

A study on BSI (BRF Structure Index) using BRF property

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CREST PEPPERS

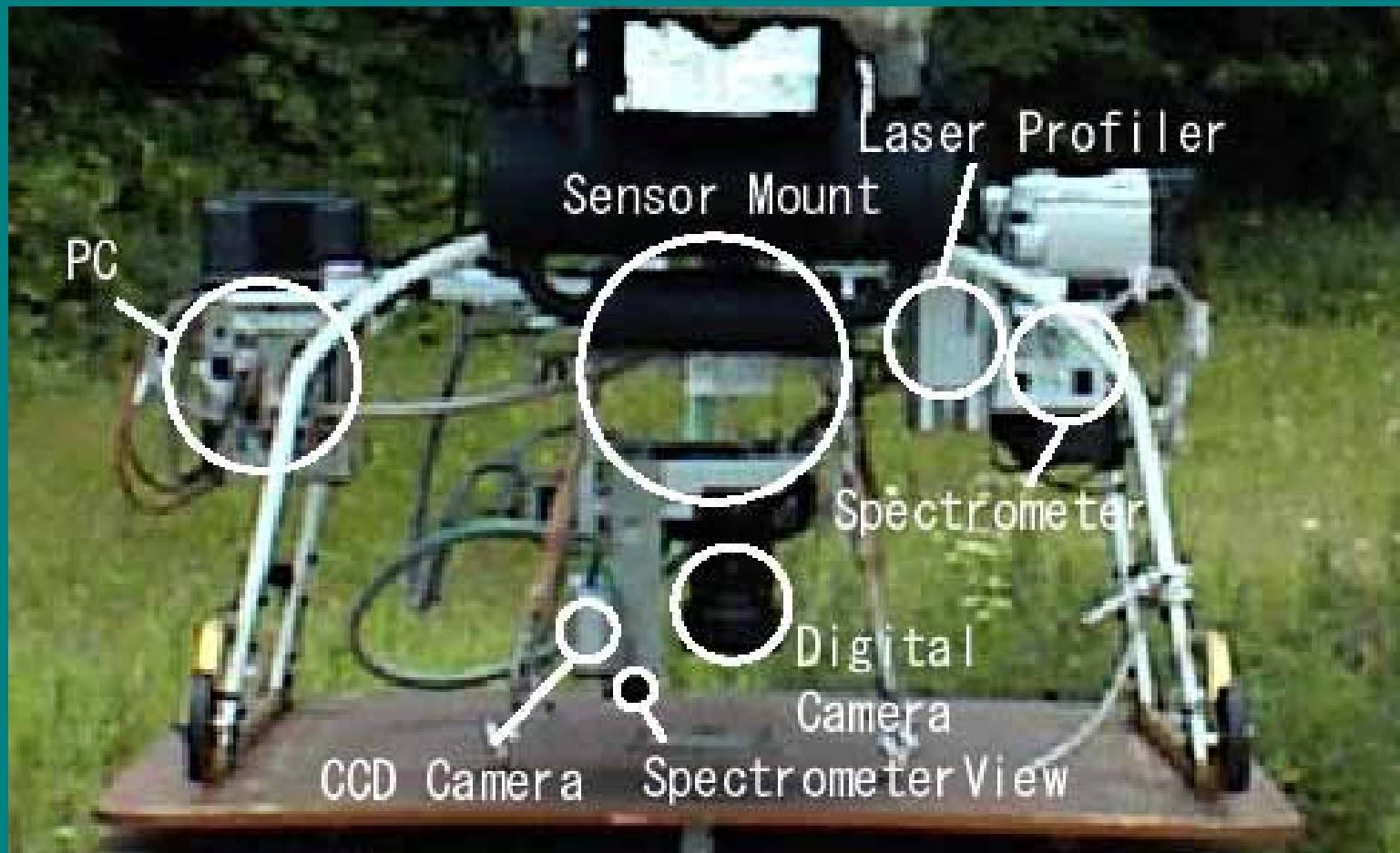
Backgrounds

- ◆ Global environmental problem is serious
- ◆ Influence of human activities increase
- ◆ Enormous satellite data will exist
(including GLI, SGLI)
- ◆ Global vegetation shows environmental condition and influence of human activities

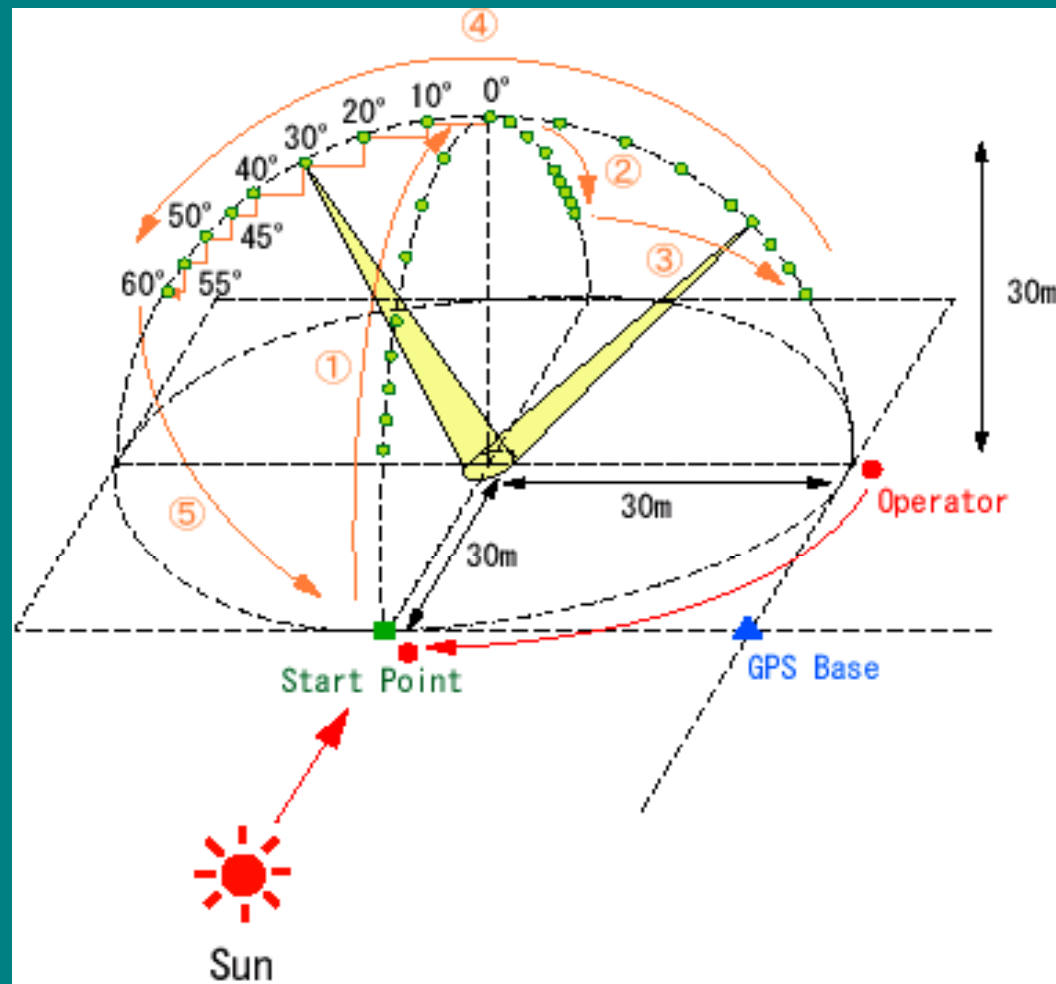
BRF measurements

- ◆ To recognize BRF of each vegetation type
 - ◆ Natural forest
 - ◆ Artificial plantations
 - ◆ Grassland
 - ◆ Farmland

Measurement system



BRF measurement



角度による見た目の変化1



2000/7/2 12:43 Oregon

N44.251292°

W122.210735°

角度による見た目の変化2



2000/7/2 12:43 Oregon

N44.251292°

W122.210735°

角度による見た目の変化3



2000/7/2 12:43 Oregon

N44.251292°

W122.210735°

角度による見た目の変化4



2000/7/2 12:43 Oregon

N44.251292°

W122.210735°

角度による見た目の変化5



2000/7/2 12:43 Oregon

N44.251292°

W122.210735°

角度による見た目の変化6



2000/7/2 12:43 Oregon

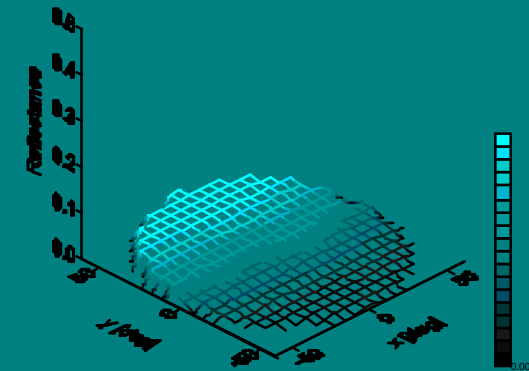
N44.251292°

W122.210735°

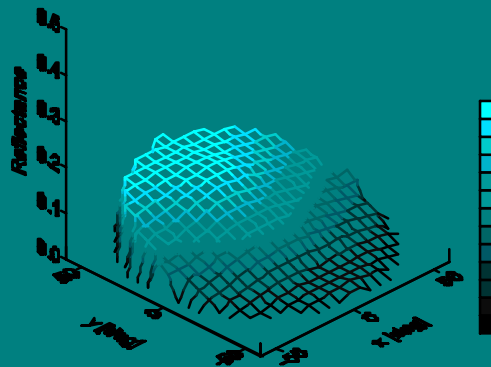
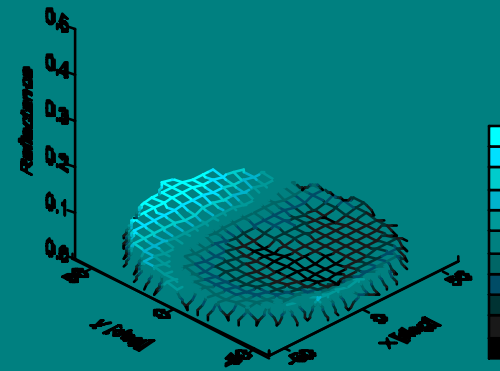
Sites in USA (MODIS core site)



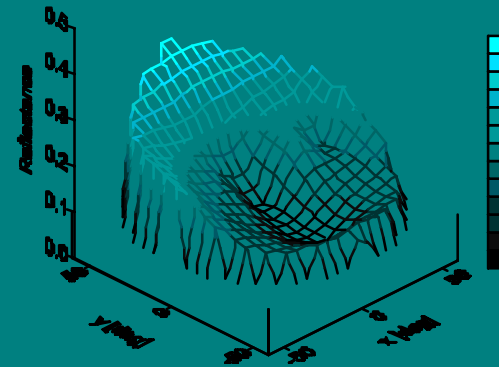
BRF from RC helicopter



R



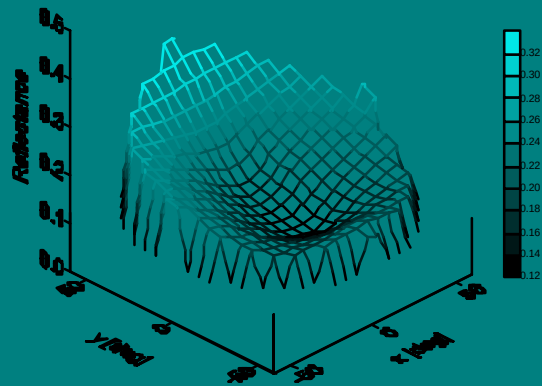
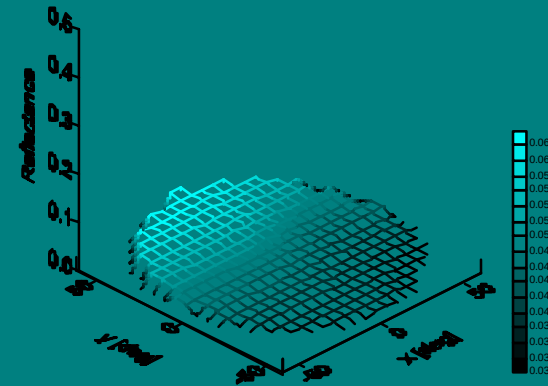
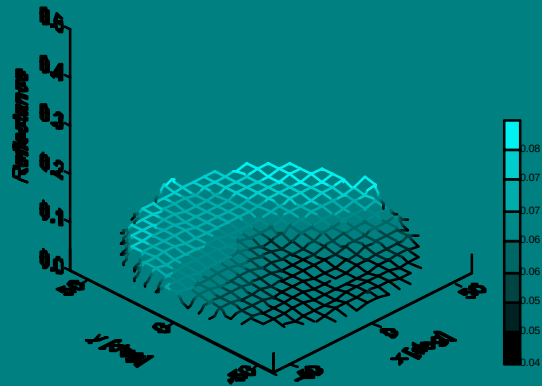
NIR



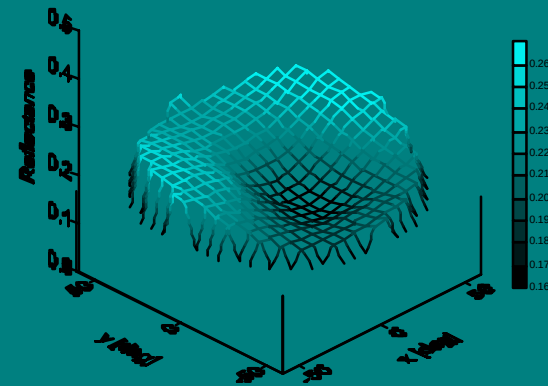
Conifer

Broad leaf

BRF from RC helicopter



Shrub



Grassland

Check BRDF model

Input

VCR : Vegetation cover Ratio

N : Number of grass

H : Grass canopy height

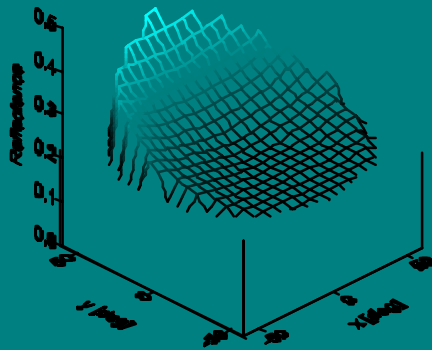
R_s : Soil reflectance for each wavelength

θ_{sun} : Solar Zenith angle

R_g : Ground reflectance at nadir

τ : Transmittance

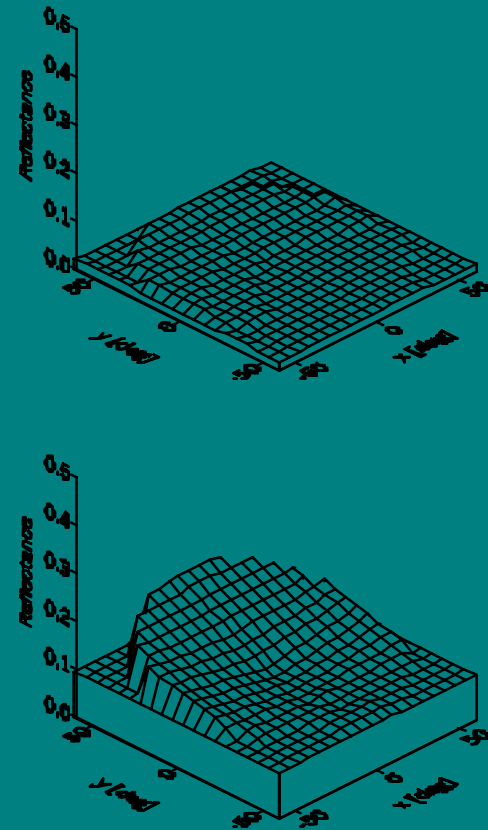
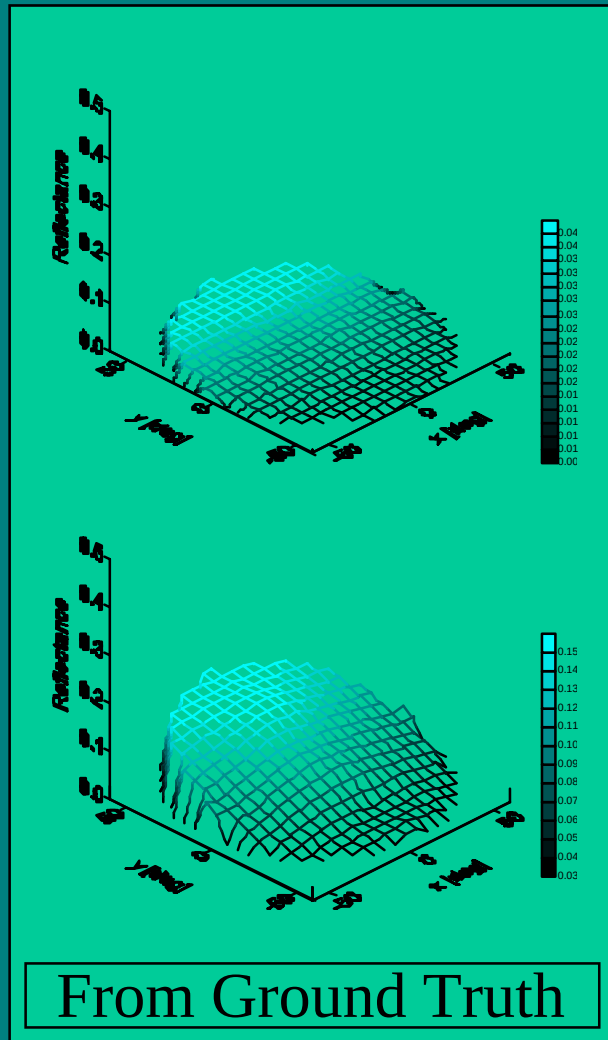
Scan : Geometry of satellite



$$R_{BRDFchk} = f(VCR, N, H, R_{schk}, \theta_{sun}, R_{gchk}, \tau_{chk}, Scan)$$

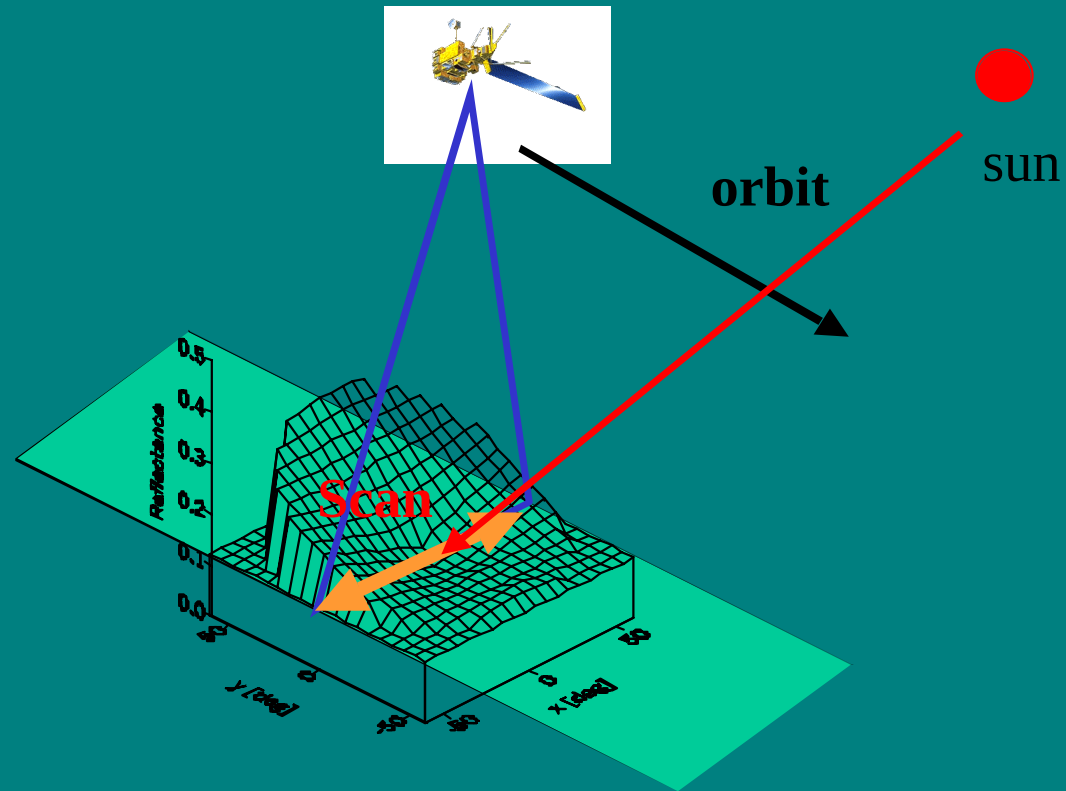
BRDF
(**R_{BRDF}**)

Model Conifer

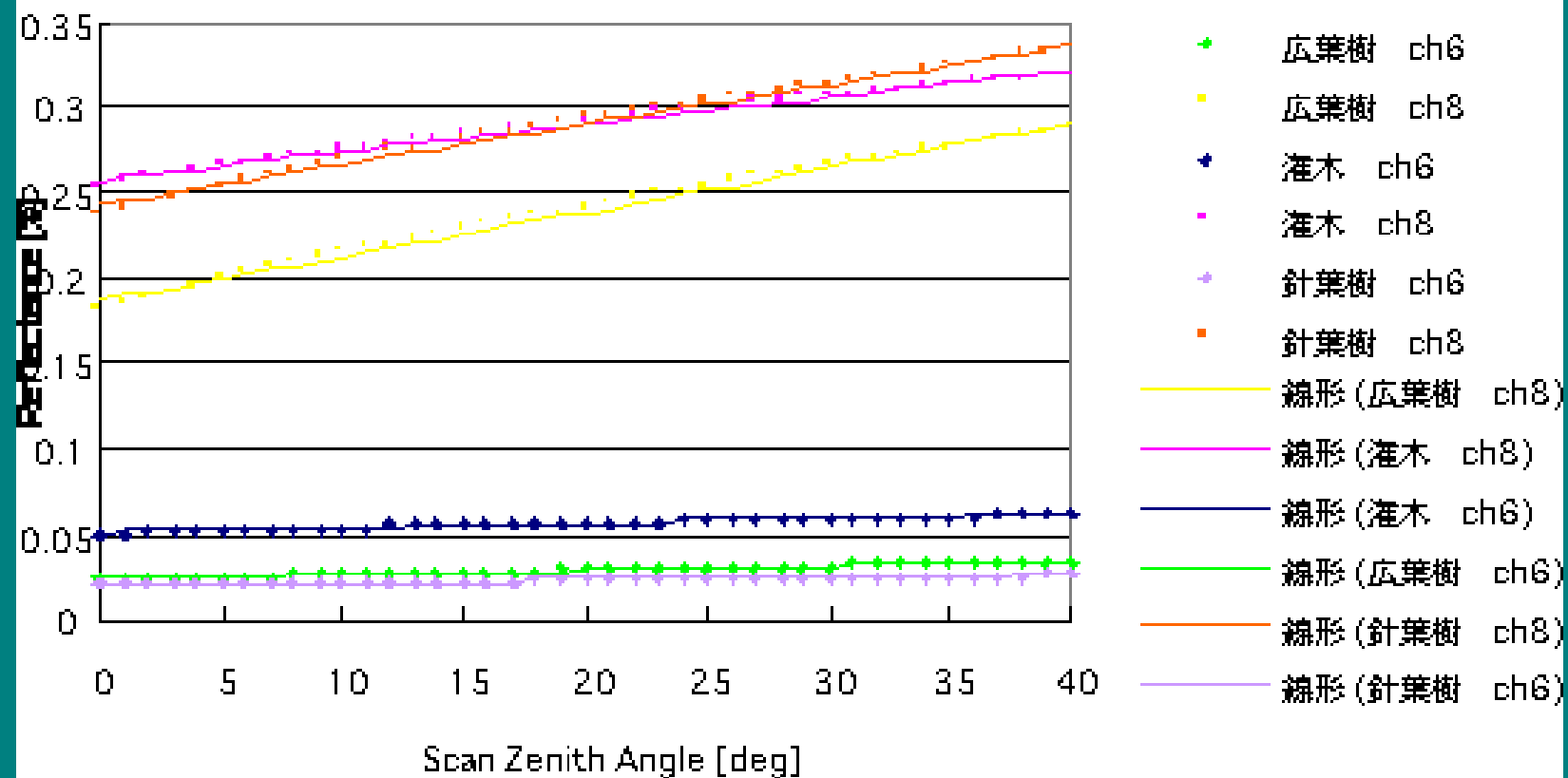


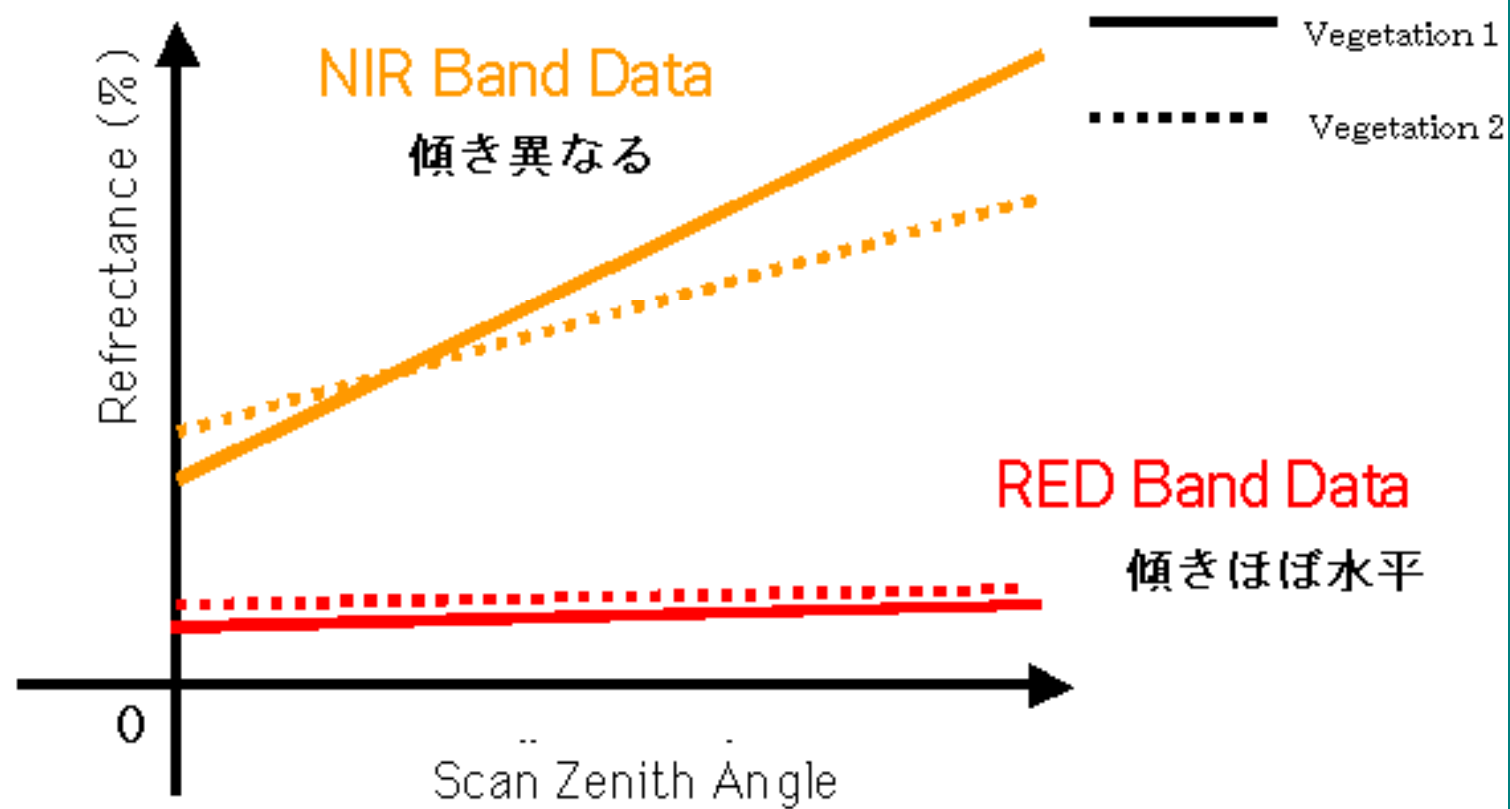
Model base

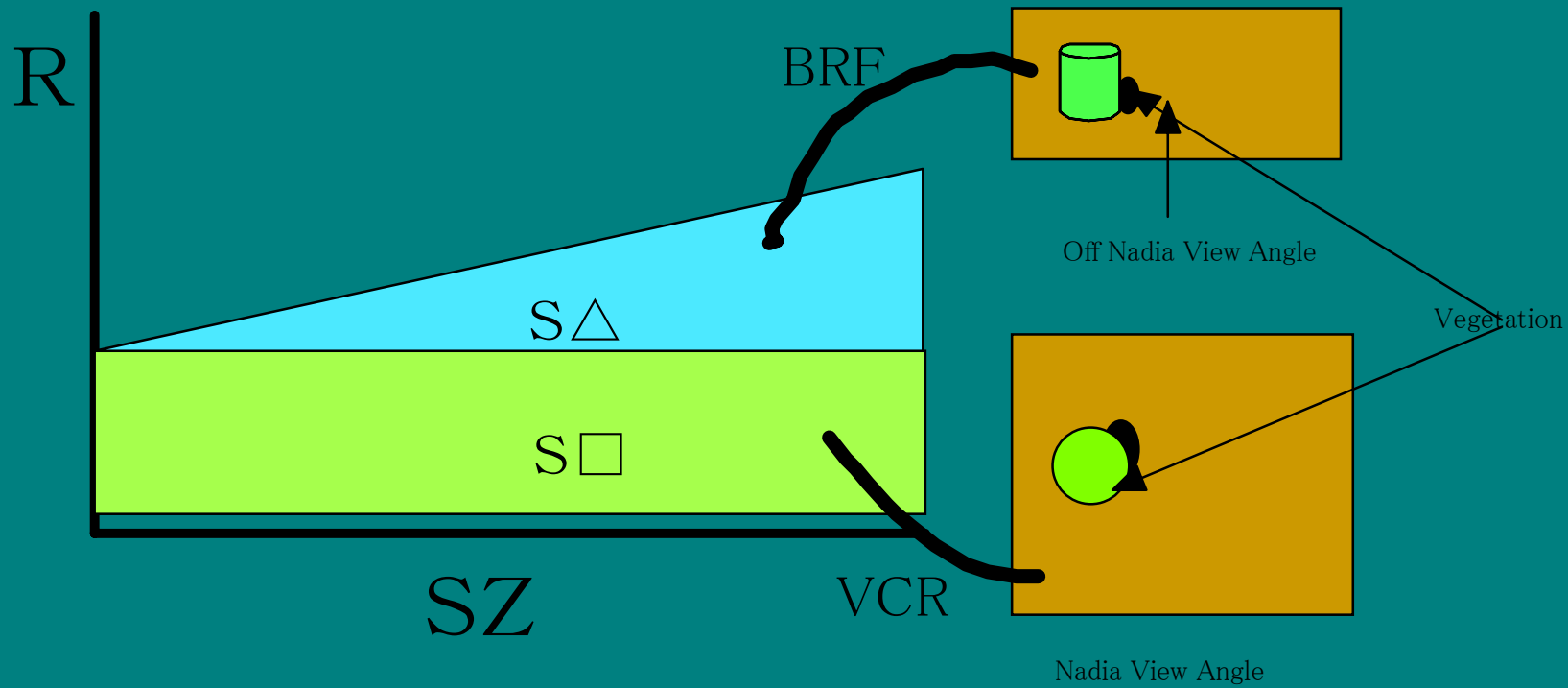
Vertical plane

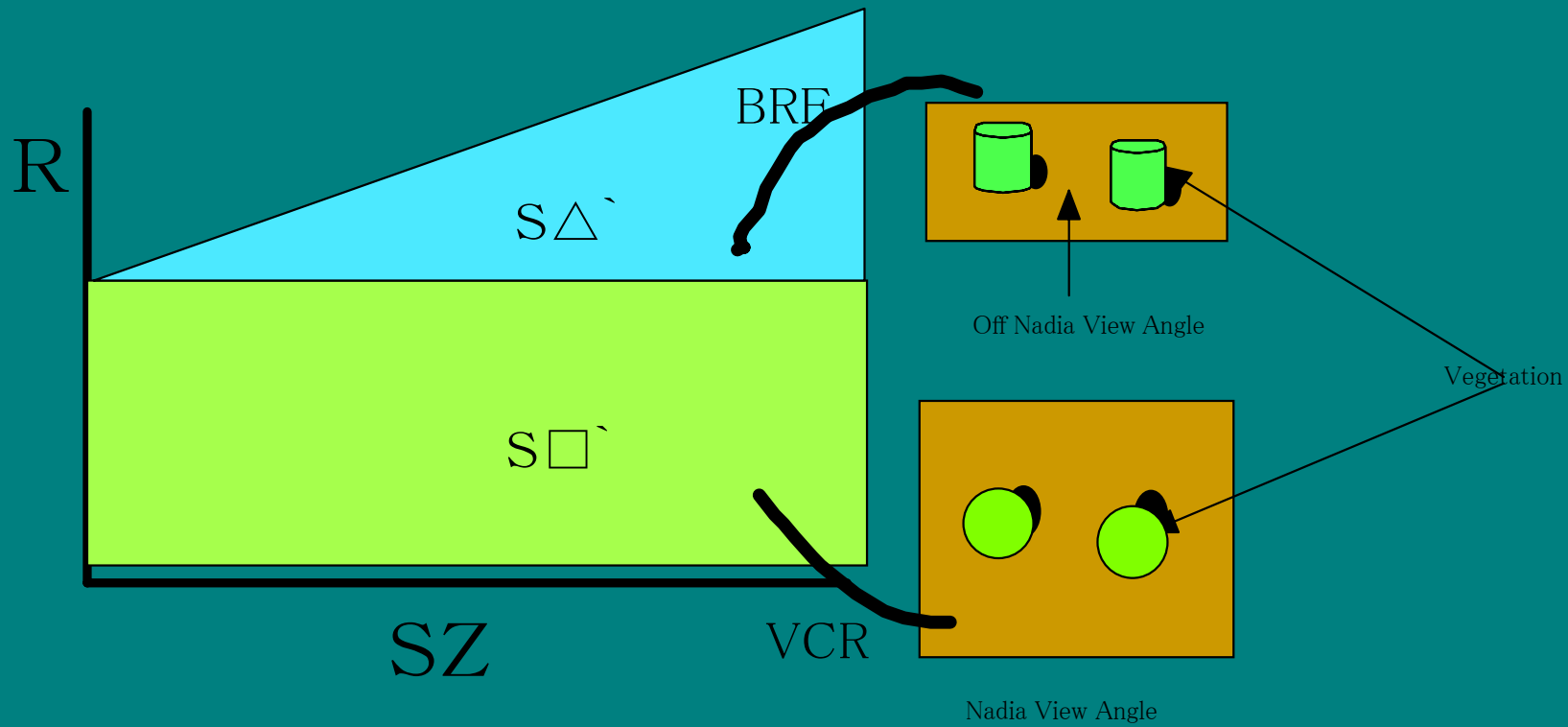


Vertical plane

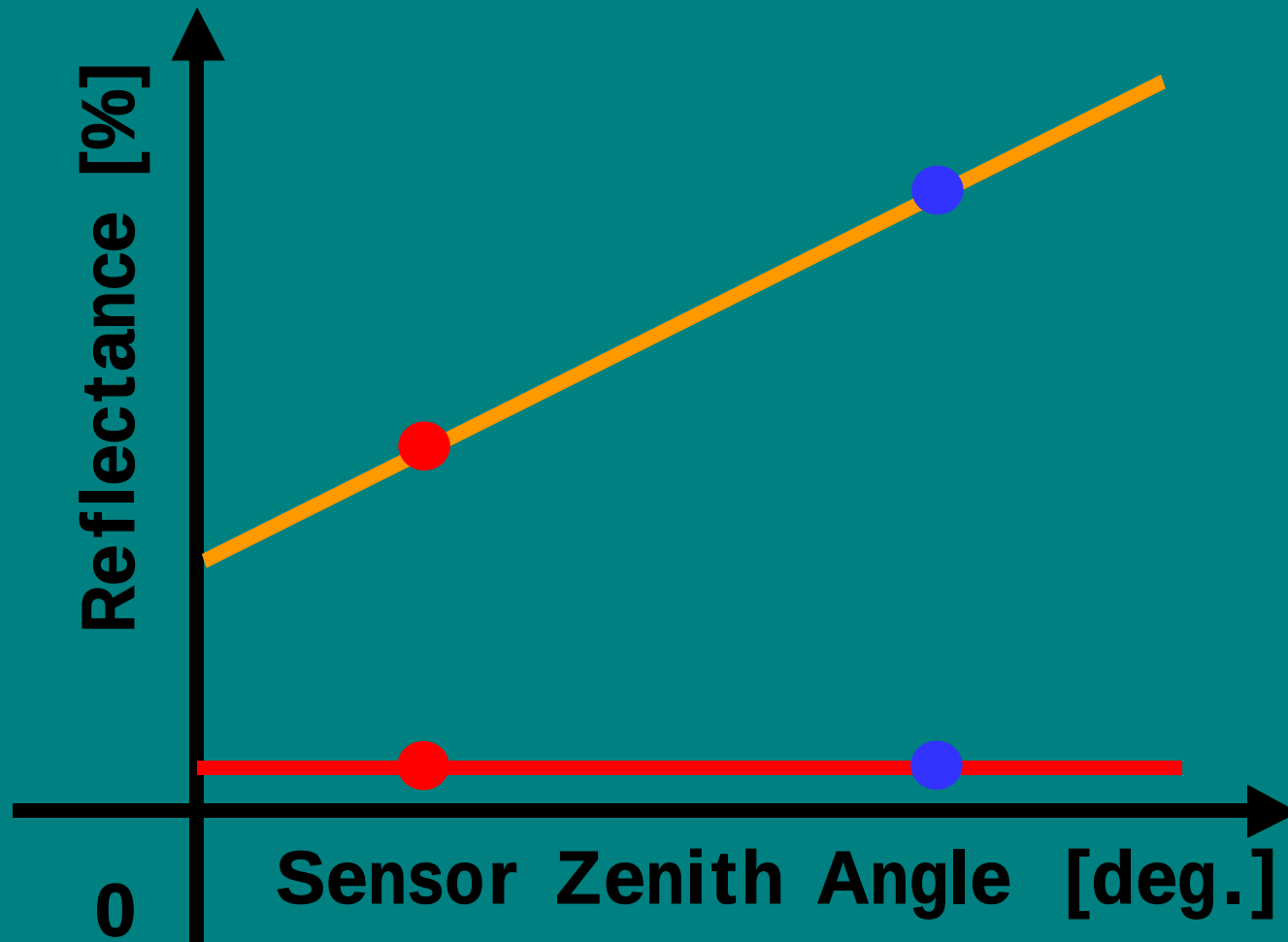




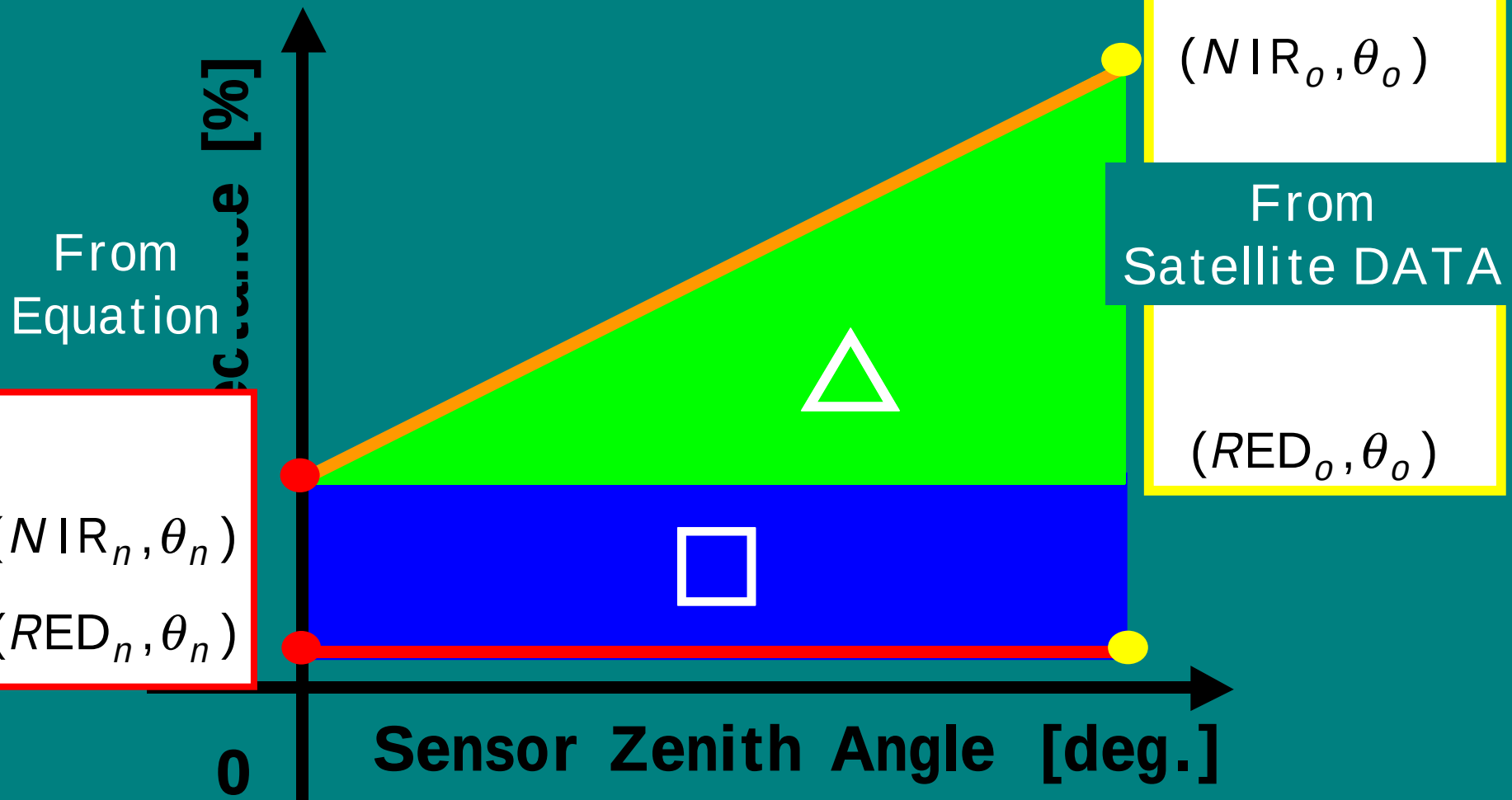




Using Satellite data



To show Using Satellite data

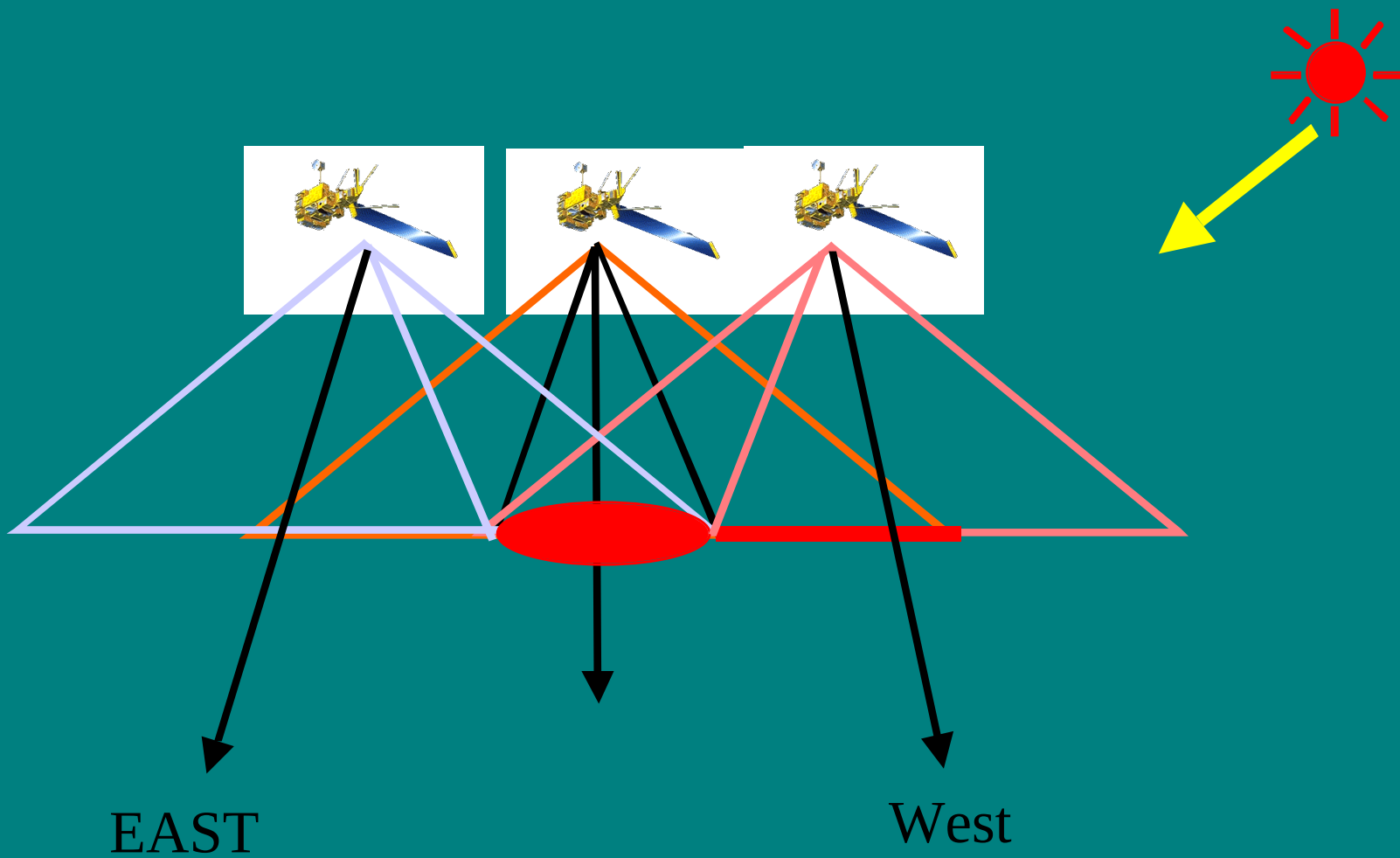


BSI

- ◆ Bi-directional Reflectance Factor
Structure Index

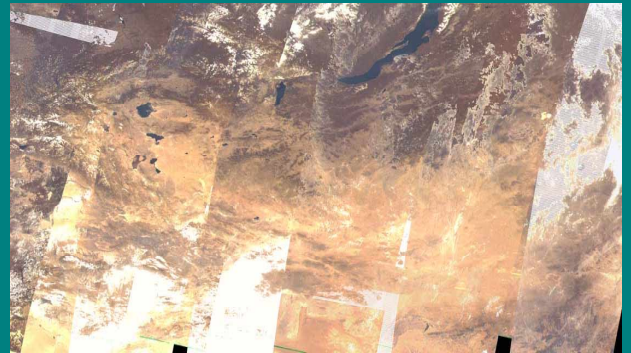
$$BSI = \frac{NIR_{side} - R_{side}}{NIR_{nadi} - R_{nadi}}$$

Defined by Y. HONDA and A. KONDA

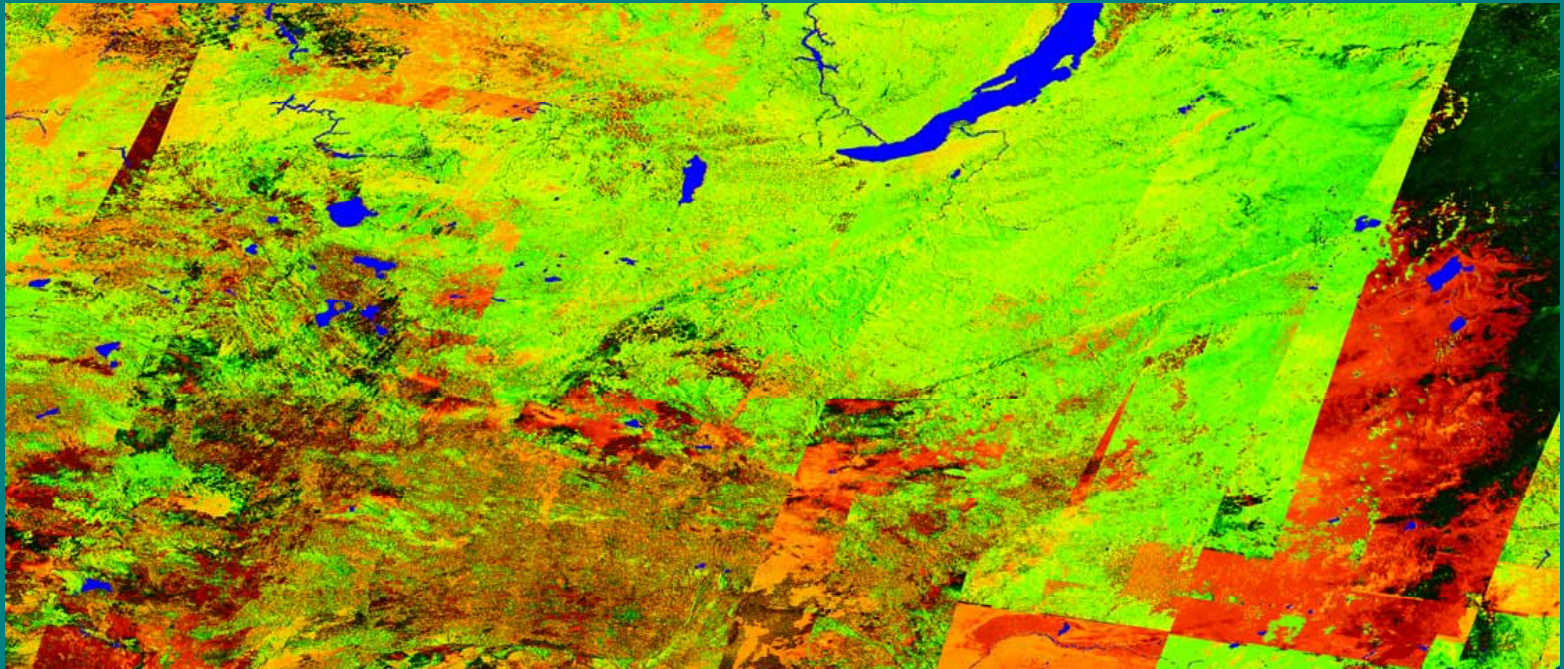




Mongolia



BSI image from OCTS (ADEOS)



Site in Mongolia



Site 1 草地



Site 2 草地



Site 3 草地



Site 4 草地



Site 5 灌木

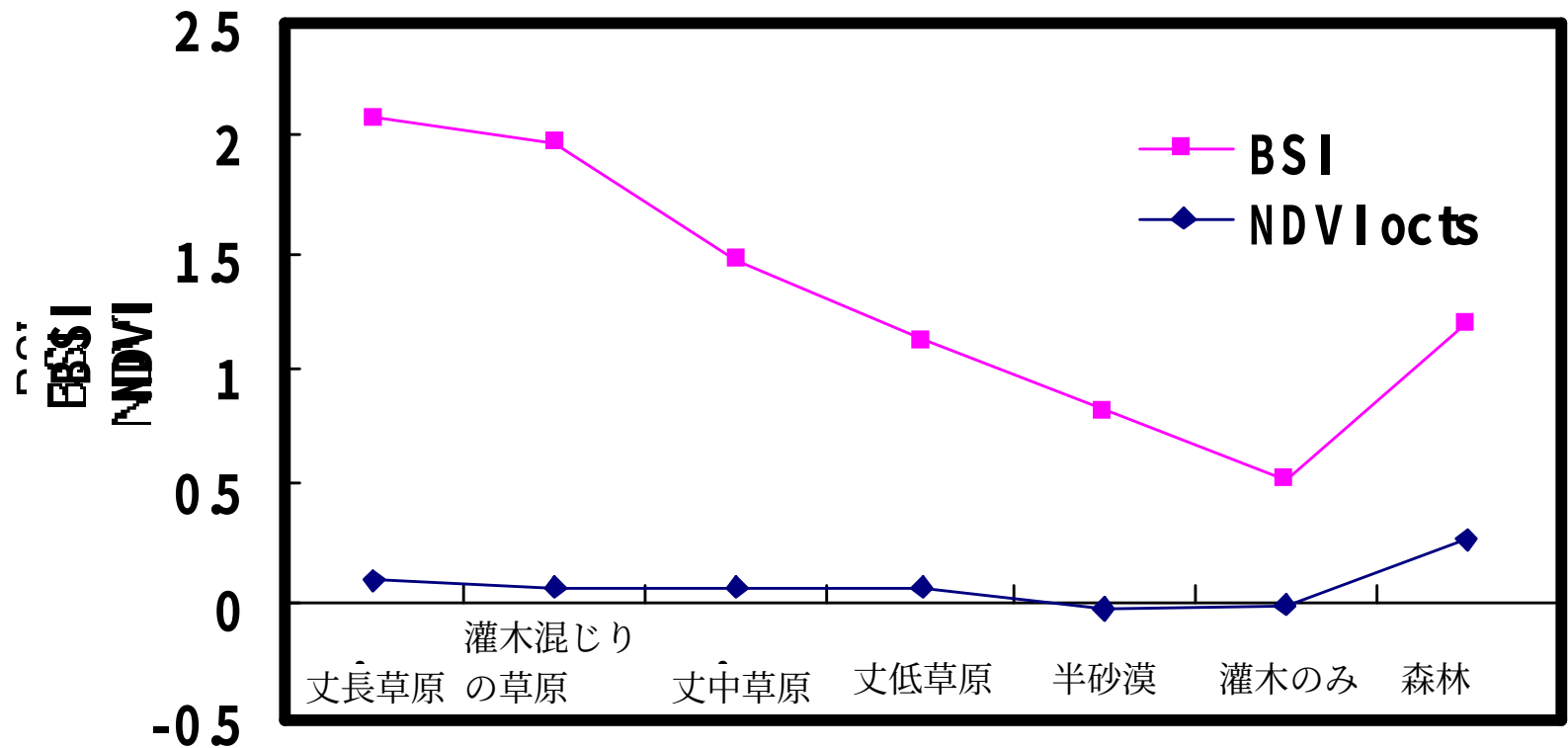


Site 6 灌木

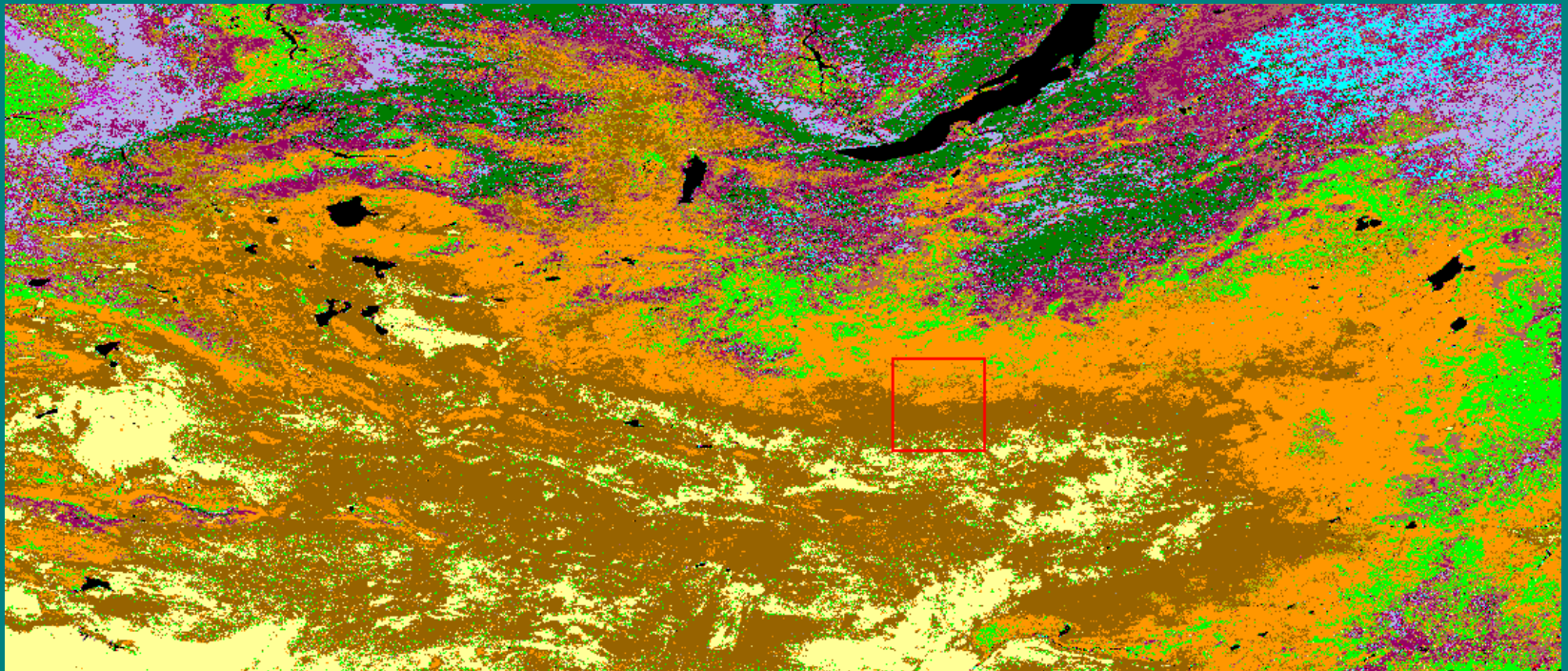


Site 7 森林

Comparison between BSI and NDVI

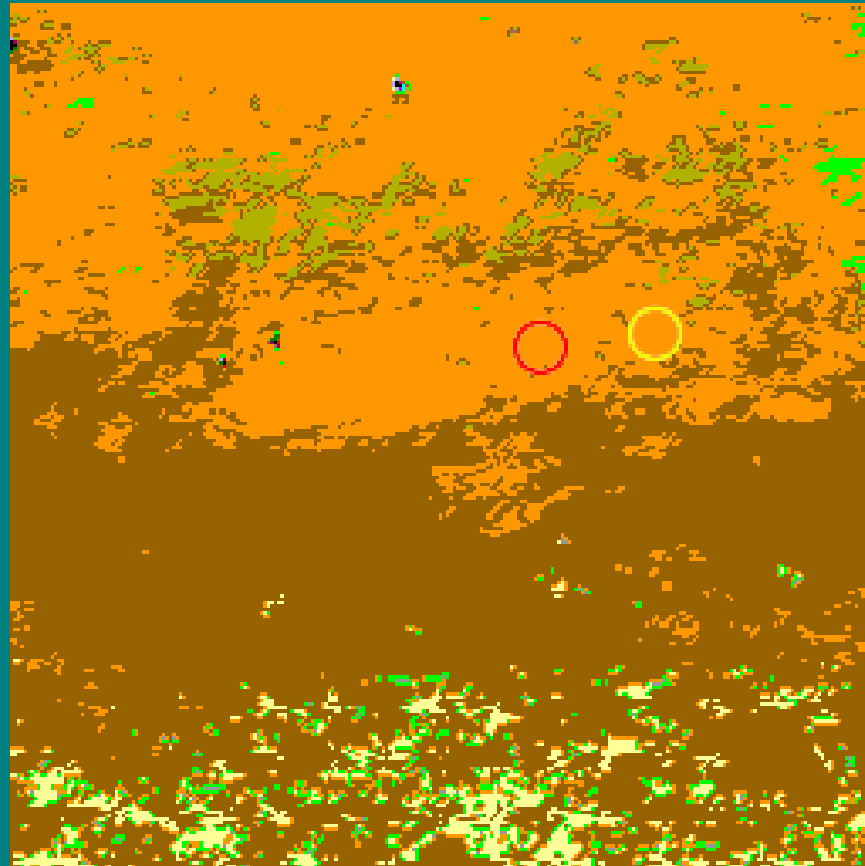


UMD Land cover map

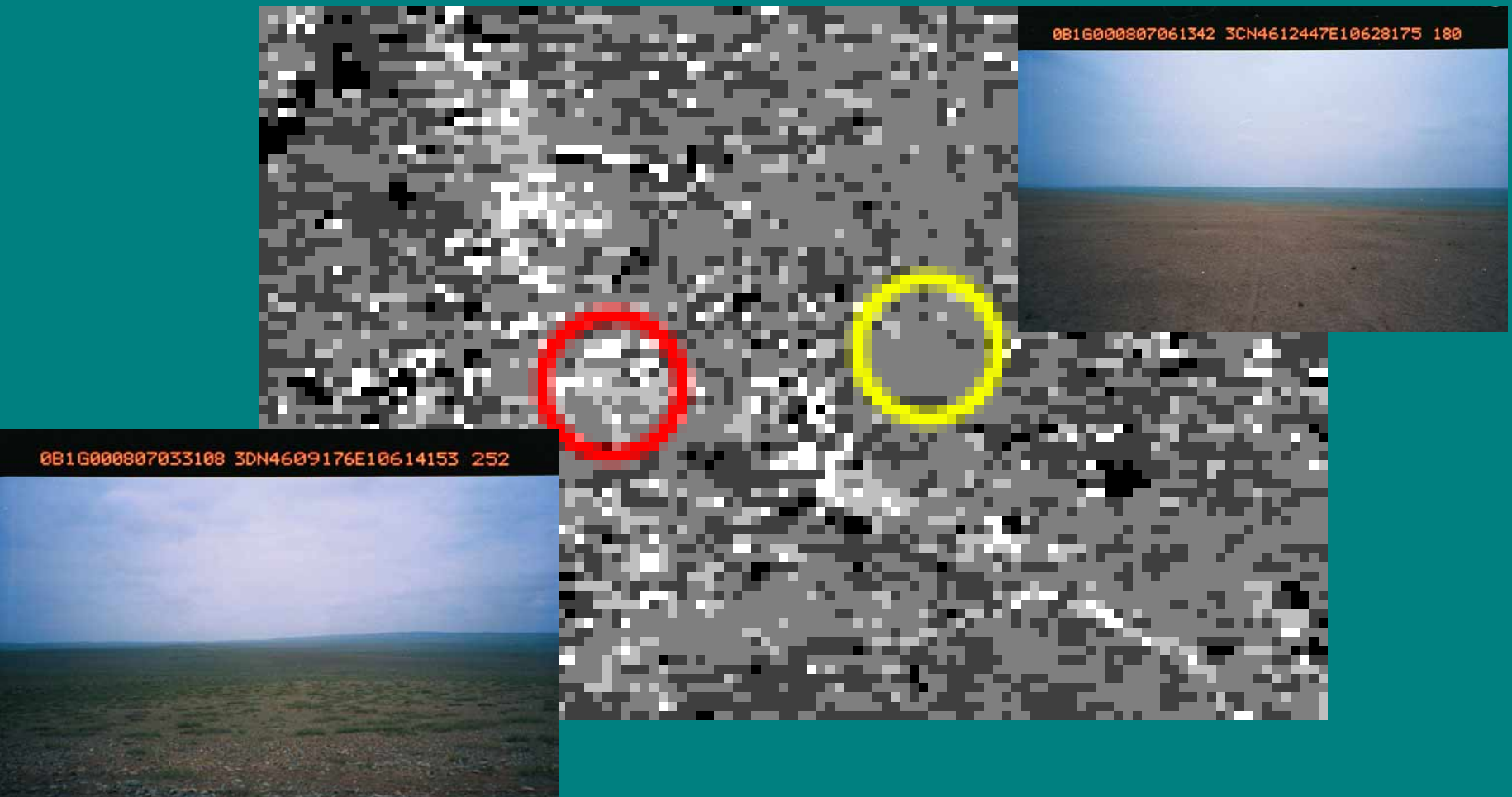


Water	Wooded Grassland
Evergreen Needleleaf	Closed Shrubland
Evergreen Broadleaf	Open Shrubland
Deciduous Needleleaf	Grassland
Deciduous Broadleaf	Cropland
Mixed Forest	Bare Ground
Woodland	Urban & Built

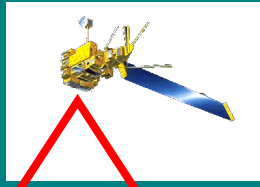
UMD Land cover map



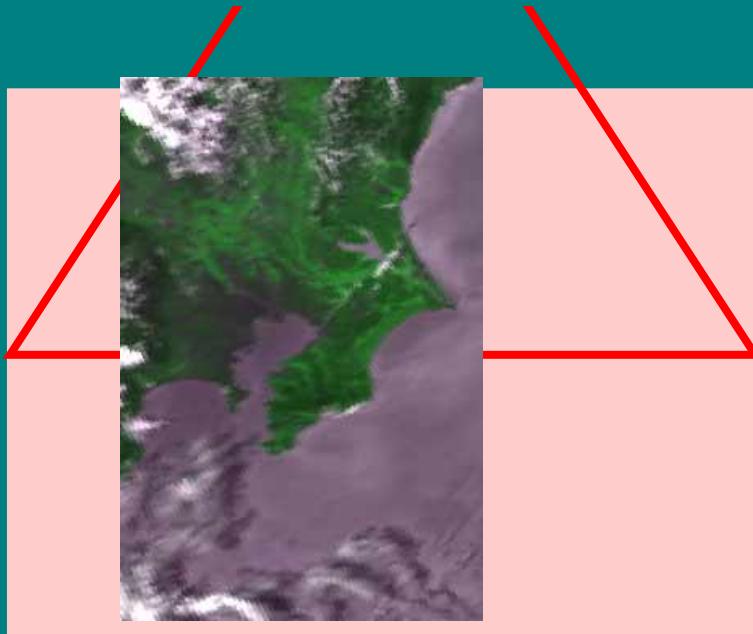
BSI image



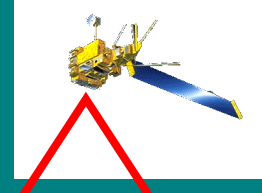
Calculate BSI using Satellite DATA



Data of Nadir



Nadir Image

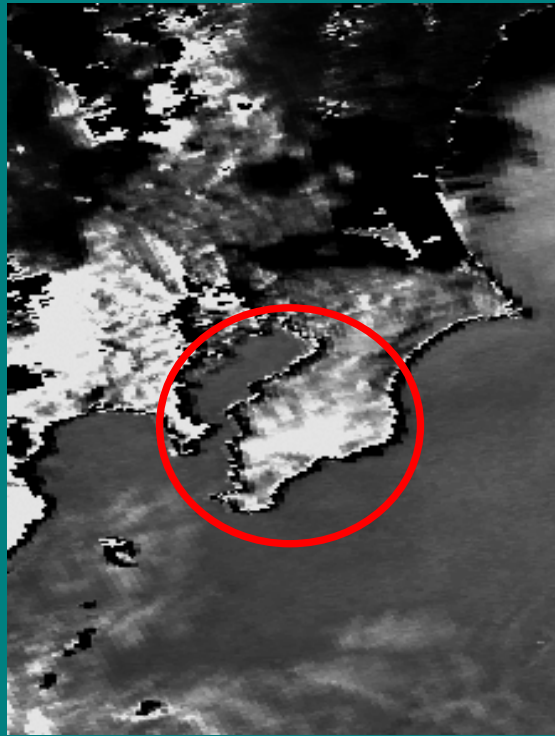


Data of Off nadir

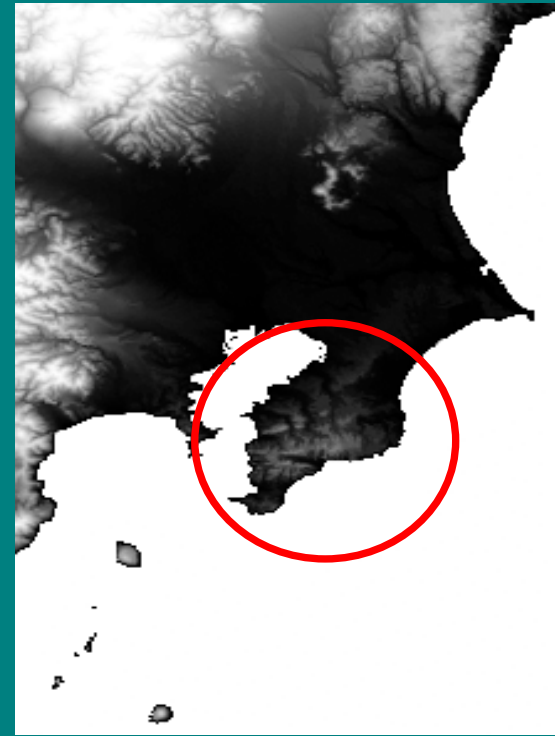


East Image

Topographic effects

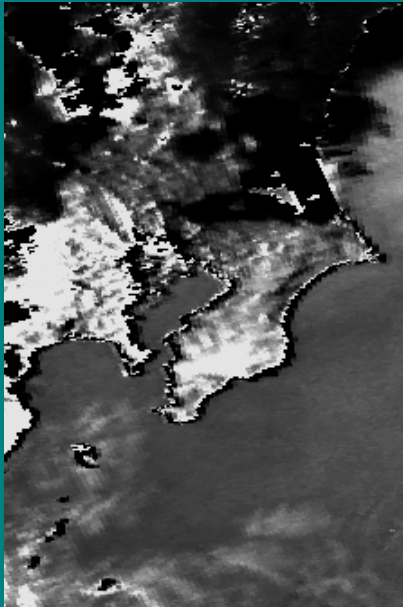


BSI



DEM (GTOPO30)

Topographic correction



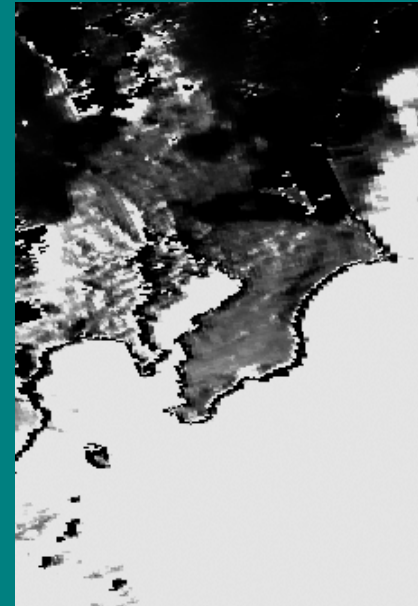
0 1.0 2.0

BSI



0m 500m

DEM (GTOPO30)



0 1.0 2.0

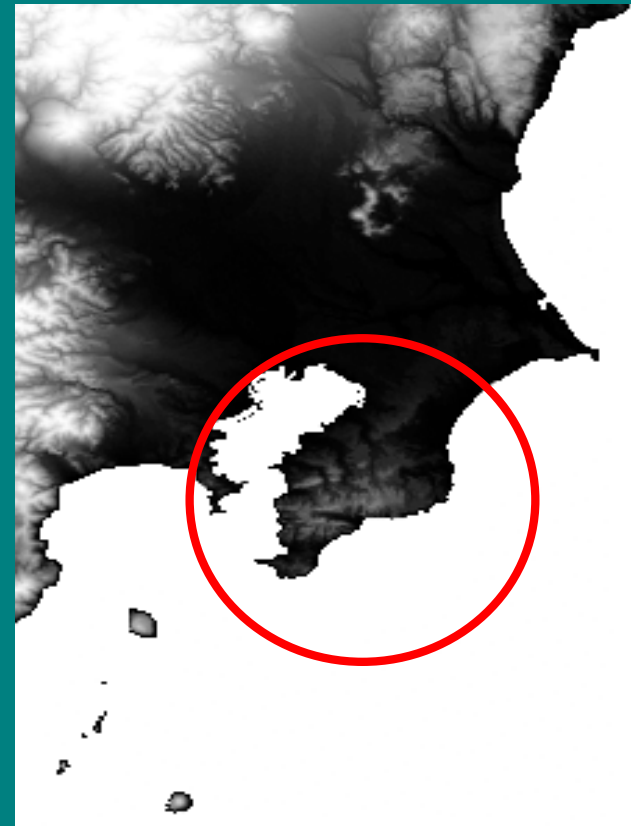
Corrected BSI



0

0.5

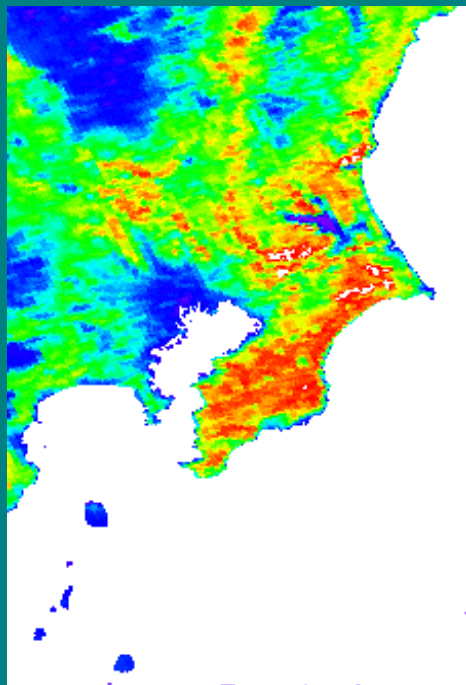
BSI — Corrected BSI



0m

500m

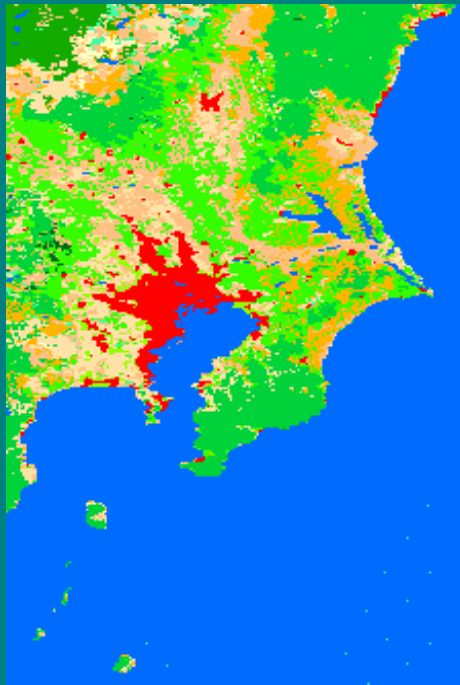
DEM (GTOPO30)



0

0.5

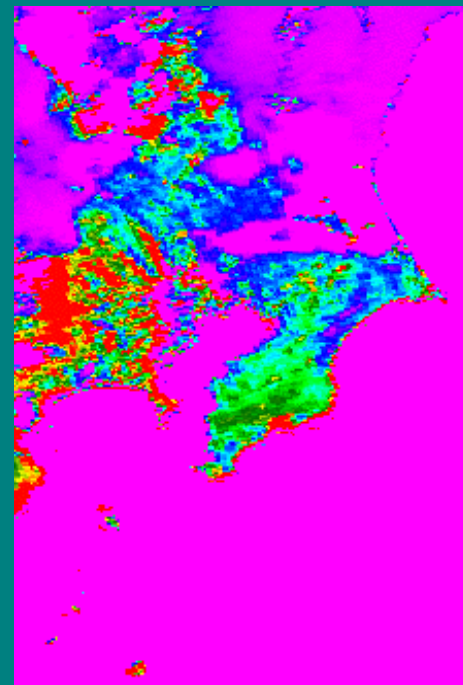
NDVI



- | | |
|------------------|------------|
| evergreen forest | 草地 |
| Broad leaf | Rice field |
| Mixed forest | 畑 |
| forest | 市街 |
| forest | 農地, 自然地の混 |
| 木が多いサバ | 裸地, 砂地, 岩 |
| ナ | 池部 |

Land cover map

(from Global Mapping project,)
GSI)



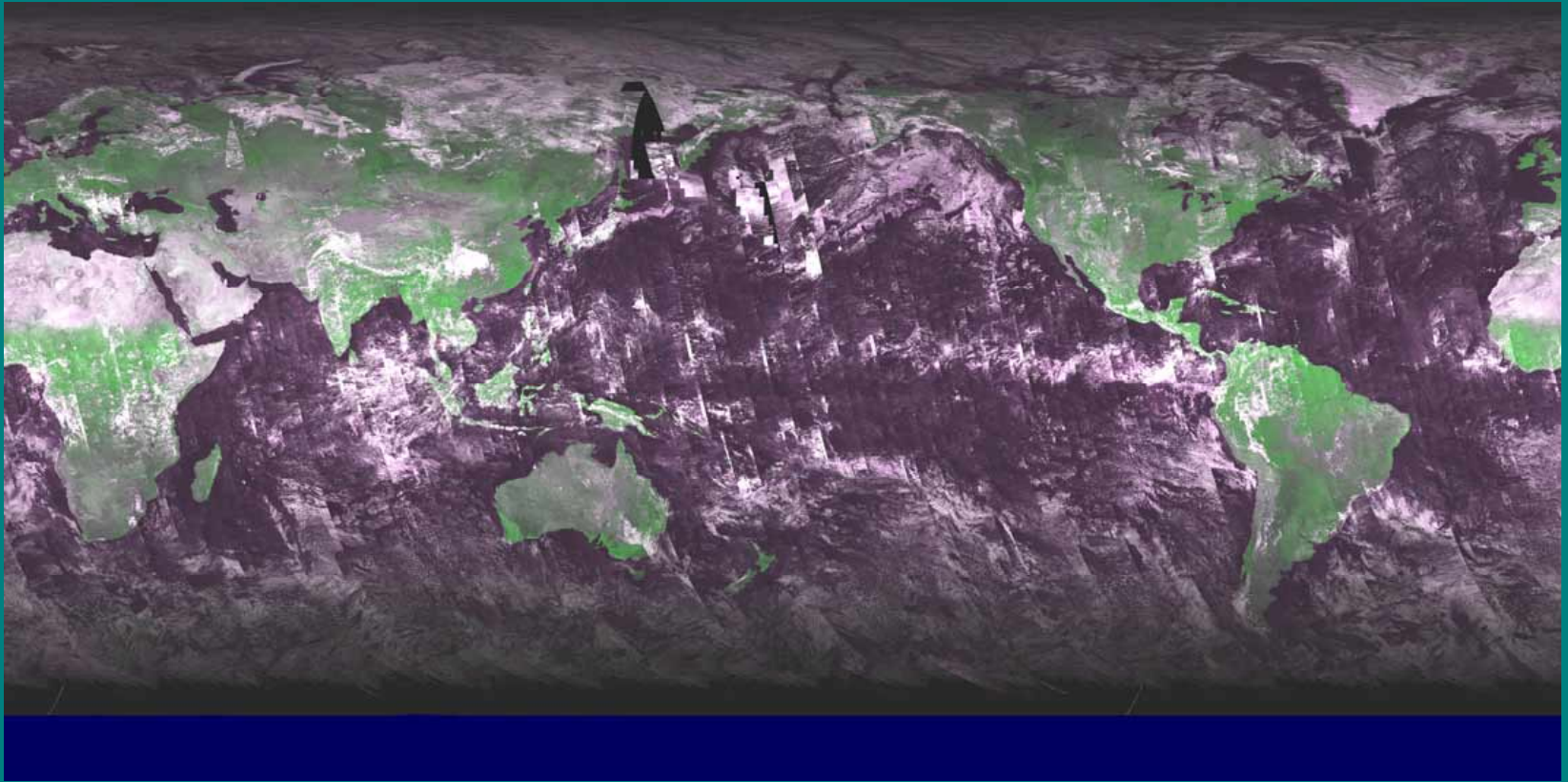
0

1.0

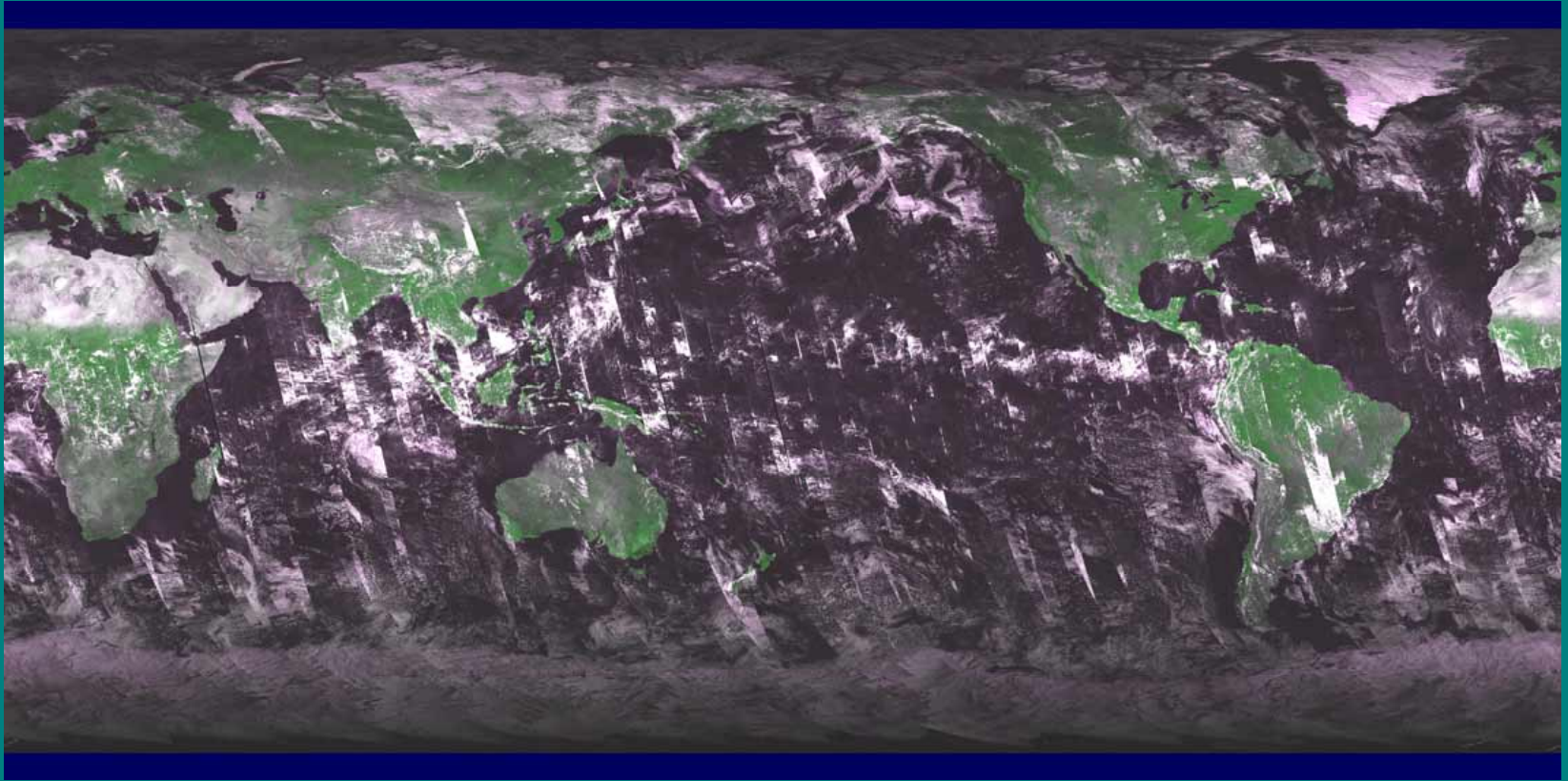
2.0

Corrected BSI

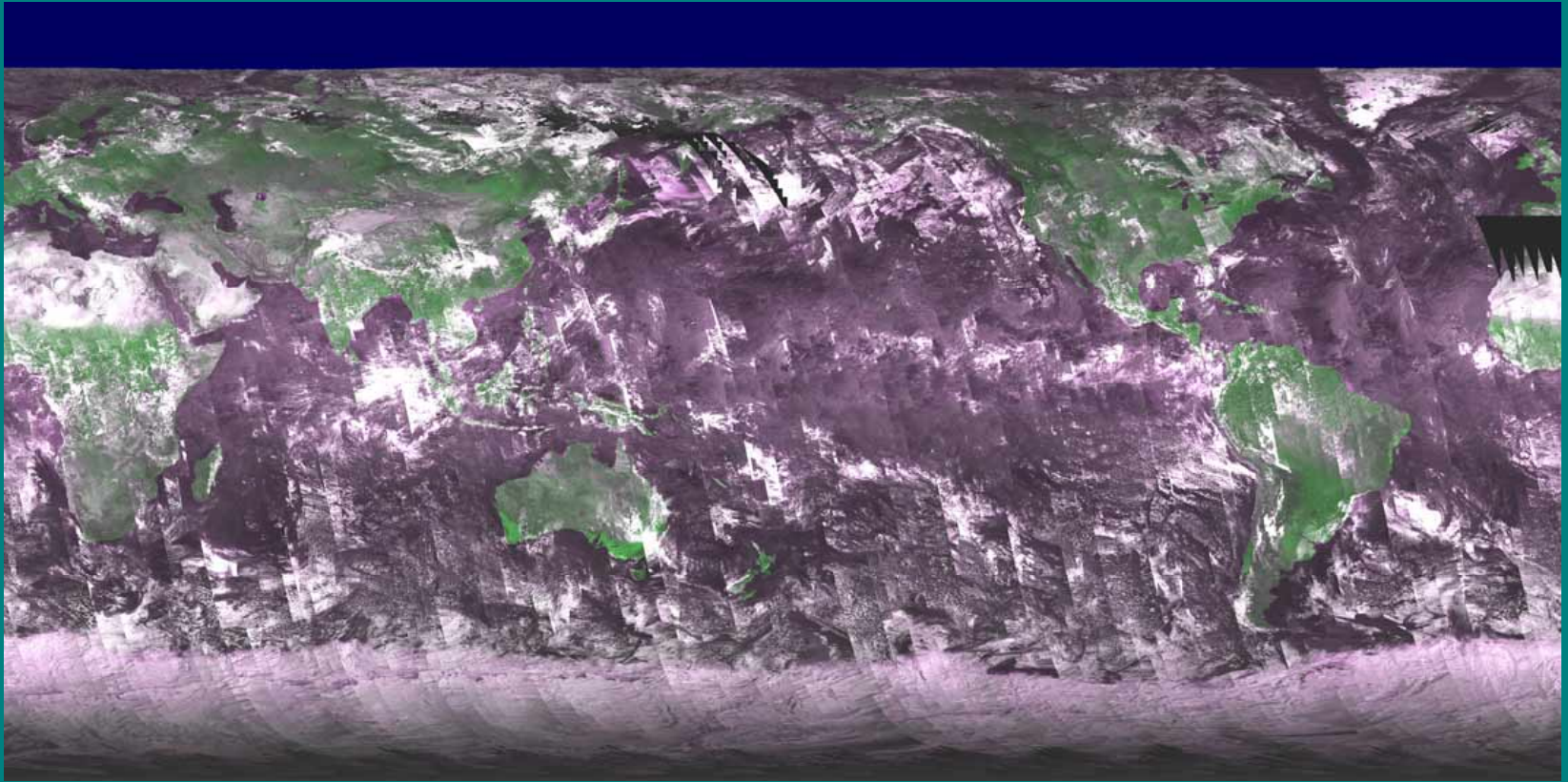
Off Nadia (East)



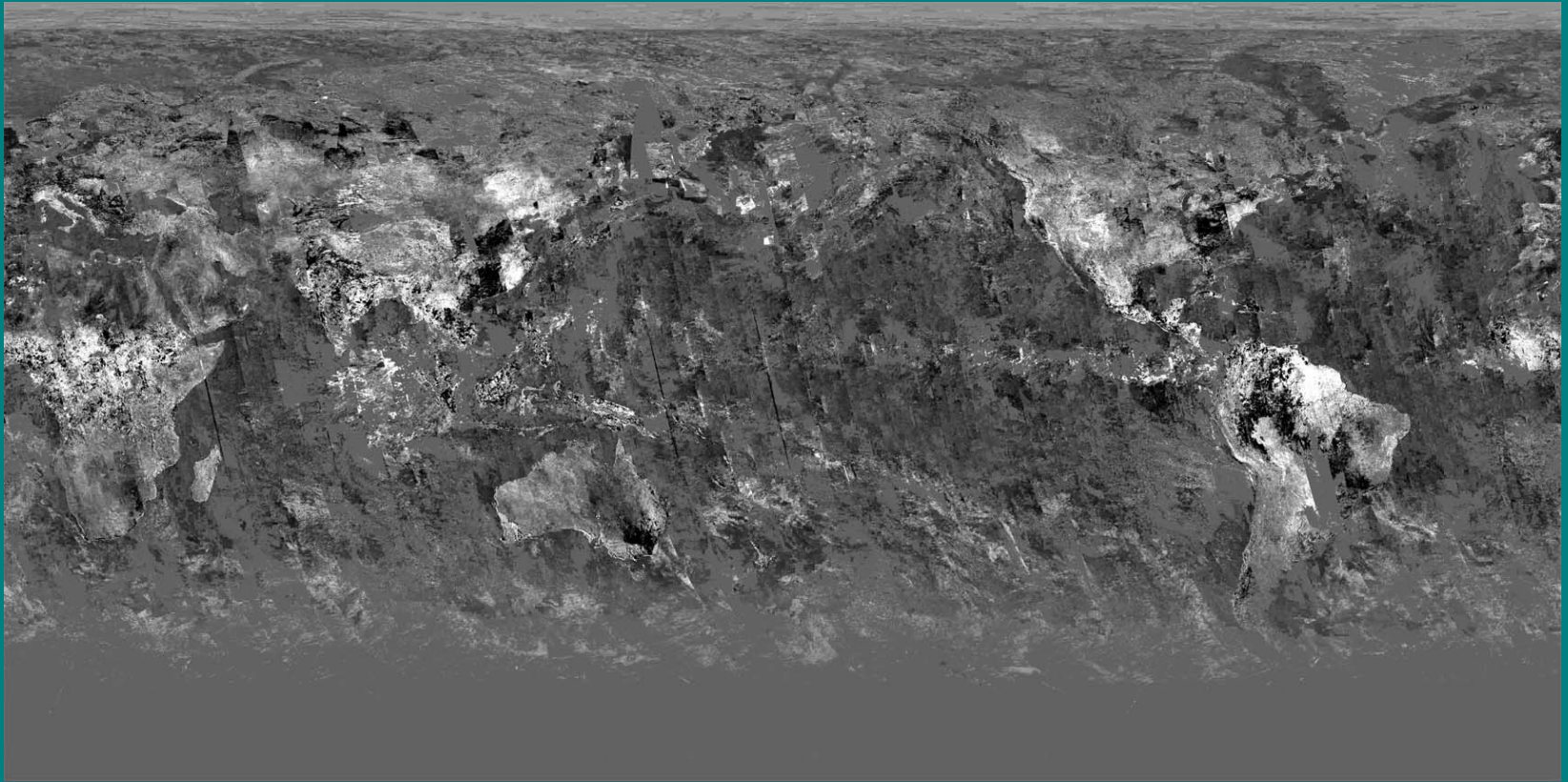
Nadia



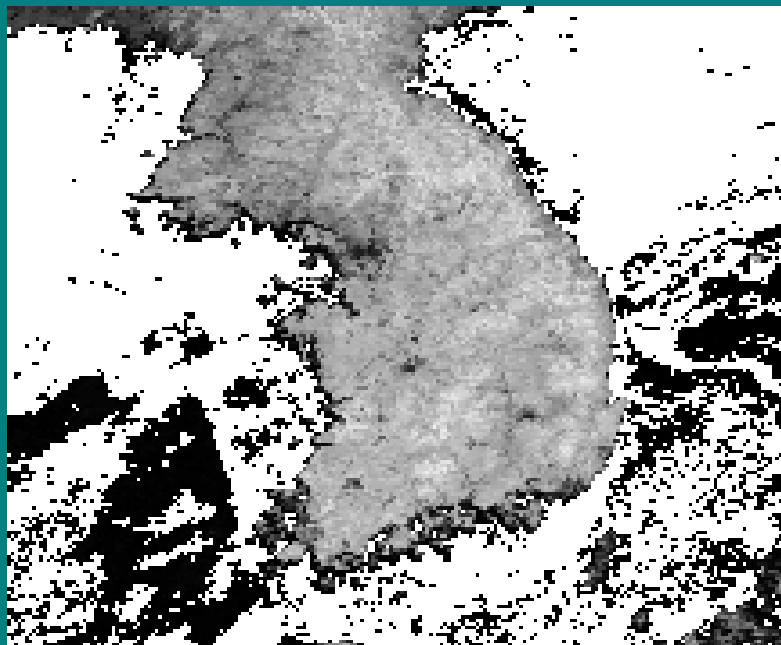
Off Nadia (West)



Corrected BSI



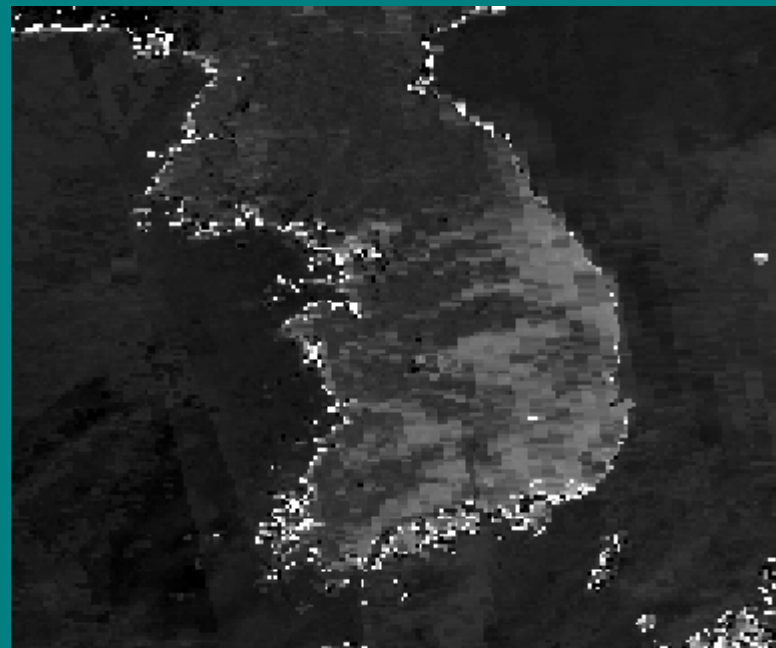
NDVI and BSI



0

0.4

NDVI



-1.0

0

1.0

2.0

3.0

Corrected BSI

Summary

- ◆ BDF has been measured by RC helicopter.
- ◆ BSI (Bi-directional Reflectance Factor Structure Index) was proposed.
- ◆ BSI will show human impact to vegetation cover.