Applications of Outgoing Longwave Radiation

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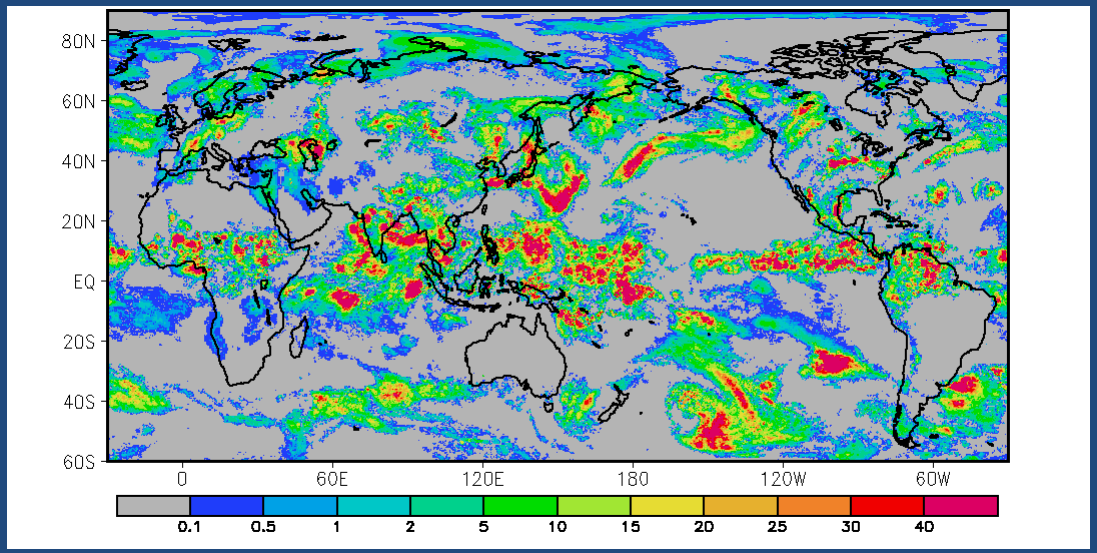
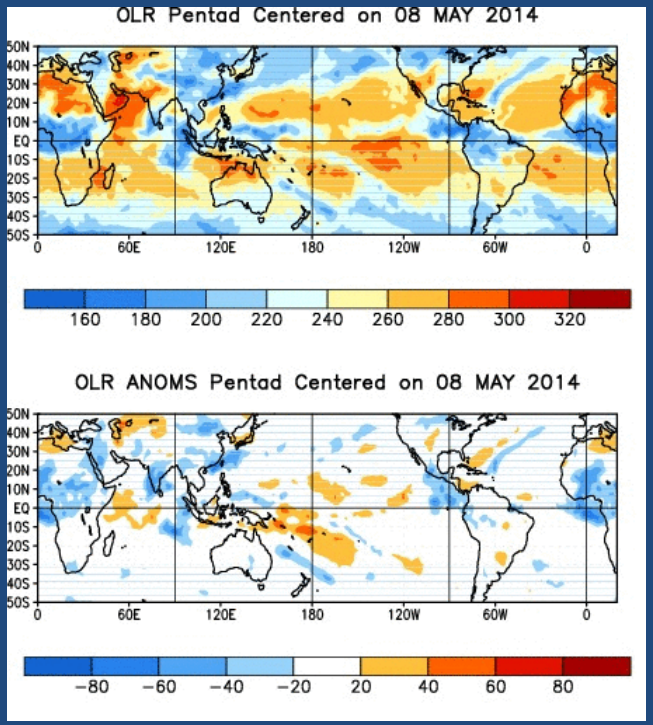
OLR is Critical for Weather / Climate

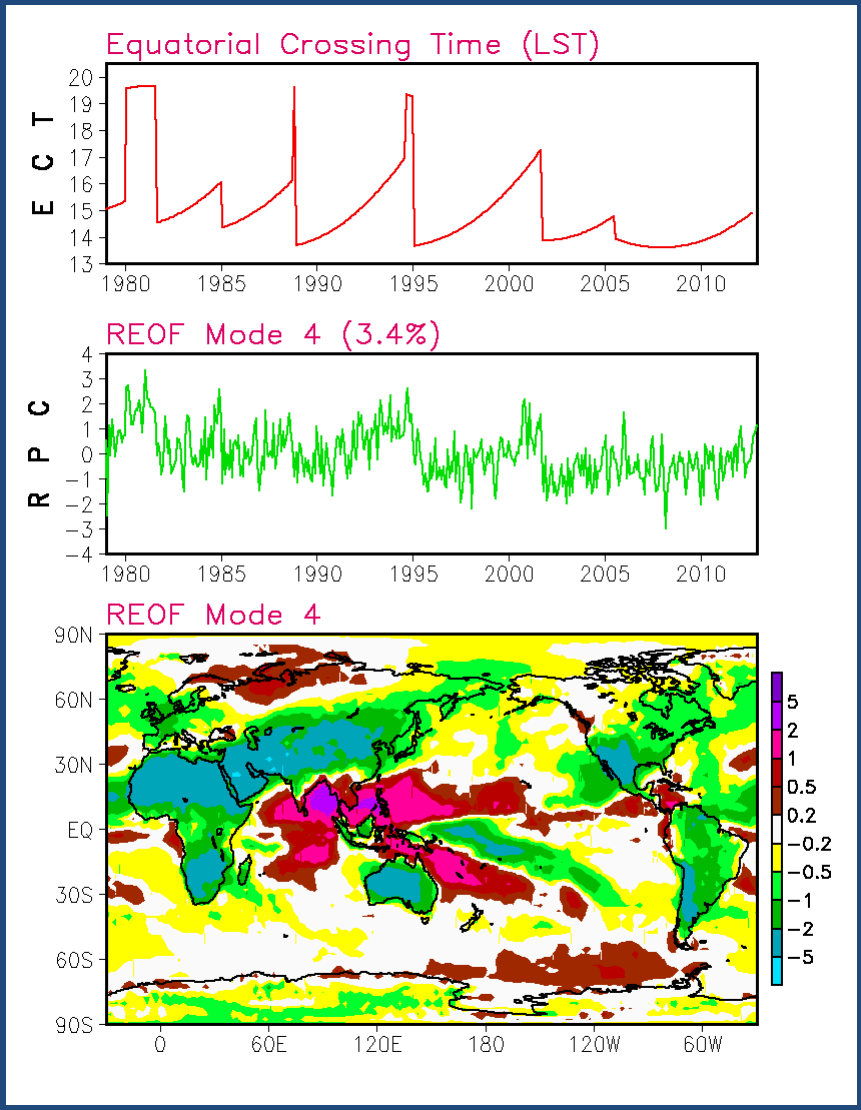
- Monitoring of weather / climate / tropical storms (ENSO, MJO et al.)
- Monitoring and mitigation of hazards
- Monitoring crop production
- Forcing Verifying weather / climate models
- Global water cycle / energy budget studies / global change studies
- Deriving precipitation information





Current Operational OLR is a 30-Year Old technology

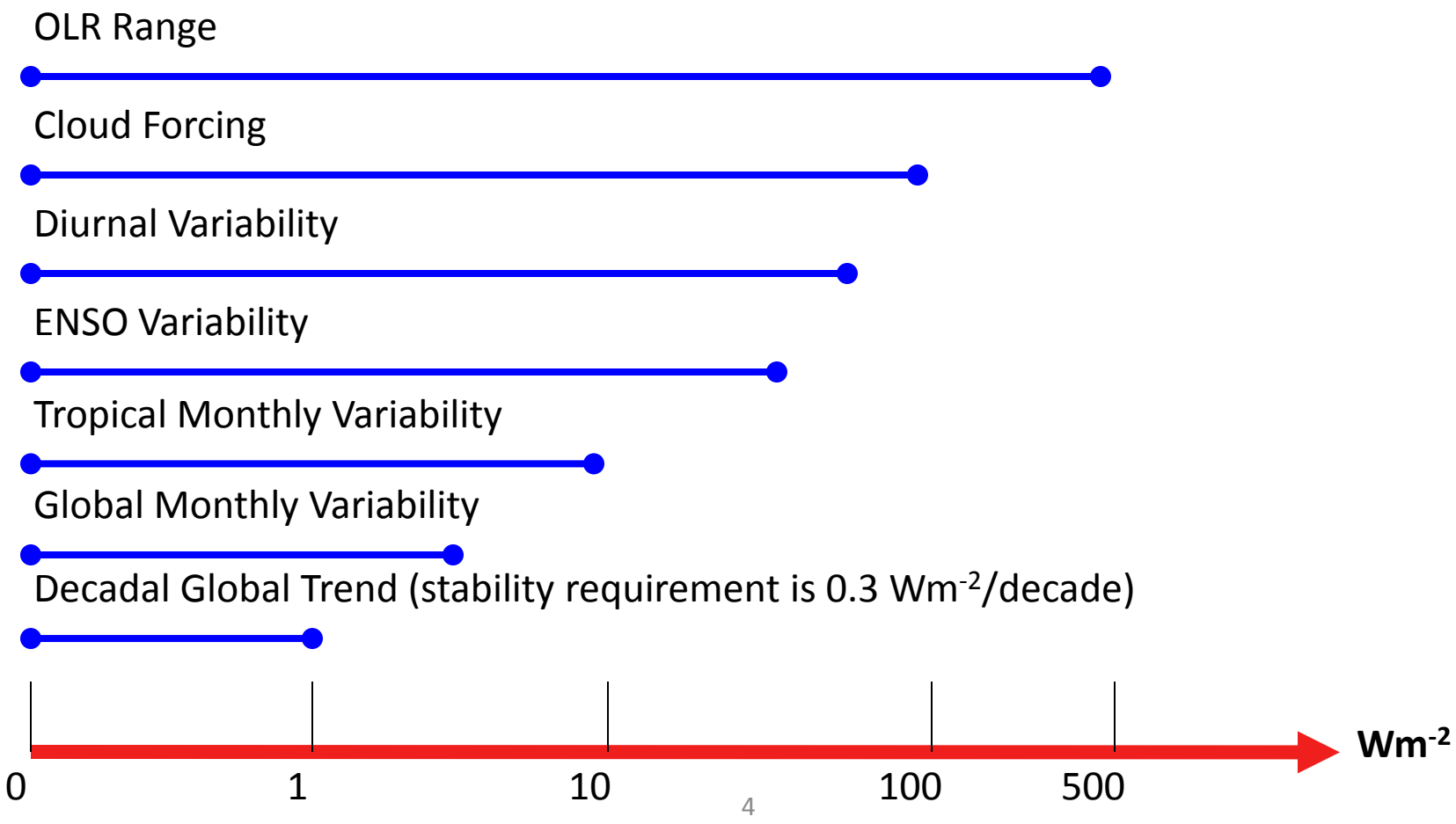
- Based on AVHRR
- Using data from one single satellite only
- Less-than-desirable accuracy / coarse resolution
- Discontinuities
- We need new OLR data!!



OLR Variability & Accuracy Requirements

Absolute Accuracy vs. Uncertainties

Process vs. Time Series Applications



Outgoing Longwave Radiation Overview

Outgoing Longwave Radiation (OLR) is the energy leaving the Earth as infrared radiation Definition:

$$OLR = \int_0^{\pi/2} \int_0^{2\pi} \int_{\lambda_1}^{\lambda_2} [R(\lambda,\theta)\, d\lambda] \cos(\theta) \sin(\theta)\, d\theta d\varphi$$

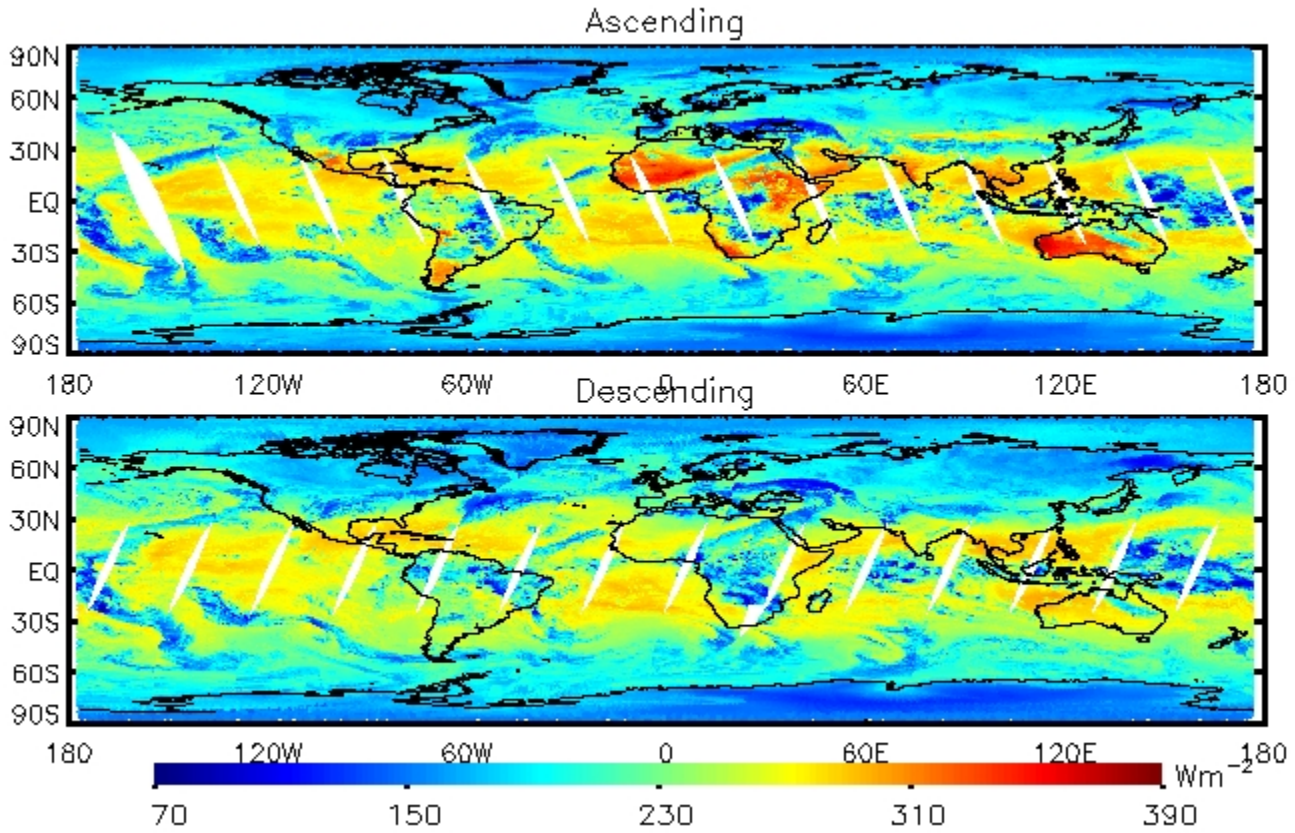
$R(\lambda,\theta)$ the radiance at the top of the atmosphere.

Spectral coverage is essential, that is why OLR from hyperspectral sensors more accurate.

1. Std ~ 11 W/m^2, AVHRR IR window channel at 11 µm (Ohring et al., 1984)
2. Std ~ 6 W/m^2, Meteosat IR window + WV channels (Schmetz and Liu, 1988)
3. Std ~ 4 W/m^2, HIRS IR window + WV + CO_2 channels (Lee et al., 2007)
4. Std ~ 3 W/m^2, AIRS full IR spectra (Susskind et al, 2012; Sun et al., 2011)

CrIS OLR Status

- CrIS OLR passed Critical Design Review (CDR)
- NOAA/STAR uses IASI-like algorithm and derived the conversion coefficients from radiances to OLR based on match-up AIRS, CERES.
- The CrIS OLR product is under validations.



Basic questions

- Describe how SNPP/JPSS products provide continuity from legacy POES, METOP, DMSP, EOS?
  - Or is SNPP/JPSS a new capability for our application?

  Community including CPC would like to replace the AVHRR based OLR data with a blended product (hyperspectral OLR from CrIS et al, plus from other sensors)
- What benefits or improvements do you expect from SNPP/JPSS?

  Inter-satellite calibration among hyperspectral OLR sensors from different platforms

  Improved sampling from both the morning and afternoon operational satellites

  L2 data reprocessed from the beginnings of respective satellite observations

  OLR from multiple platform / sensors integrated into a single time series of high quality with reduced latency (~12 hours) and refined resolution (0.25°lat/lon,daily)

  -- Expected impact (low, medium, high) and why?

  Medium
- Provide Details on:
  - when do you plan to use the SNPP/JPSS Product?

  Somewhere around FY15-FY16 when we finish work to establish a homogeneous record of OLR from multiple satellite / sensor from at least 1981 updated on a real-time basis (~6hr delay)

    - Is there an actionable plan?

    Yes,. We drafted a proposal to NESDIS/OSD on converting IASI OLR to operation and another one to be submitted to JPSS on CrIS OLR.

    - Is it funded?

    Yes, by NESDIS/OSD for IASI up to FY14, No, no funding from JPSS for CrIS.

    - What is the priority?

    Reprocessing the IASI/CrIS OLR and blend them with OLR from other historical data for a consistent record

    - Have you thought about how you will get the data and have you identified the issues with your operational use of SNPP/JPSS ?

    Yes.
  - Are the current legacy products well utilized?

    CrIS OLR is not yet publically available. People are still using AVHRR OLR for climate monitoring et al.
  - Is the SNPP/JPSS product part of a blended product?

    No. There is no blended OLR so far, we are proposing an effort to do so.
  - What additional work needs to be done to ensure that the SNPP/JPSS product is/will be well utilize

    Create a homogeneous long-term (>=30 years) record of high accuracy / high resolution OLR by blending information from hyperspectral sensors with those from other instruments.

Are enhancements needed for:

- Accessibility (data flow, latency, format)
  a latency of 6~12 hours is good enough for weather/climate applications.

- Product performance (accuracy, precision)
  We have not yet conducted comprehensive examination on this. However, for climate applications, it is more important to ensure accurate inter-satellite calibrations and lime corrections for the OLR data

- User applications (modifications to modeling , decision tools, visualization to use the new products)
  - *monitoring of global climate (El Nino, MJO et al.)*
  - *monitoring of tropical convection, severe storms and hazards (hurricane and disasters..)*
  - *weather / climate model verifications*
  - *enhance climate forecasts*
  - *climate diagnostics and attributions*
  - *distributed from CPC to climate centers of many countries around the world for climate monitoring, and decision support*

- Other topics:
  - Product fusion?
    - Yes, blending info from different sensors from LEO / GEO platforms
  - Reprocessing
    - We need the retrievals to be reprocessed every time a new algorithm is implemented