Support of Shortwave Algorithms Development for ABI on GOES-R

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Topic: Exploratory Science

Program: AWG

NOAA Satellite Science Week
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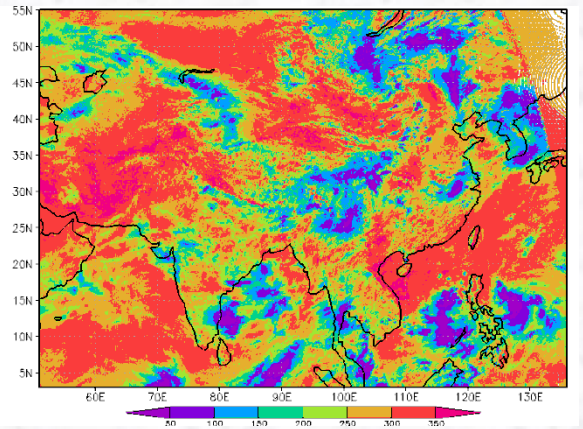
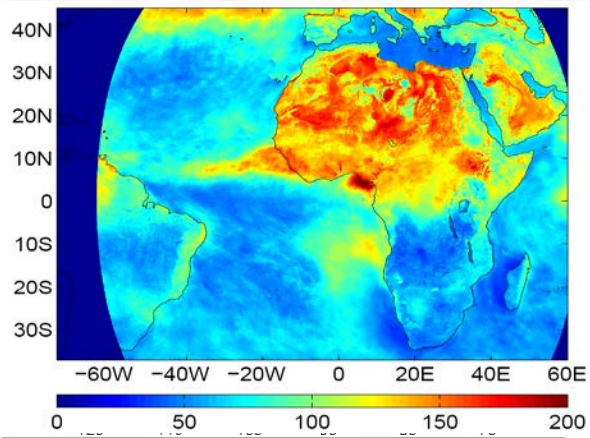
Project objectives

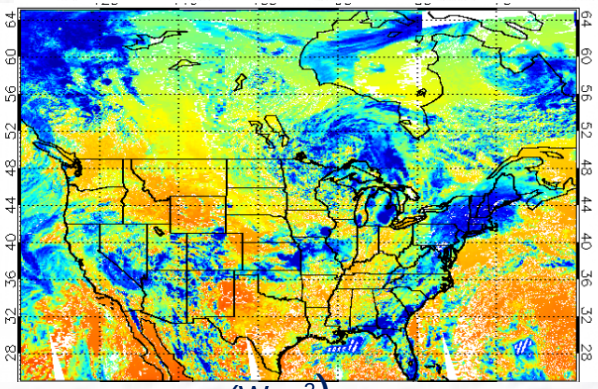
- Support the *development* and *evaluation* of algorithms to derive *shortwave* (SW) radiative fluxes at the *surface* and *Top of the Atmosphere* (TOA) from the ABI sensor on GOES-R.
- Scene dependent *narrow-to-broadband (NTB)* transformation and *angular distribution* models (ADM) are developed to facilitate the use of ABI.
- Used is a *combination* of theoretical *simulations* and the Clouds and the Earth's Radiant Energy System (CERES) observed ADMs.
- The ABI algorithms are driven with *proxy* observations (e. g., MODIS, SEVIRI)



SW↓ daily mean Meteosat-5, 08/01/98



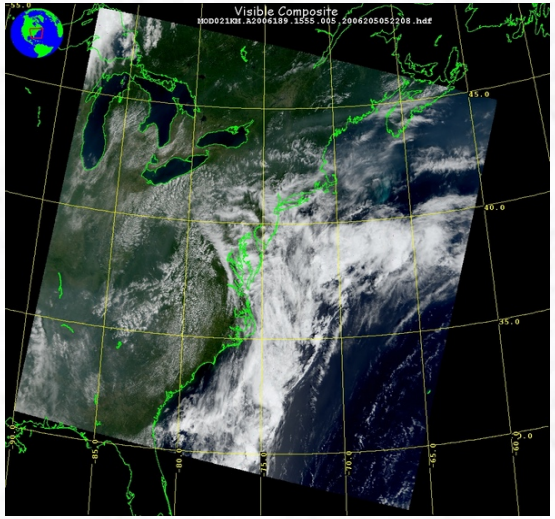
Monthly mean TOA SW↑ METEOSAT-8



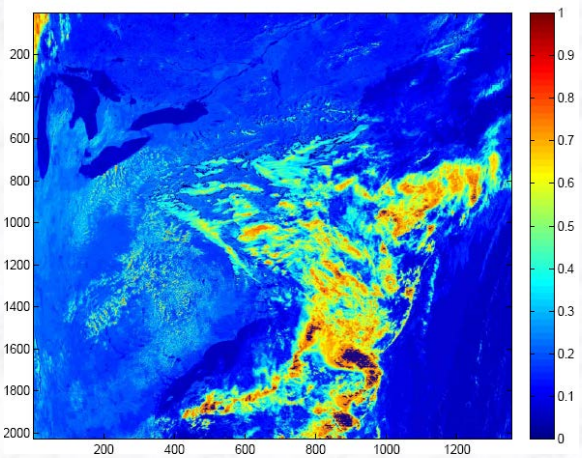
UMD_MODIS SW↓ 5 km Terra, 08/01/03

(Wm^{-2})

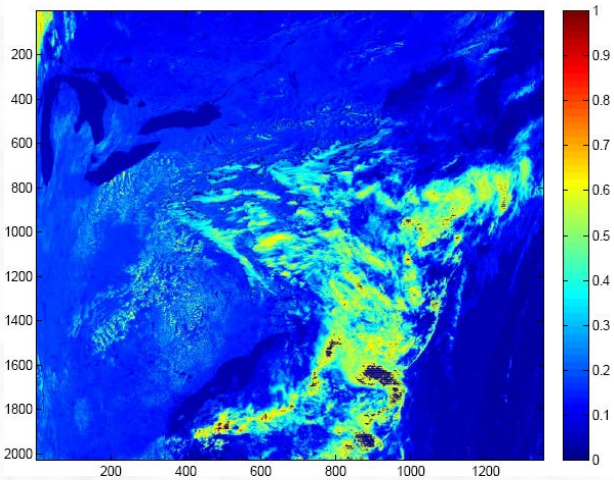
Shortwave TOA Flux from MODIS



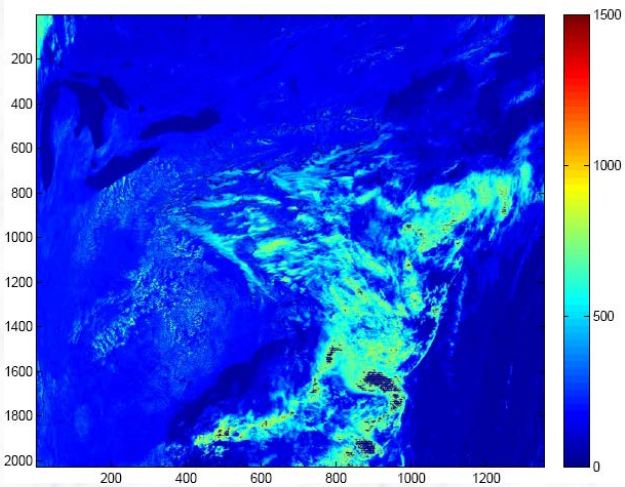
MODIS image
07/08/2006 at 15:55 GMT



Apply NTB transformation



Apply ADMs to correct for angular dependence



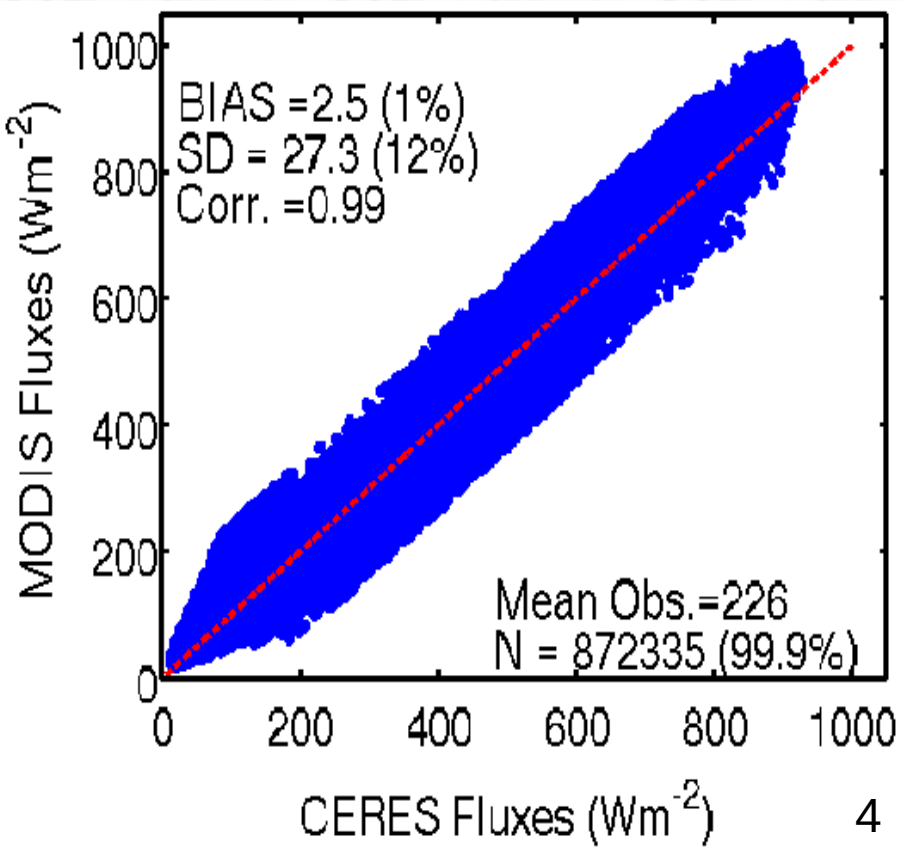
Top-of-atmosphere SW upward radiative flux

Routine Validation

Produce extended *collocated* database that matches *CERES* and *GERB* observations; use for comparison at the TOA against estimates from ABI algorithm driven with proxy MODIS and SEVIRI observations

TOA SW↑ from MODIS compared to CERES for nearly 900,000 points globally from all available data on 7/8/06.

Niu, X. and R. T. Pinker, 2011. Int. J. Rem. Sens., 33 (5),1383-1399

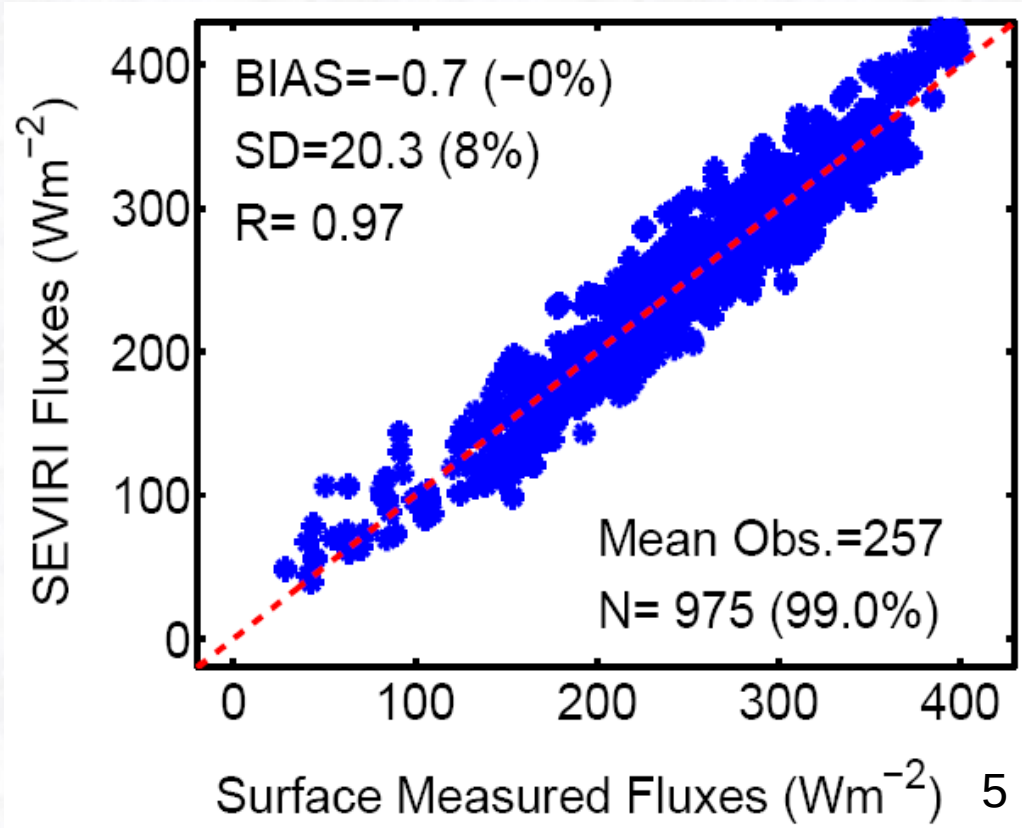


"Deep Dive" validation

Tools for extensive analysis are developed:

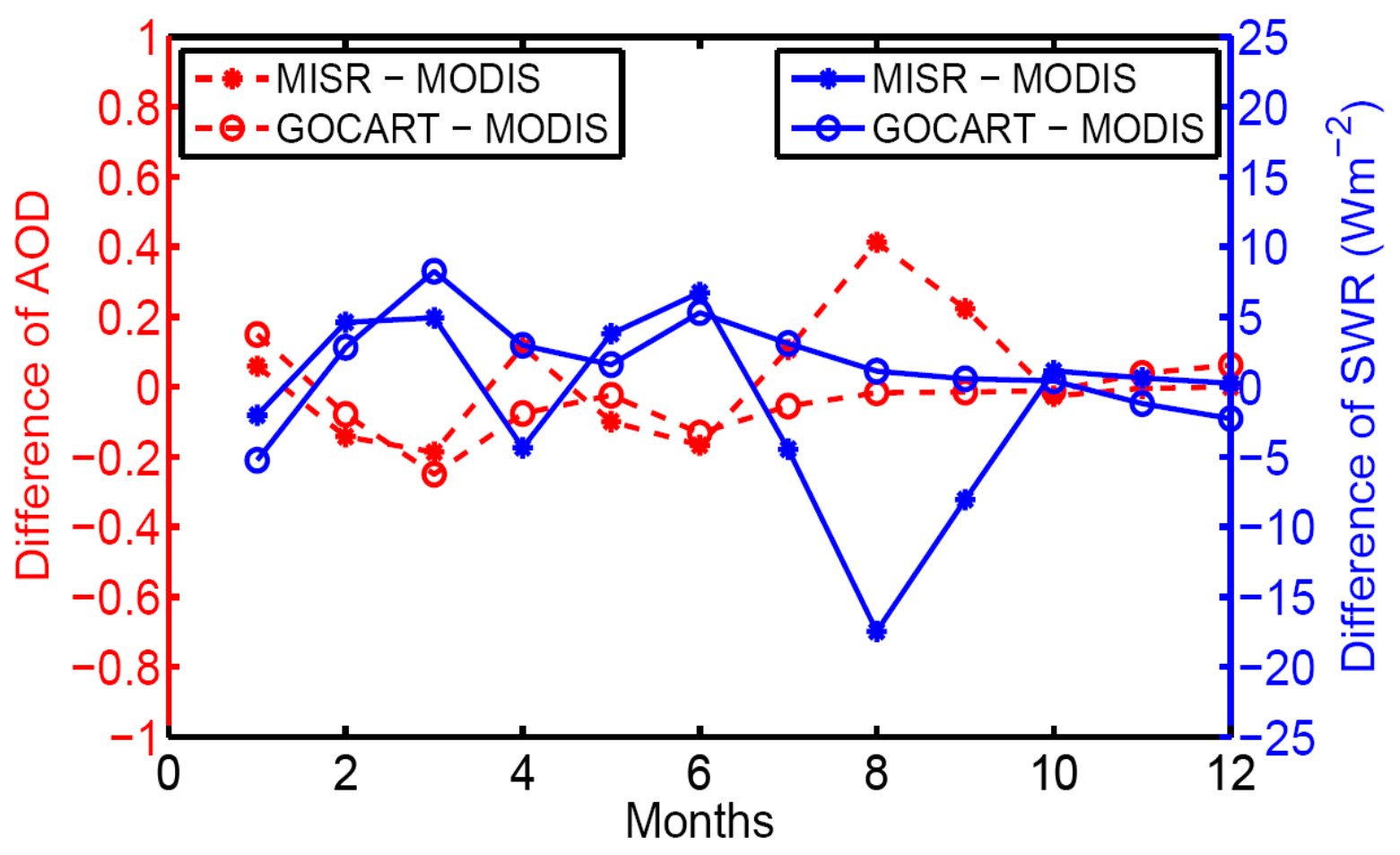
- *Surface radiative* fluxes are derived with proxy data from SEVIRI and MODIS and evaluated against ground observations.

Evaluation of daily mean surface SW↓ fluxes estimated from UMD/SRB_SEVIRI against surface observations over 3 sites in Africa for 11 months (February-December) 2004



"Deep Dive" testing

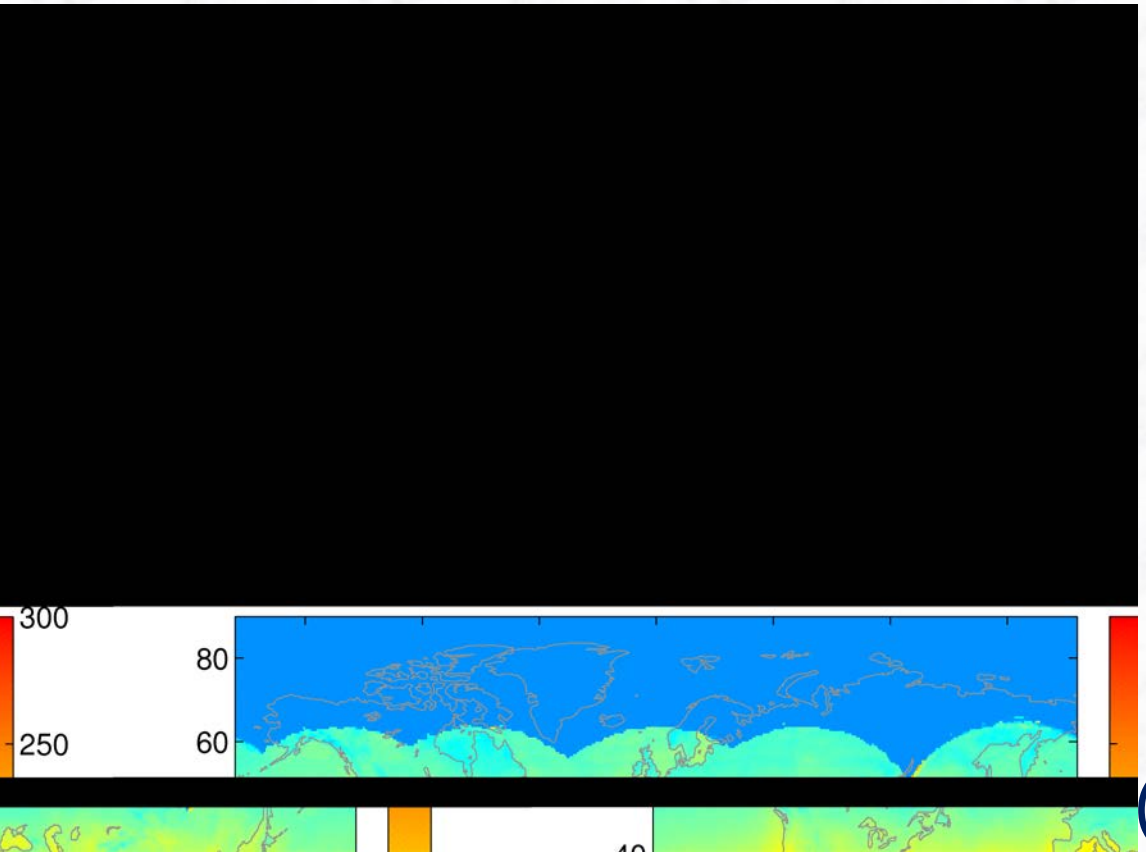
Model sensitivity to aerosol sources

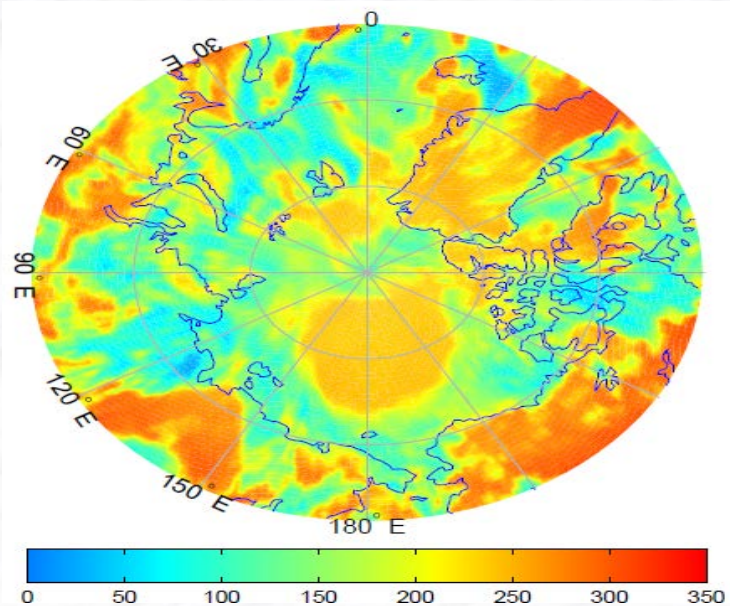


Δ in SW flux compared to PIRATA buoy observations (blue) due to Δ in aerosols (MISR, GOCART vs. MODIS) (red)

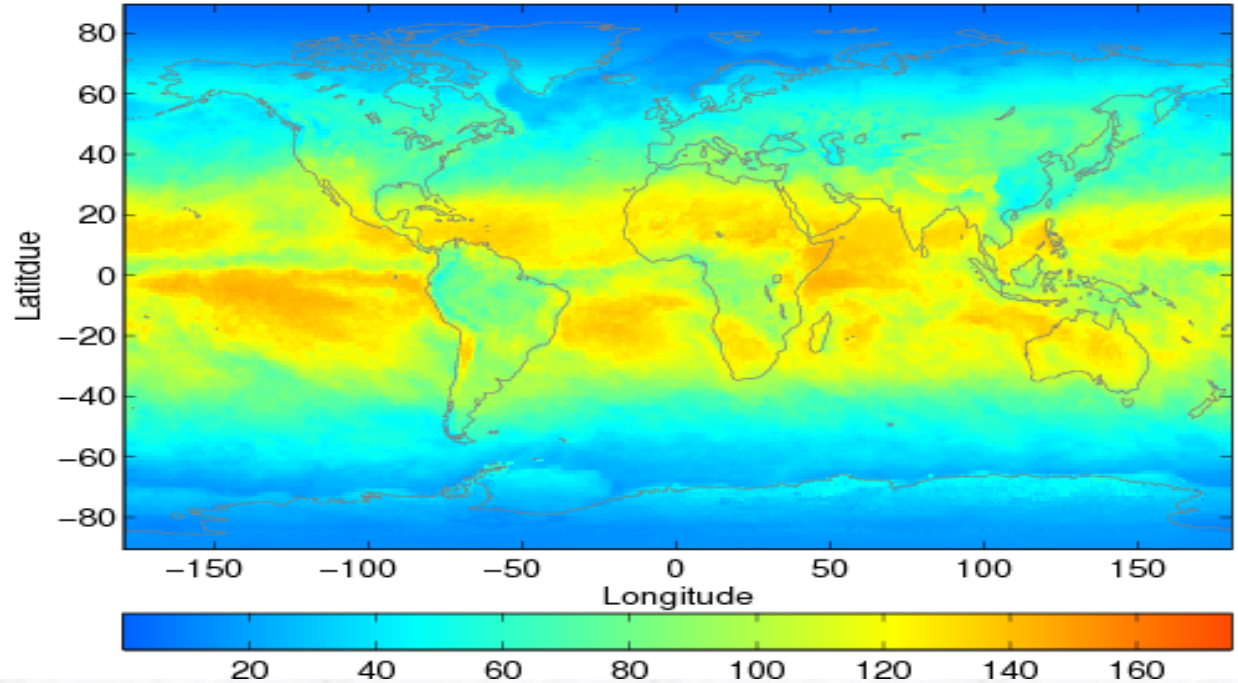
At Issue

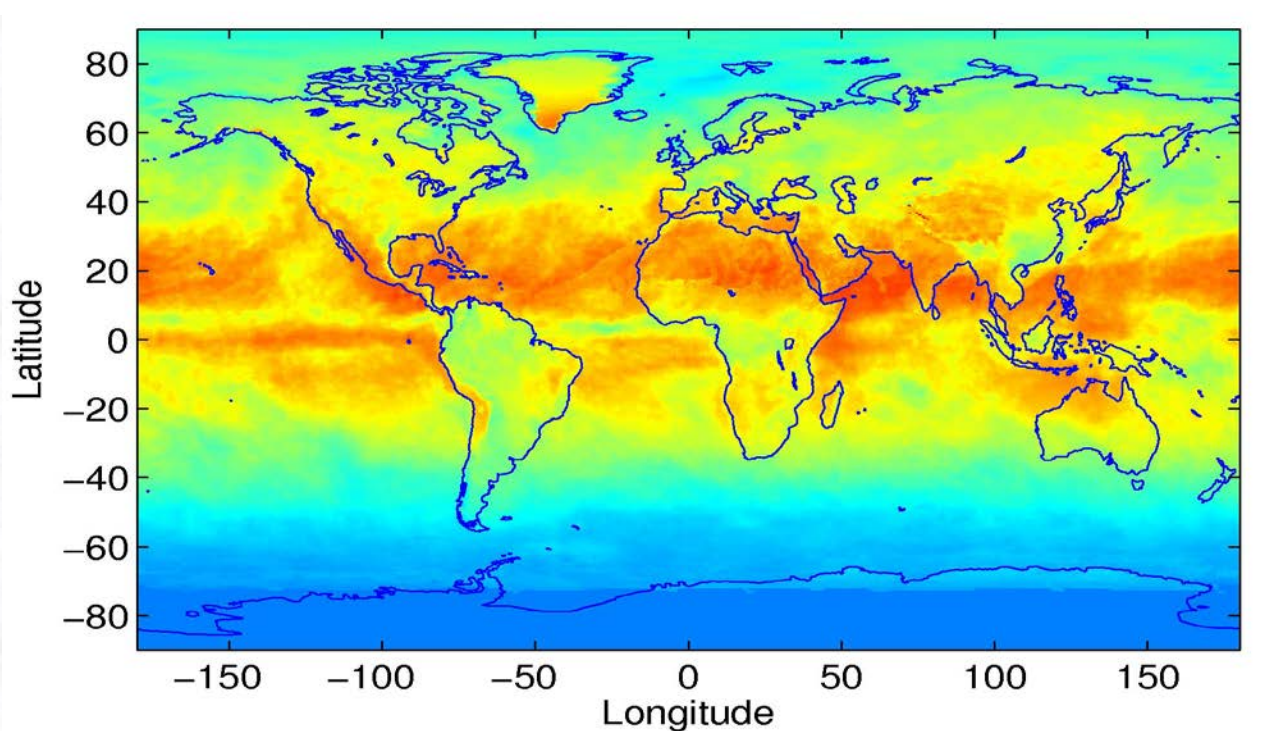
- Geo satellites do not cover polar regions
- Calibration issues with multi - systems
- Need coverage from one satellite





Daily mean **SW**↓ Wm^{2} UMD_MODIS (5 km) over the Arctic (60°-90°N) , 05/01/07





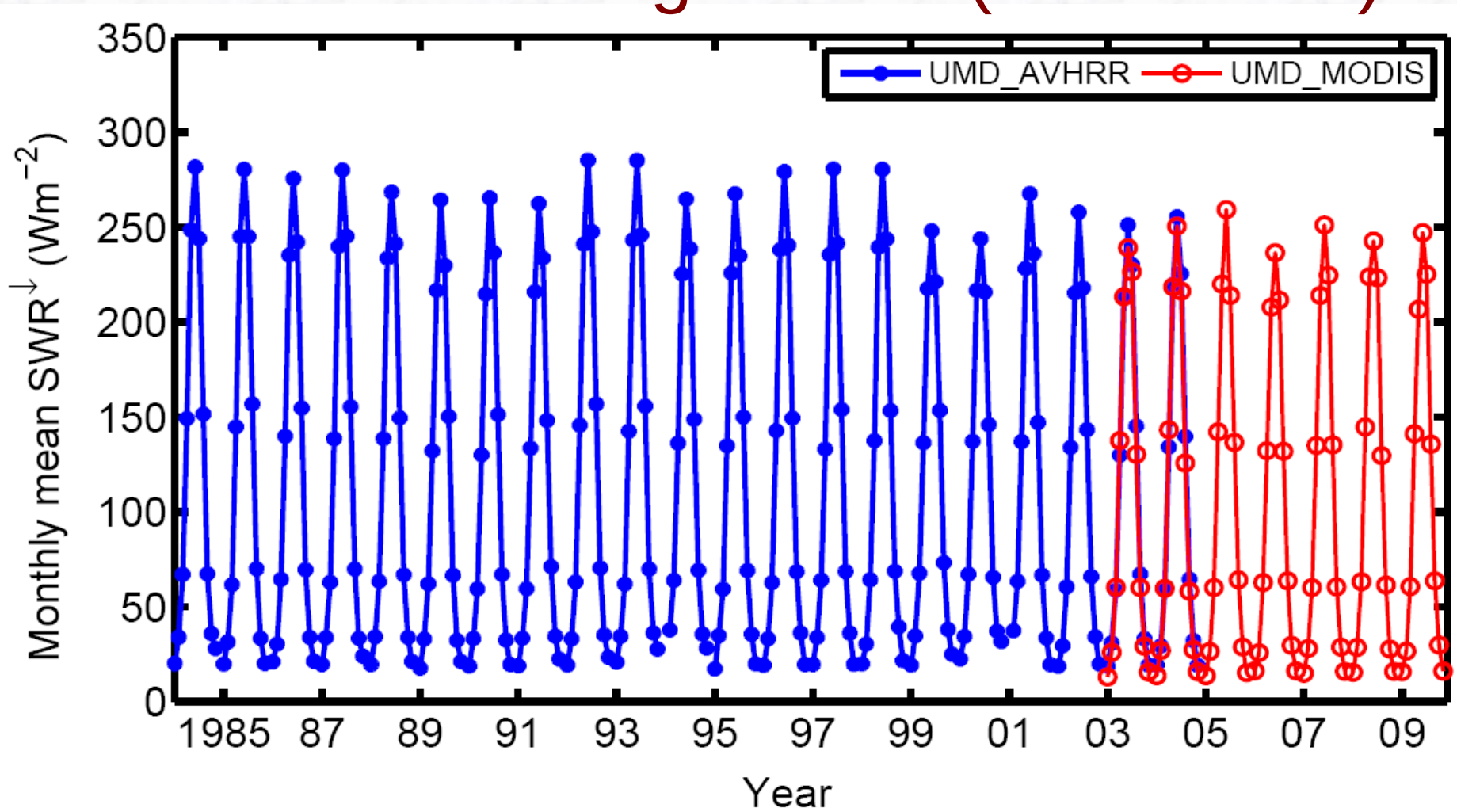
Capabilities exist to derive SW↓ from MODIS at global scale

Wang, H and Pinker, R. T., 2009. JGR-Atmospheres, 114, D20201

Capabilities exist to derive SW↓ from AVHRR at global scale

Ma, Y., and R. T. Pinker, 2012: *JGR-Atmospheres*, 117, D23202

Monthly mean SW↓ down from MODIS and AVHRR averaged over (60°N-90°N)



After MODIS, capabilities to monitor high latitudes will be endangered

Preparing for the Future

- Information on SW↓ fluxes at the surface is needed by climate modelers, hydrologists, industry, agricultural and oceanic community.
- SW↓ fluxes from VIIRS can provide continuity of a long term record derived from AVHRR and MODIS, and to which NOAA's contribution has been critical.
- The know-how is available to meet such a need.