep-seated landslides. By comparing the TCPs and the field investigation records, several imperceptible deep-seated landslide locations with identifiable boundaries and spatial distribution of instability are found. The surface deformation pattern also implies different landslide developments and failure mechanisms on the slopes. Furthermore, such monitoring can lead to a classification of deep-seated landslides and determine hazard zonation based on different deformation rates, which are considered as the key index of deep-seated landslides. Our monitoring can also be used to detect suspicious activity and fast deformation that correspond to precursor of catastrophic landslides. TCP-InSAR provides the possibility to monitor deep-seated landslide activity over an extensive area. From the short-term perspective, we can conduct a comprehensive investigation on potential landslide areas that are larger than 10 hectares and select those with higher activity level; from the mid-term perspective, we can better the assessment of deep-seated landslide risks, build an inversion model for sliding surfaces, locate deep-seated landslides, and monitor small potential landslide areas that have important secured objects; finally, together with sustainable geotechnical ground and underground monitoring works, we will be able to acquire cumulative surface deformation over time to monitor significant deep-seated landslides comprehensively.
		5	Joong-Sun Won	A study of recent earthquakes in South Korea by ALOS-2 interferometry	This research is focused on studying recent earthquakesin the southwestern parts of the Korean Peninsula using ALOS stripmap and ScanSAR interferometry. The Korean Peninsula had long been relatively stable and free from large earthquakes mainly because it locates inside of Eurasian plate. However, a series of earth quakes with considerable magnitudes has been occurred in the southwestern parts of the peninsula in 2016 and 2017. ALOS-2 has been a key role to understand the characteristics and mechanism of those unexpected fault activities. A comprehensive approach is applied for this study including ALOS stripmap and ScanSAR interferometry, multi-aperture interferometry (MAI), modeling, etc. Results of the analysis is to be reported with a view of important contribution of ALOS to the study.