Atmospheric correction algorithm for GLI ocean color bands: Current status and plans

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in collaboration with

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with special acknowledgement to

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Objectives

- **to provide ocean color community with "working" and "reliable" atmospheric correction**
- **to develop an algorithm especially tuned for "Asian aerosols/waters"**
- **to evaluate the performance of the developed algorithms in comparison with other ocean color atmospheric correction algorithms (by participating IOCCG/Atmospheric Correction WG activities)**

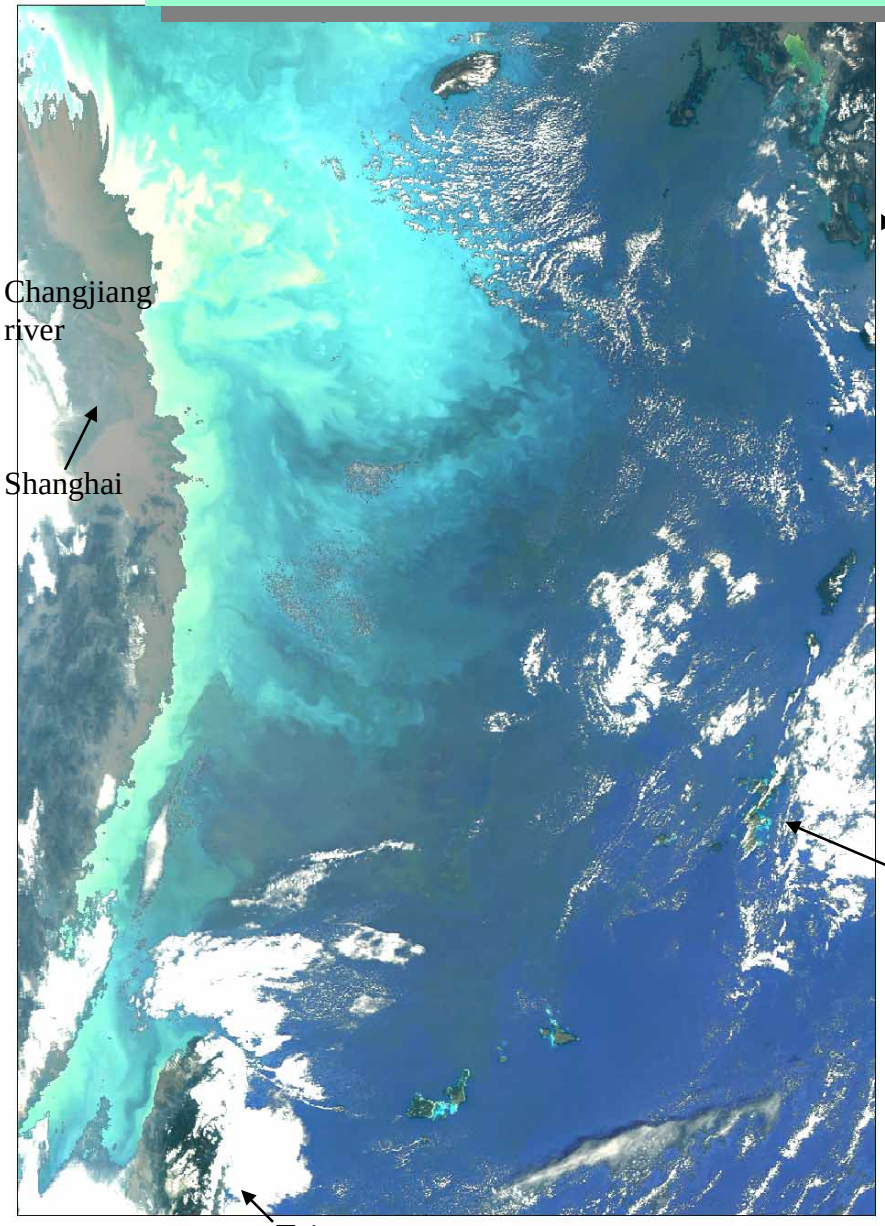
Work items and current status towards "working atmospheric correction"

- **Validation of the code and LUT / Evaluation of the expected accuracy**
  - Significant progress in 2000. Effort continued to 2001.
    - Checking/Comparison with GSS/GSD completed
    - OTSK1a vs. "Atmos. corr. simulator
- **Miscellaneous corrections and/or mask/flag algorithms**
  - **Sun glitter correction/mask (SG)**
    - Implementation/validation underway
  - **White cap correction (WC)**
    - WC corr. completed (Frouin/GAIT)
  - **Water vapor correction (WV)**
    - Prelim. WV corr. for 710 studied
      - Moriyama/Kuji/Matsunaga
      - Postlaunch validation with AMSR?
  - **Gas absorption correction (due to O2?) at 625 nm**
    - No action taken yet
  - **Cloud/near-cloud mask/flag**
    - Cloud screen. on ρ_A implemented
    - Near-cloud masks imp/adj underway
- **Alternative band algorithms (ALT)**
  - Significant progress at GAIT!
- **Speeding up the procedure?**

Work items and current status towards "Asian algorithms"

- **Atm. Corr. over Turbid Case 2 Water**
  - Significant progress (Toratani/Tanaka)
    - In-water model/Neural Net incorporated
    - Further study underway
- **Asian aerosol correction**
  - **Modeling of Asian dust aerosol**
  - **Implementation to AC module**
  - Dust model updated (Fukushima/Takahashi)
    - Better matching with SeaWiFS TOA
    - Dust aerosol is not all!
  - Further study on-going (Fukushima/Li/Frouin/Mitchell/ACE-Asia)
- **Detection of dust aerosol/ evaluation of dust aerosol optical thickness**
  - Progress in detecting dust aerosol (Fukushima/Miura/Uno)
    - Empirical index compares well with TOMS/AI and transport simulation
    - Participated in APEX-E2 with daily SeaWiFS-derived images on web

Examples of the GLI Expected Results - work by Murakami/Chen/Park



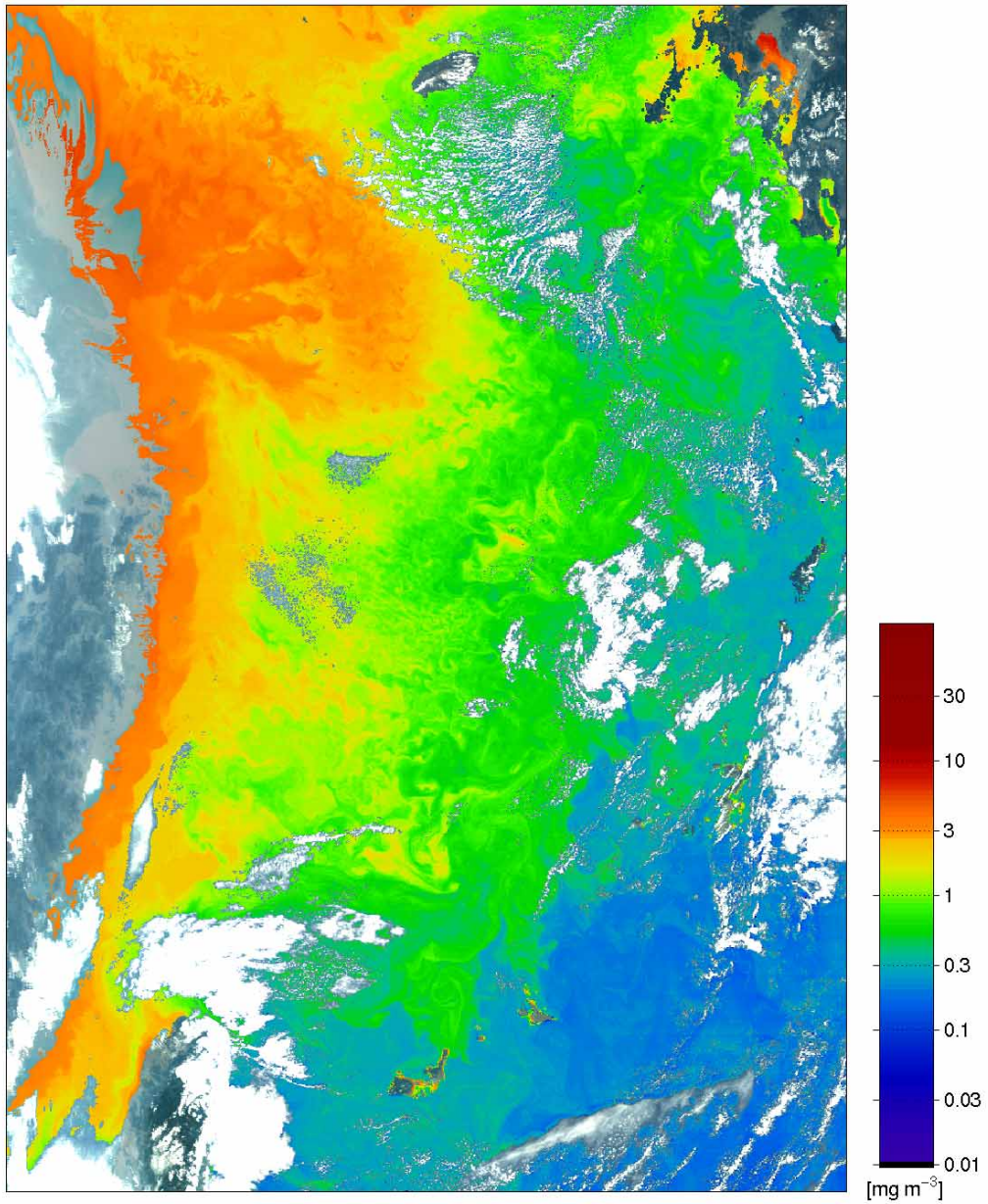
RGB image of normalized water leaving radiances (nLw at 666nm, 545nm and 460nm) derived by GLI ocean-color algorithm (OTSK1a) using MODIS L1B data in 20 February 2001.

Land and cloud area are filled by RGB-image of satellite observed radiances (at 625nm, 545nm and 490nm).

Upper left is the mouse of the Changjiang river. Kyusyu island is in the upper right and Amami island is in the middle right.

This image show “ocean color” removing the atmospheric effect. The ocean color changes in various conditions (solids, biological..).

Examples of the GLI Expected Results - work by Murakami/Chen/Park



Chlorophyll-a concentration derived by GLI ocean-color algorithm (OTSK2) using MODIS L1B data in 20 February 2001.

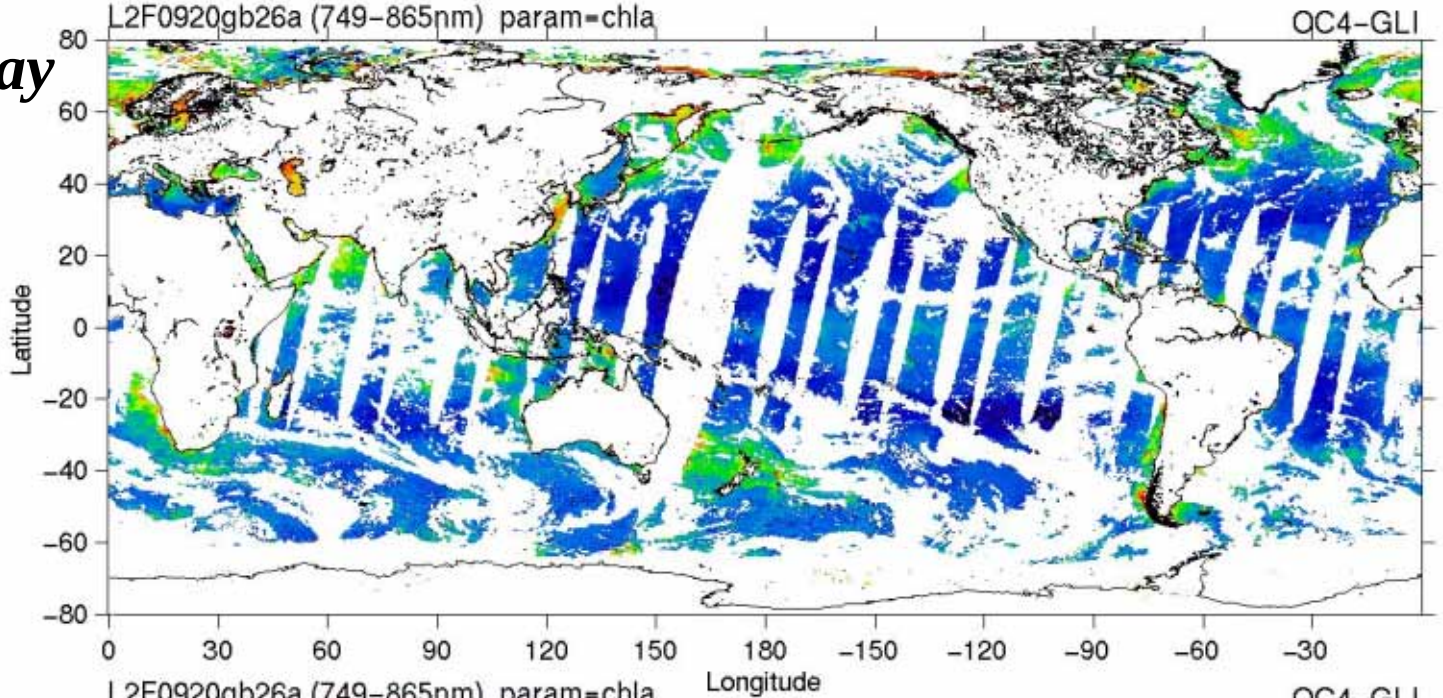
Land and cloud area are filled by RGB-image of satellite observed radiances (at 625nm, 545nm and 490nm).

Upper left is the mouse of the Changjiang river. Kyusyu island is in the upper right and Amami island is in the middle rigit.

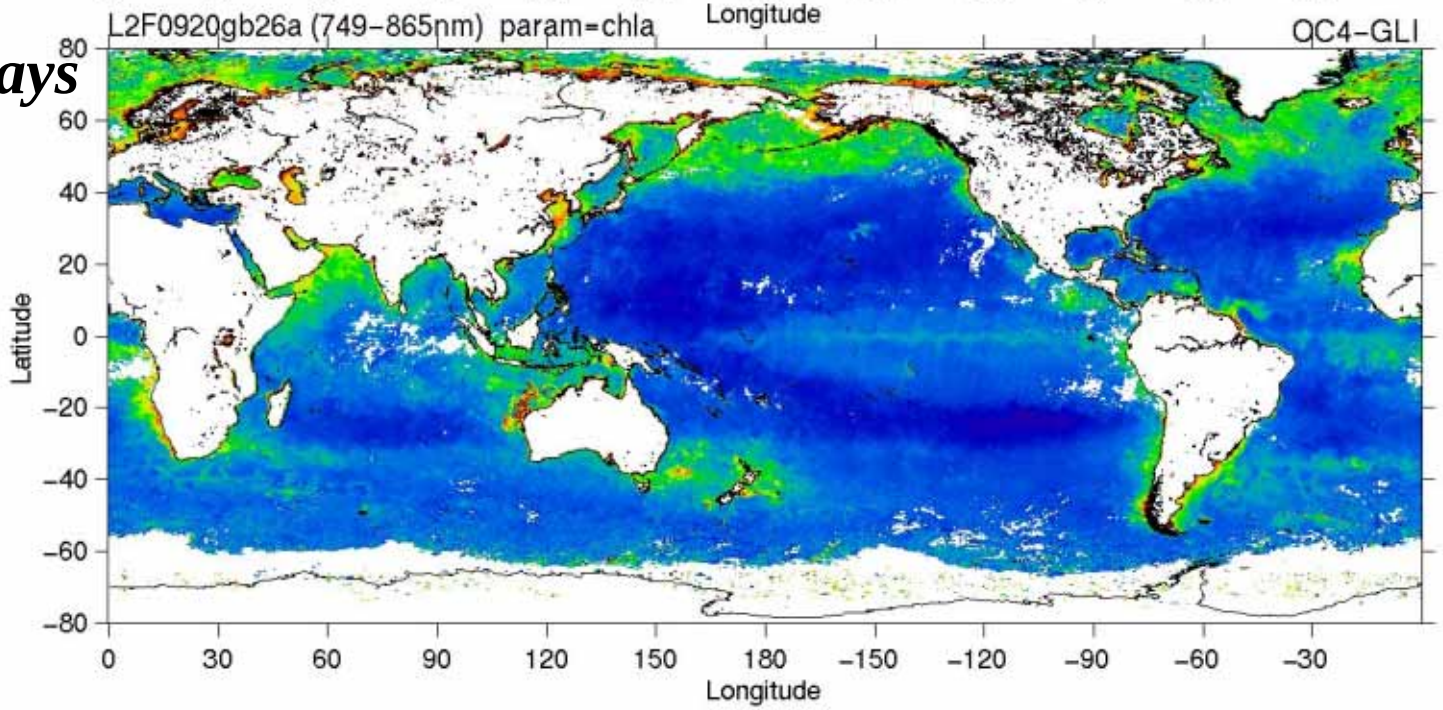
The “ocean color” can be interpreted as the amount of phytoplankton chlorophyll-a.

This image indicates that biological activities is more active in the continental shelf in the East China Sea.

1 day

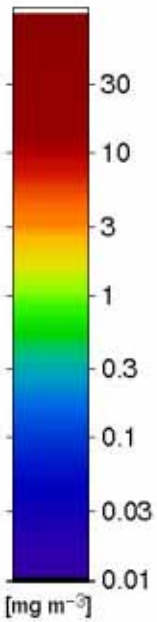


8 days

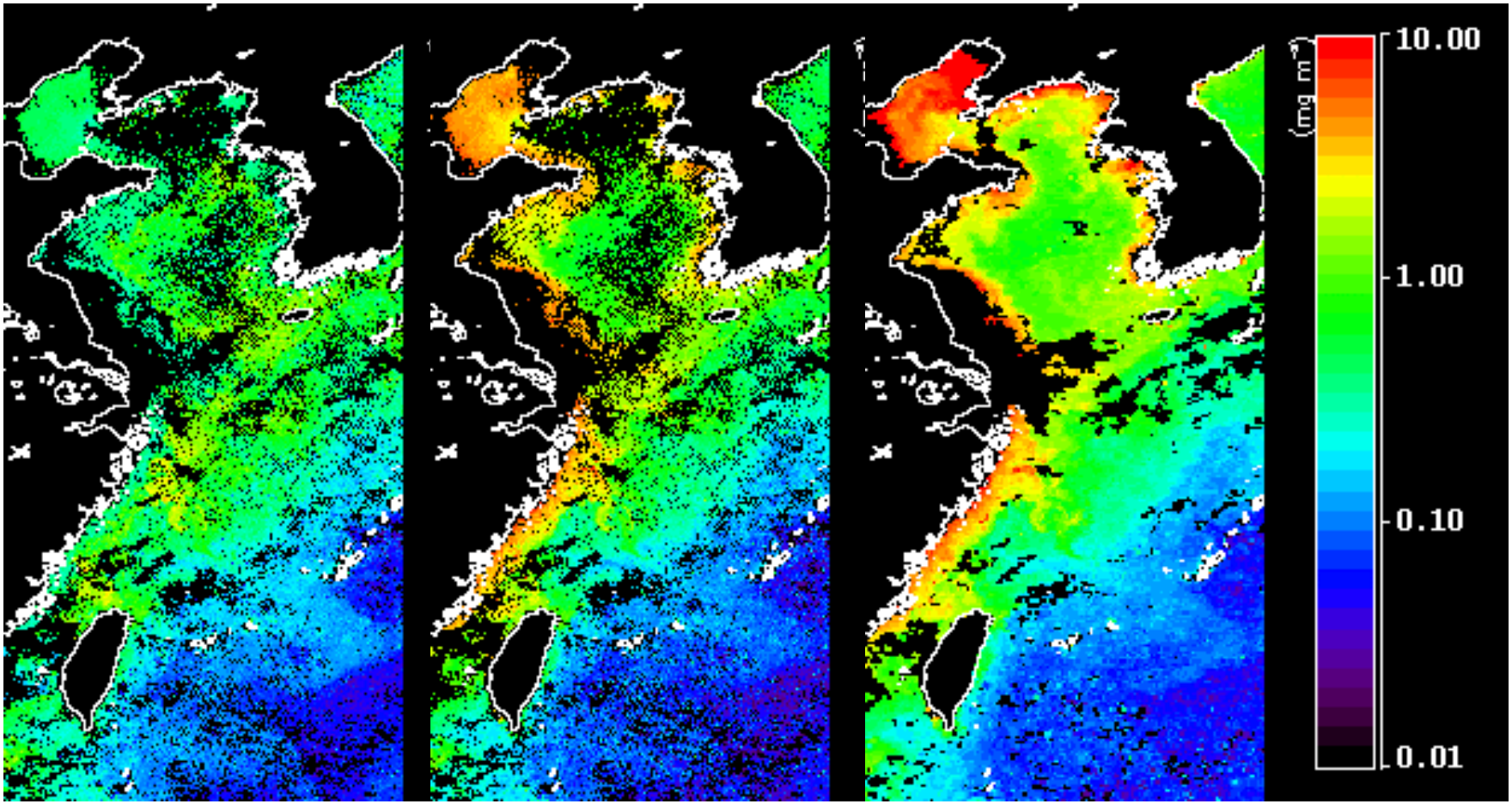


Chlorophyll-a concentration **derived by GLI ocean-color algorithm (OTSK2) using MODIS CSS 5km data (2000/06/13~20) . Daily average (upper) and 8-day average (lower)**

by Murakami, Chen, and Park



Comparison over weekly/bi-weekly SeaWiFS chlorophyll-a imageries: full-NN, partial-NN, and standard Siegel



T&T with full NN **T&T with partial NN** **Standard Siegel**

1999/281 - 294 **1999/281 - 289**

Evaluation of OTSK1a by Atmospheric Correction Simulator

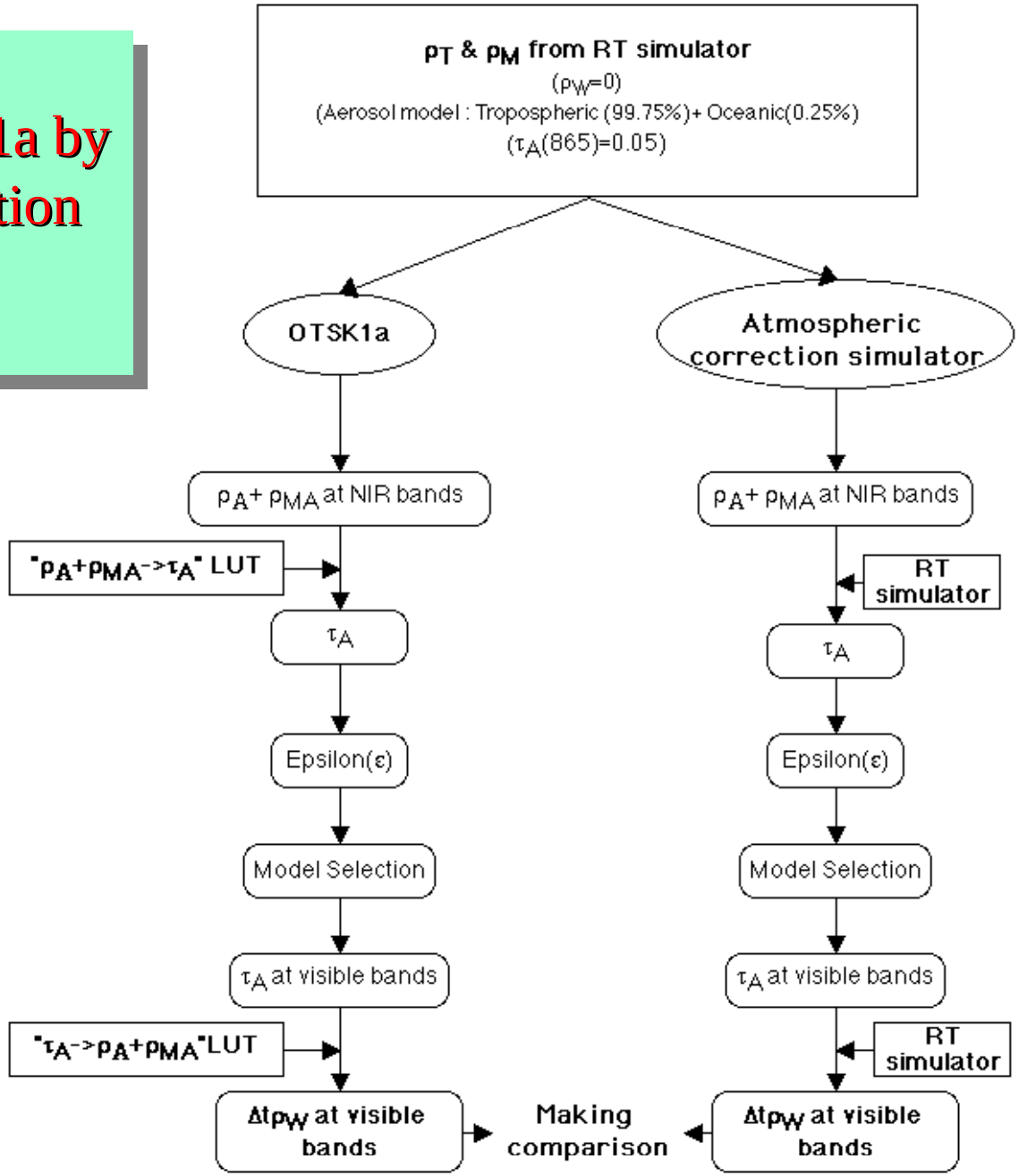
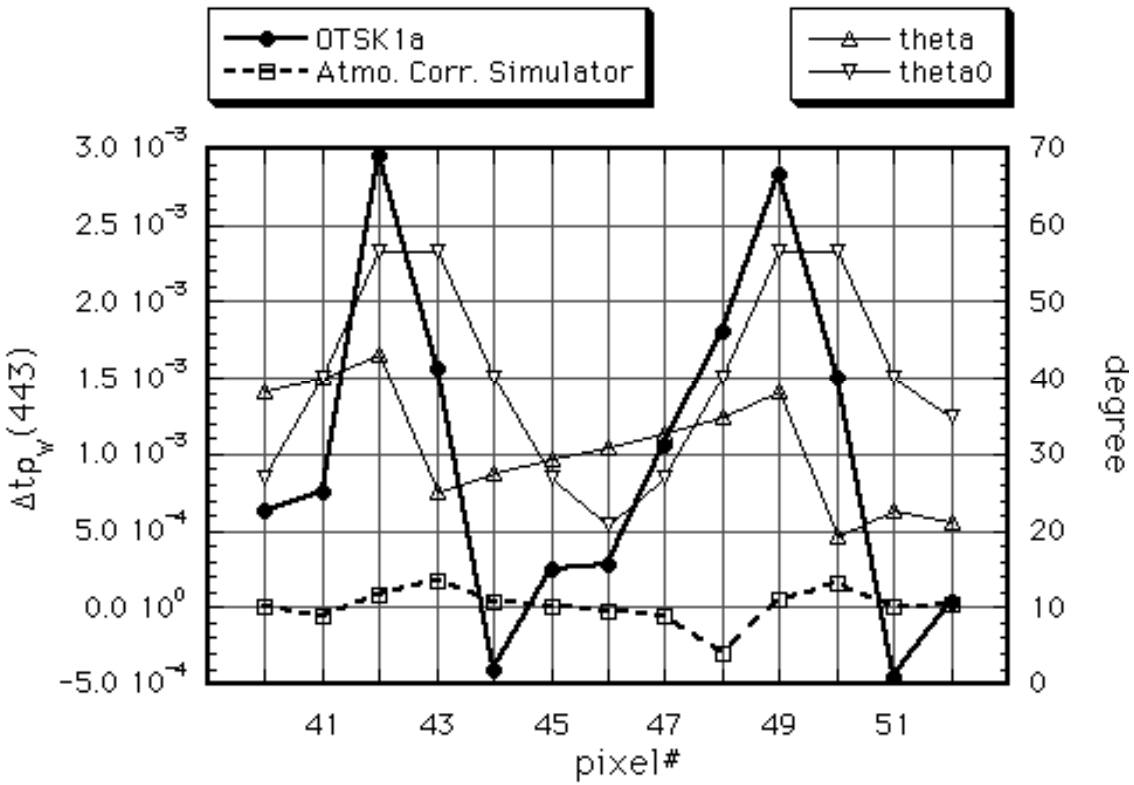


Fig. Simplified flow diagram of OTSK1a code check

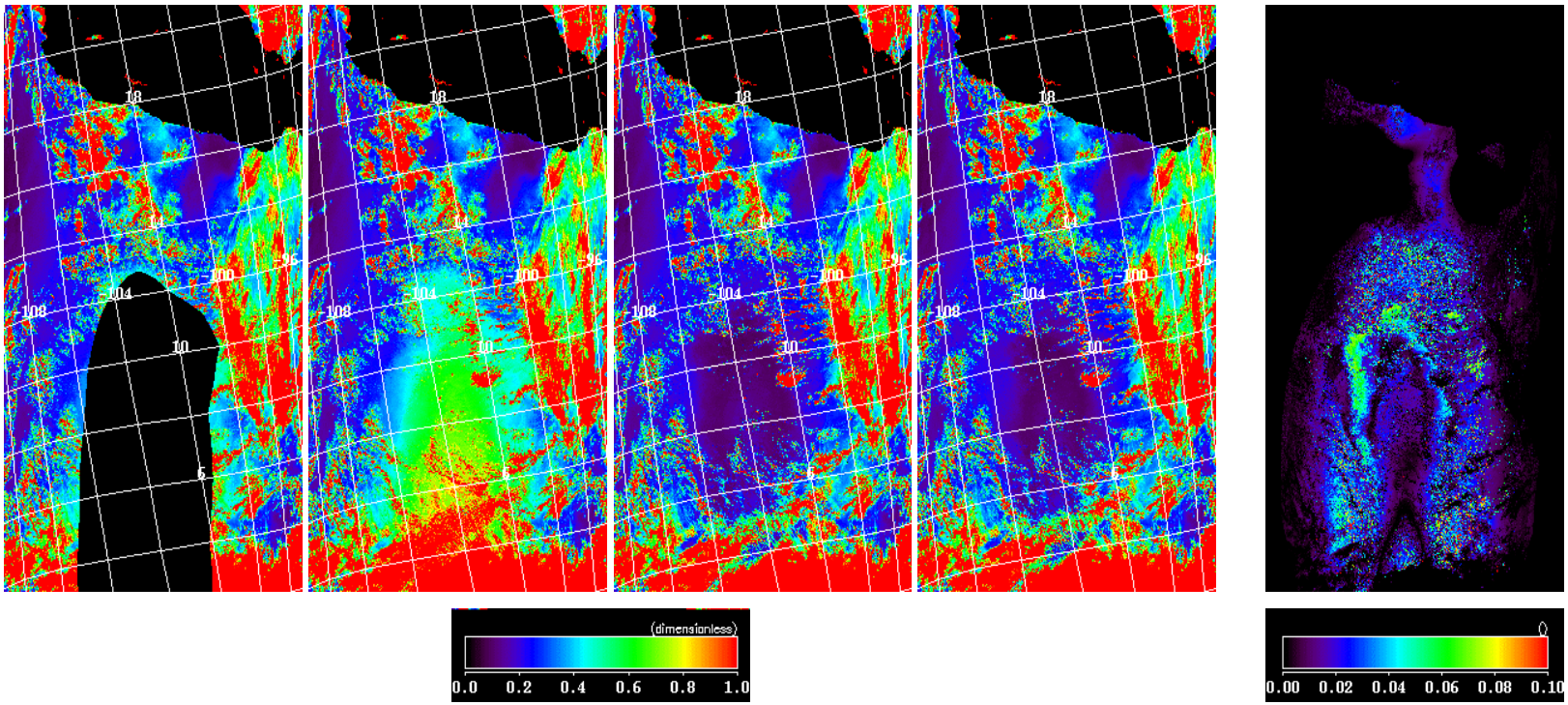
Difference between true and estimated water-leaving reflectance at 443 nm ($\Delta t\rho_w$)

- **Target: $\Delta t\rho_w(443) < 0.002$**
- **Significantly large error found in the table look-up**
- **Recalculation of LUT underway...**



Tau-a(865)

Sun-glitter correction trial

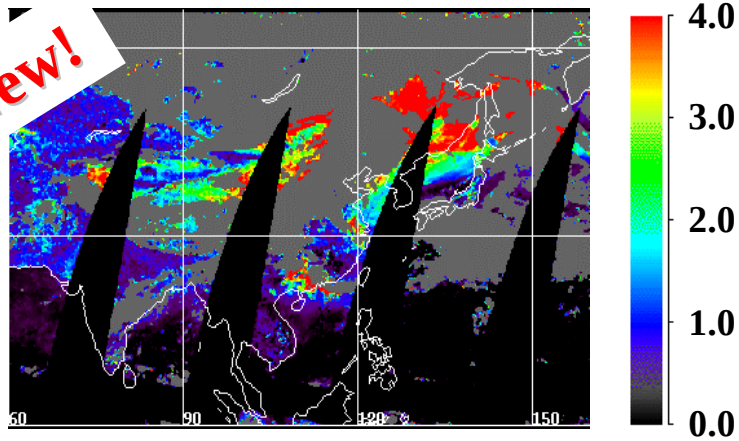


a) Sun glint mask **b) No sun-glint corr.** **c) W. GLI alg.** **d) W. SeaWiFS corr.** **e) Absolute difference bet. GLI and SeaWiFS algorithms**

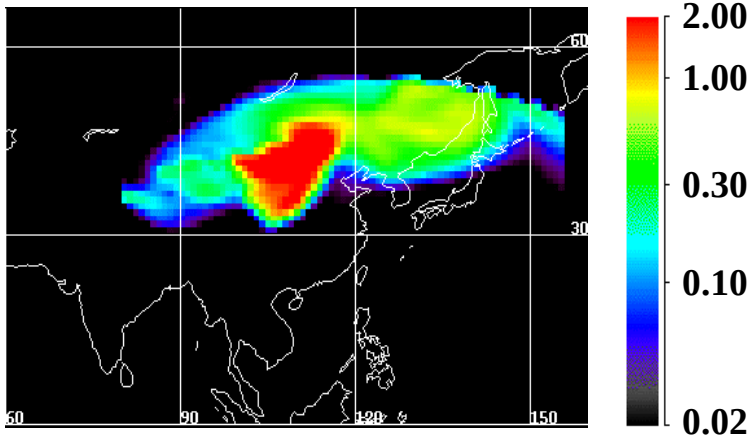
Figure. Comparison of sun-glitter correction over Tau-a(865) Images. Derived from SeaWiFS data of April 9, 2000.

Detection of Asian dust via SeaWiFS: 4/09/01

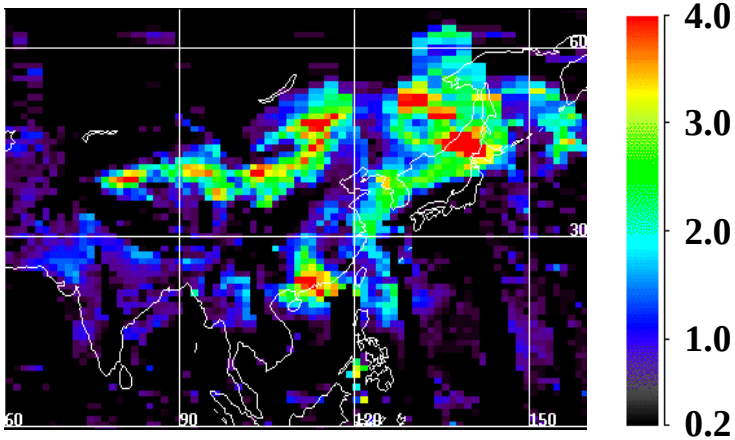
New!



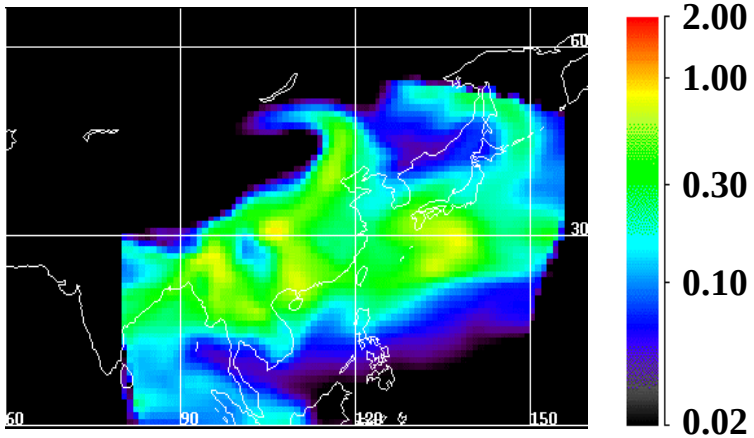
SeaWiFS-derived LDVI_corr with new cloud masking



ONLT-predicted Dust AOT



TOMS Aerosol Index



ONLT-predicted Carbon AOT

Ron Brown-SeaWiFS ACE-Asia Match-ups

by Li, Fukushima, Frouin, Mitchell, and others

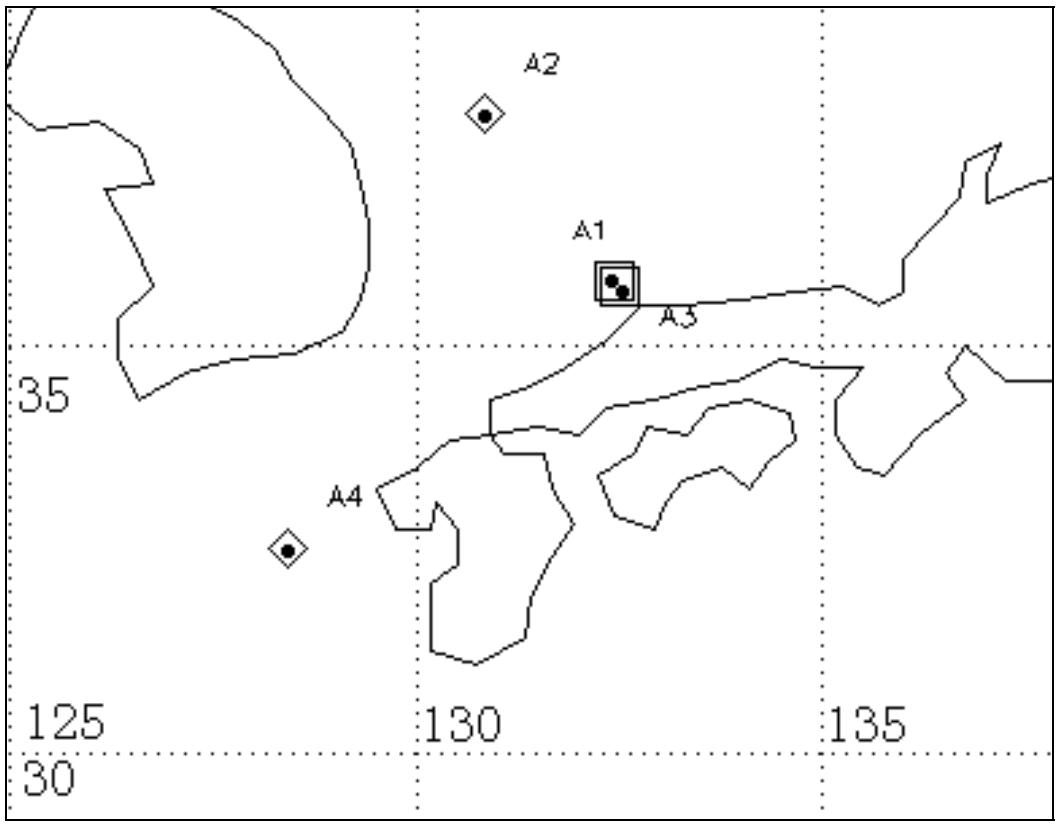


Figure 1. The site of the match-up dataset during the Ace-Asia Project A1 on April 7, A2 on April 10, and A3 on April 15, 2001.

Ron Brown-SeaWiFS ACE-Asia Match-ups

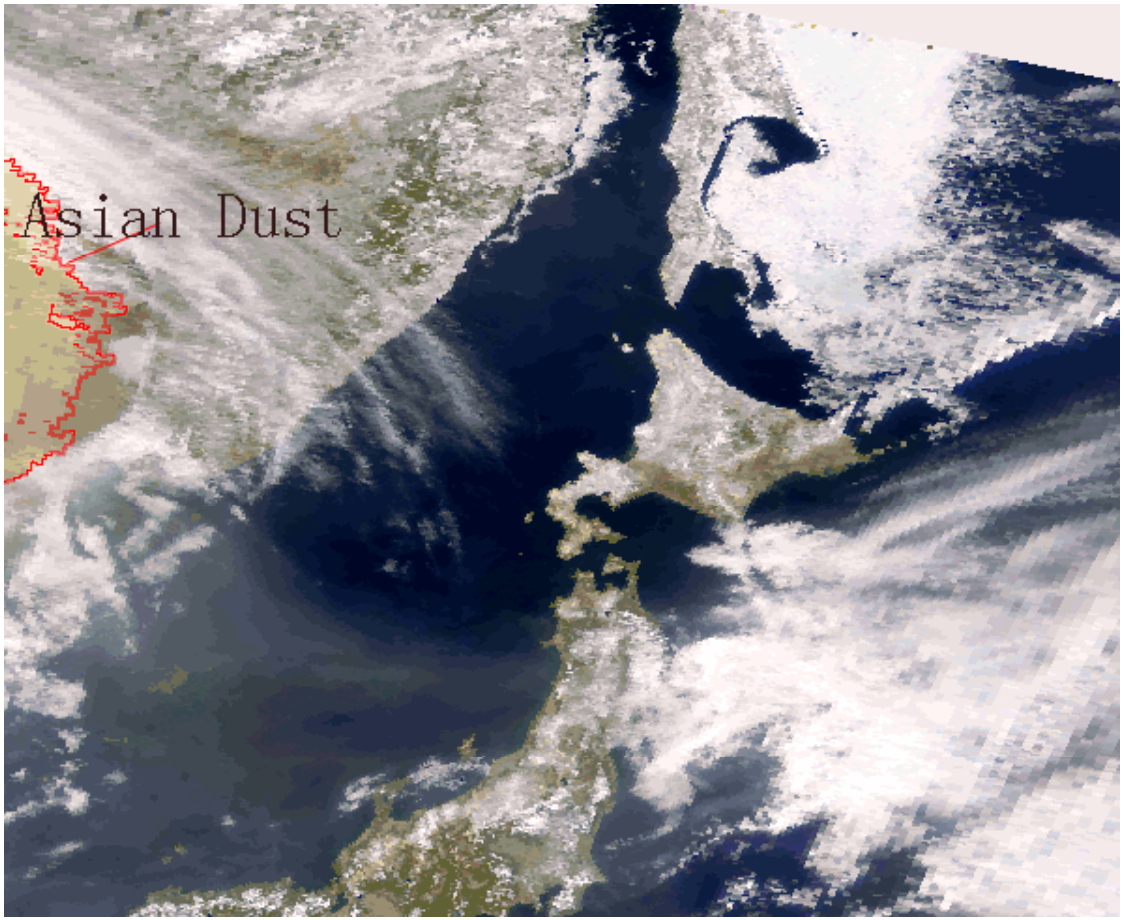


Figure 6. The true-color composite browse image of SeaWiFS on Apr.7, 2001.

Ron Brown-SeaWiFS ACE-Asia Match-ups

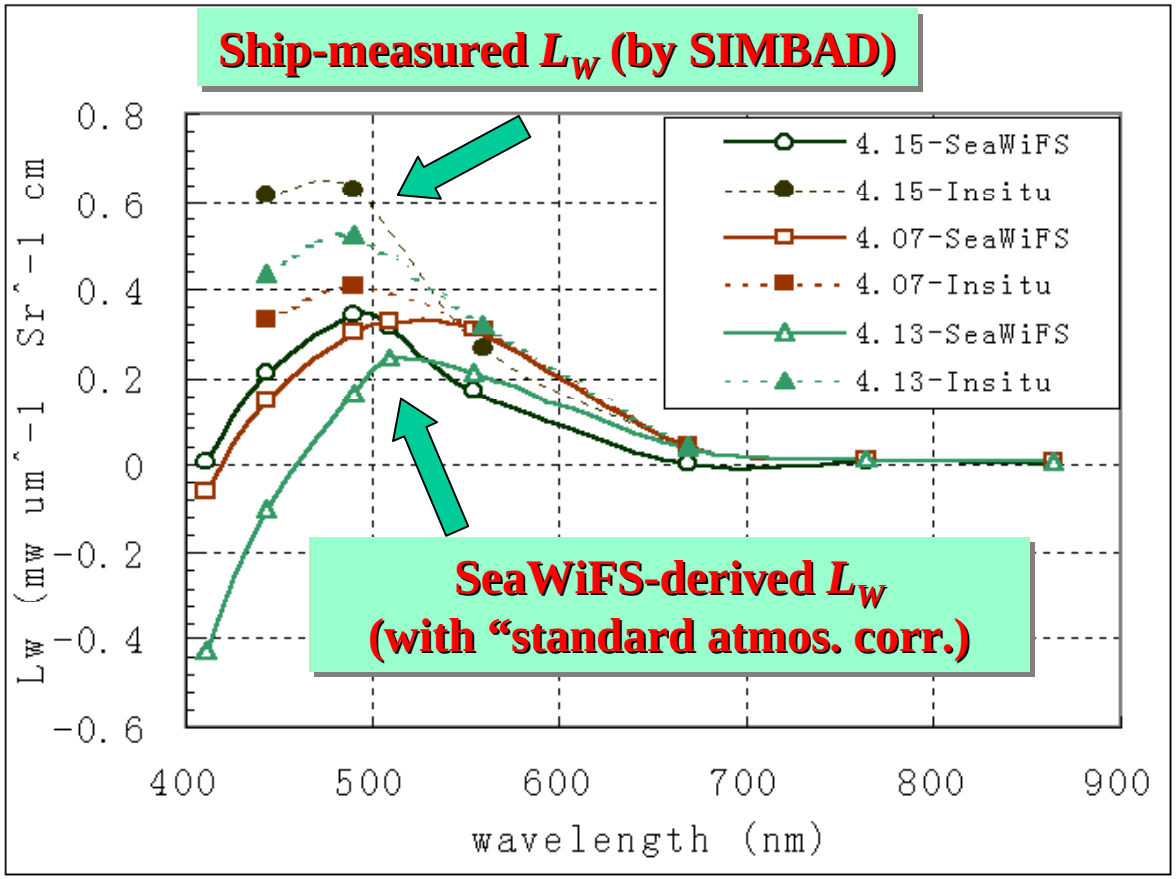


Figure 4. Validation result of the match-up dataset during Ace-Asia period.

Ron Brown-SeaWiFS ACE-Asia Match-ups: Volume size dist. by PE REDE sky-radiometer

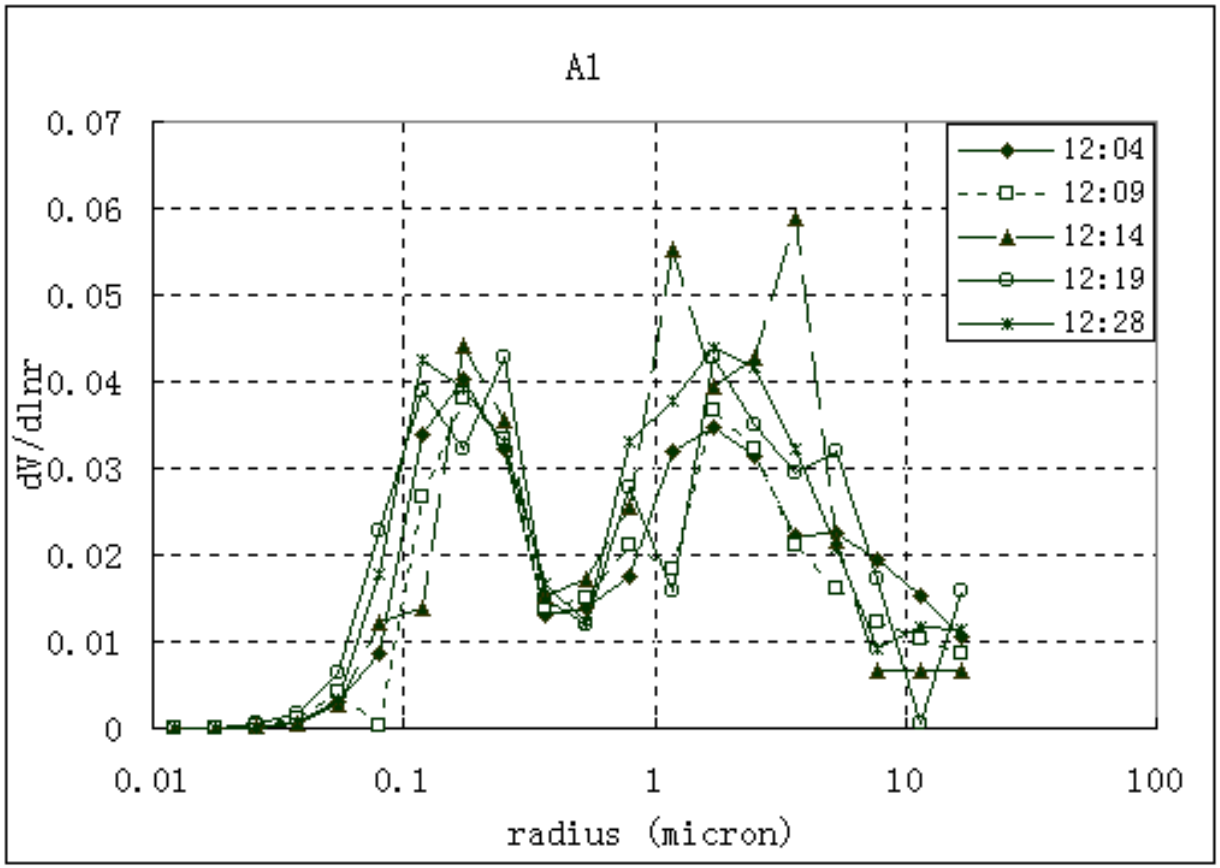


Figure 2. The *in situ* measured size distribution derived from sky-radiometer observation aboard R/V Ron Brown. Courtesy by Robert Frouin.

Ron Brown-SeaWiFS ACE-Asia Match-ups: Modeled volume size distribution

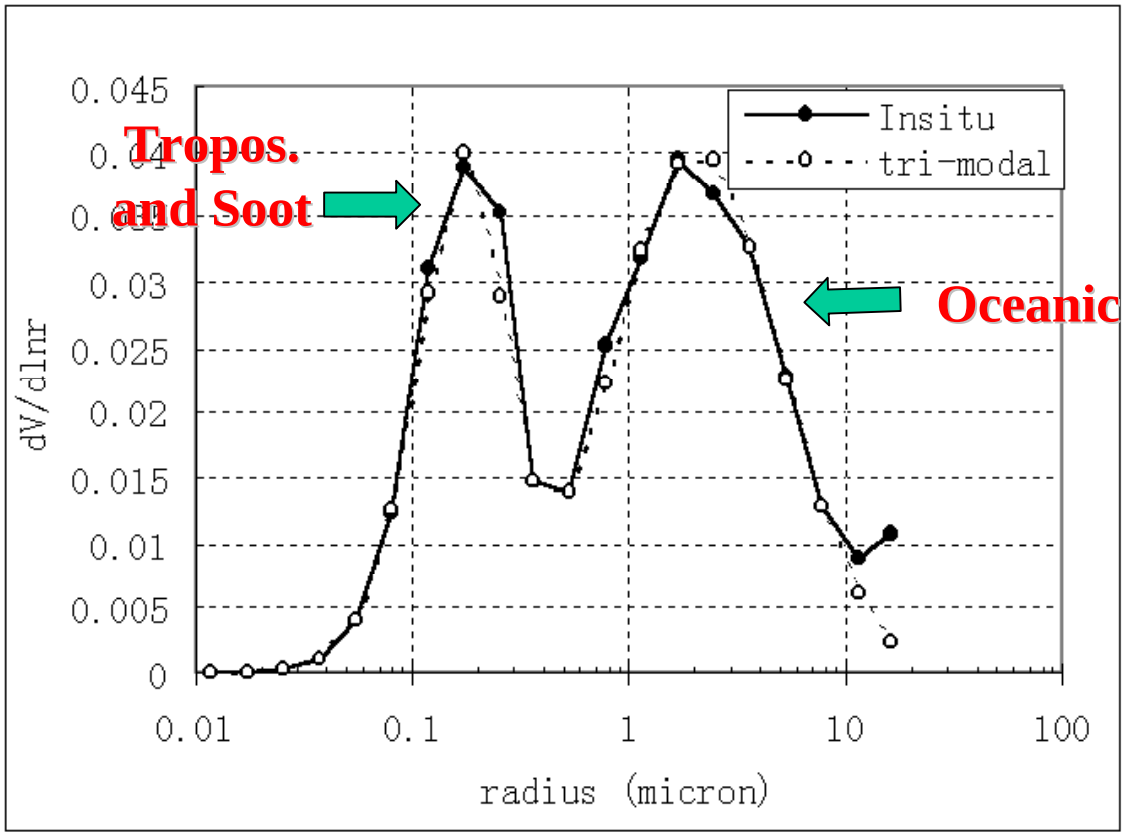


Figure 3. Comparison of the modeled size distribution with the *in situ* measurement.

SeaWiFS-Reflectance vs. Model-predicted reflectance: Soot aerosol model helps!

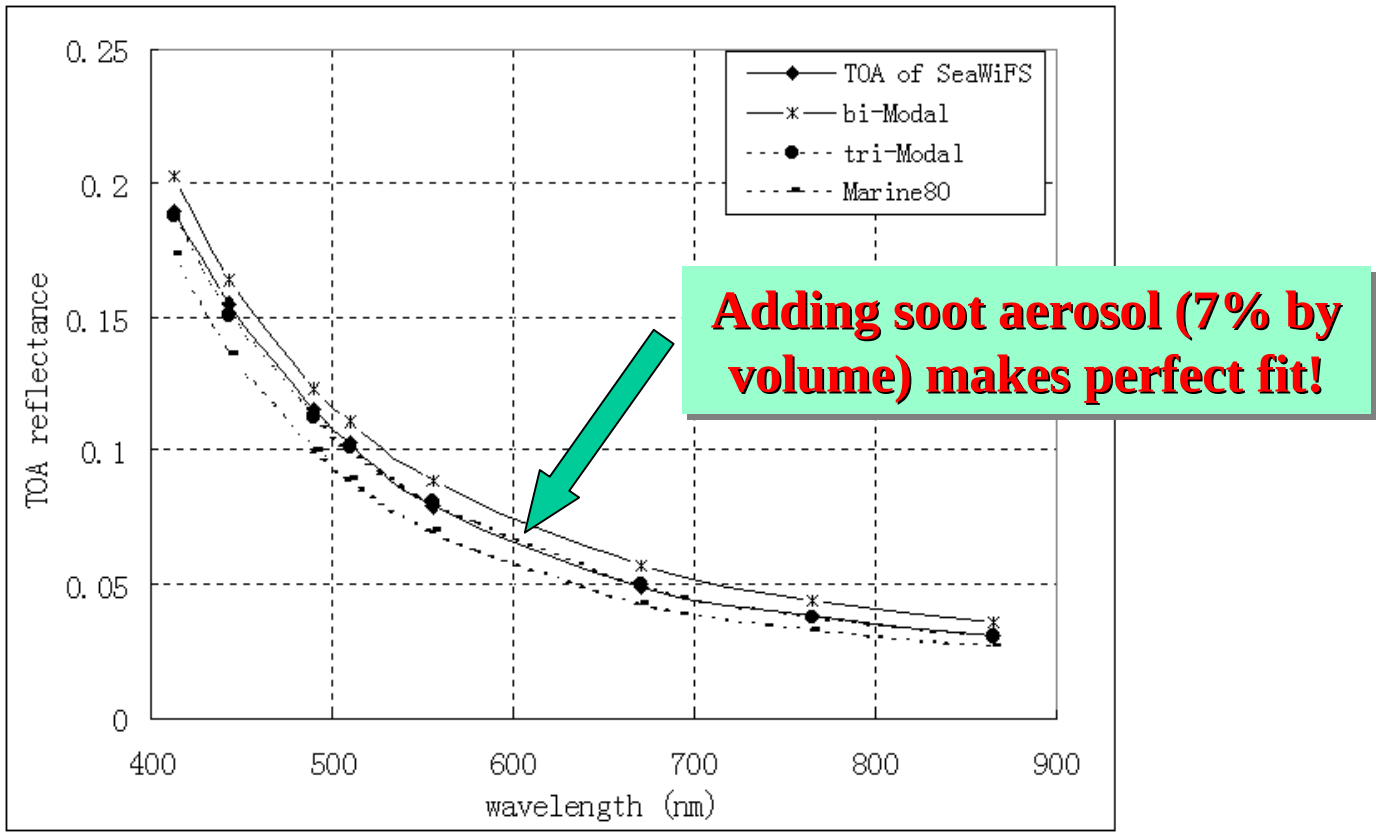


Figure 7. Comparison of the simulation result of the radiance transfer for different aerosol model. The solid diamond with solid line is the TOA reflectance of SeaWiFS. The solid circle with dotted line the simulation result of tri-modal size distribution model with soot included.

SeaWiFS-Reflectance vs. Model-predicted reflectance: KOSA (Asian dust) aerosol model doesn't help

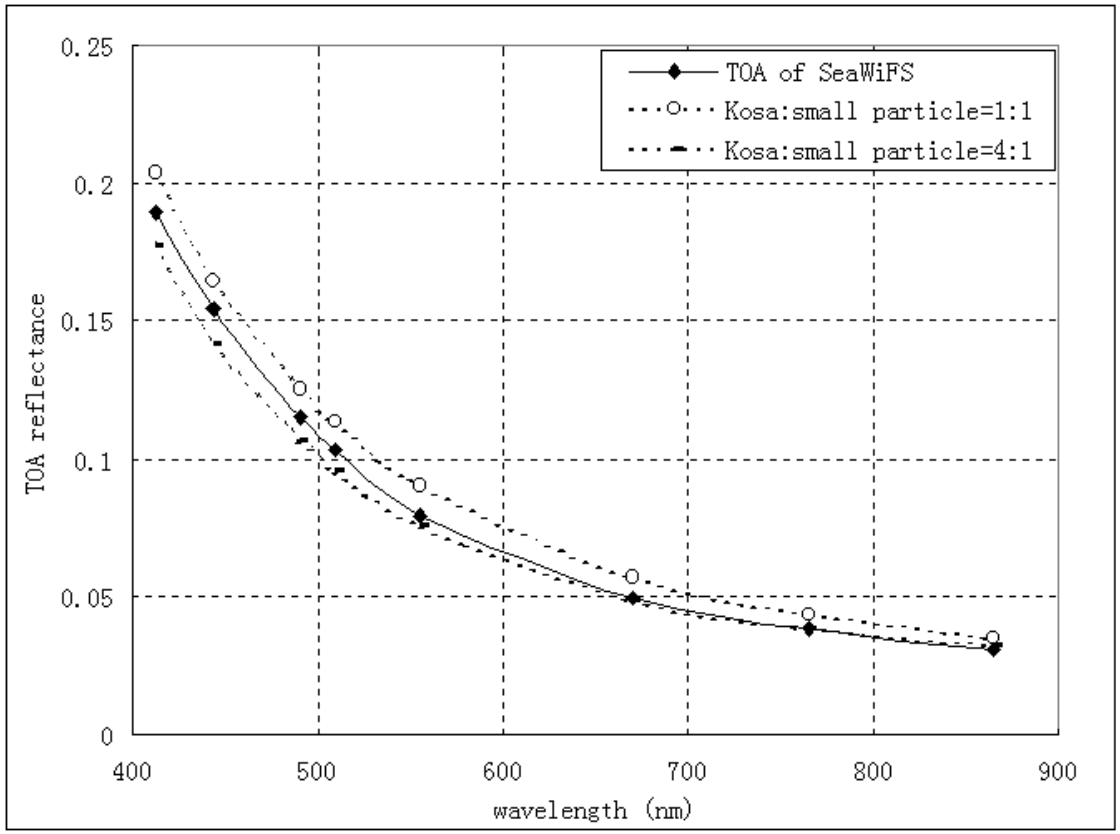


Figure 8. Result of radiative transfer simulation with different Kosa aerosol model for Apr. 7.

Current activities / near-future goals

- **Evaluate the regenerated LUT**
  - **participate in the IOCCG/AC WG activities**
- **Analyze ACE-Asia data sets**
- **Develop Asian aerosol optical models**
  - **Carbonaceous aerosol important in addition to mineral dust**
- **Develop new/modified aerosol correction scheme**
  - **in combination with the iterative “case-II” atmospheric correction?**
  - **Try/implement/test new algorithm before the GLI launch!**
- **Tune the near-cloud flag algorithms**
  - **Test over L3 images**
- **Implement water vapor correction**
- **Other miscellaneous activities**