CDR IN OPERATIONS

Monthly and Daily Outgoing Longwave Radiation CDR

Hai-Tien Lee

CICS-MD/ESSIC-NOAA
University of Maryland
301-405-0494 lee@umd.edu

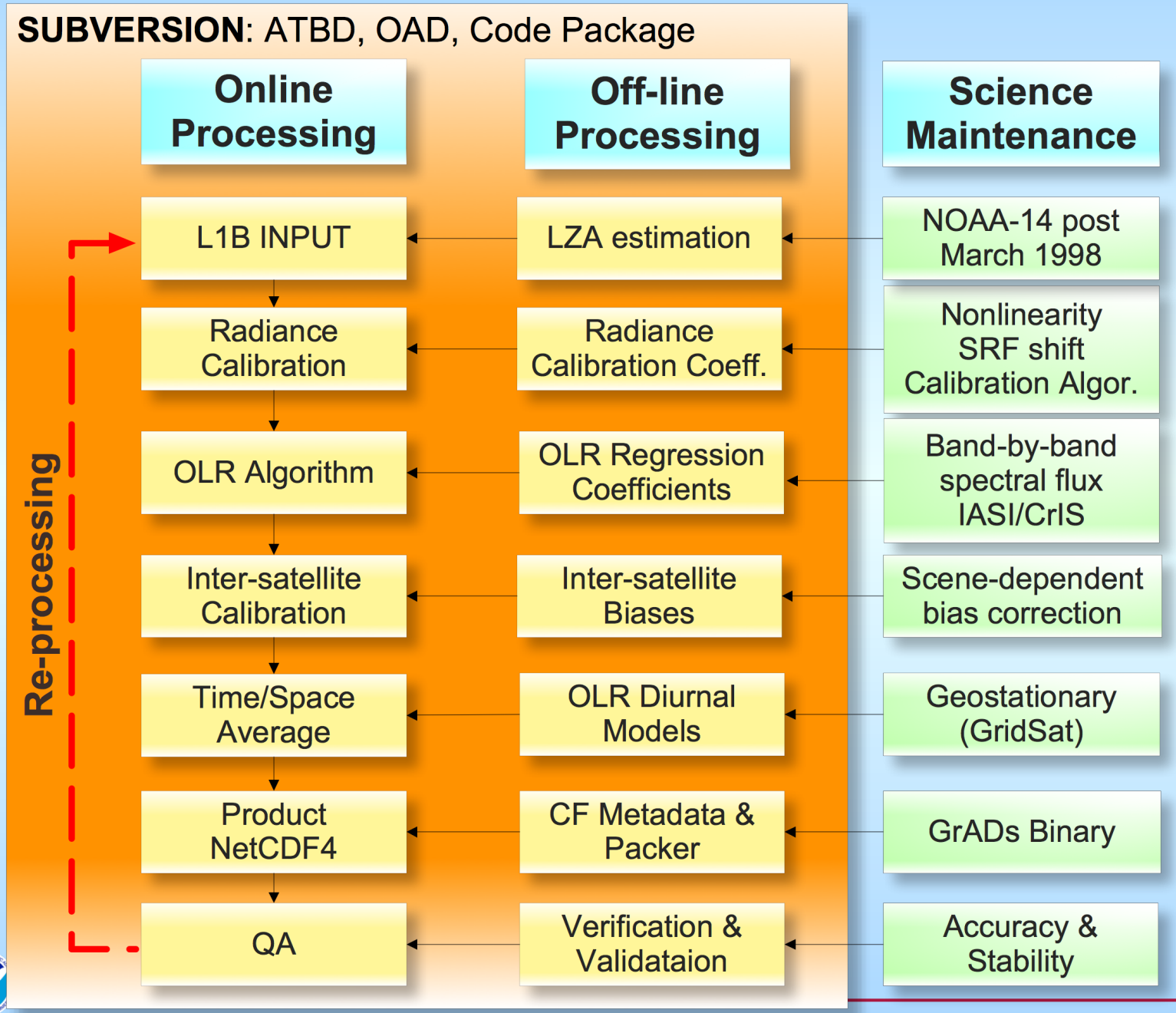
Collaborator: Robert G. Ellingson (FSU)
NCDC POC: Lei Shi, Bill Hankins

CDR Team Meeting
July 30 – Aug 1, 2013
Asheville, NC

Outline

- HIRS OLR CDR Product
  - **Monthly 2.5°** - maintenance; IOC to FOC
  - **Daily 1°** - new product
- Product status, QC/QA Approaches
- Applications
- Schedule & Issues

HIRS OLR CDR Production System Diagram



Product Description

HIRS OLR Climate Data Record:

- Global coverage
- 2.5˚x2.5˚ Equal-Angle Grid
- Monthly Mean
- Jan 1979 - Present
- Updated Monthly

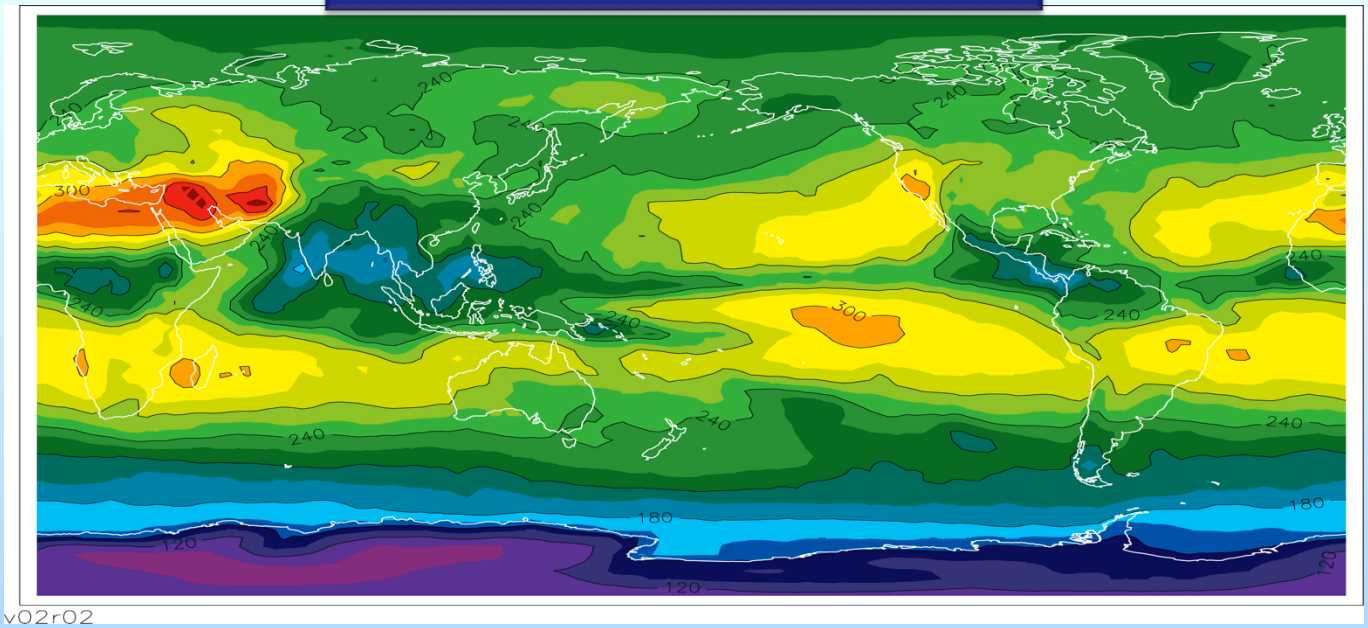
Observational Data Input:

- HIRS Level-1b data

Research Applications

- Earth radiation budget studies
- Numerical model verification
- Long-term climate variability
- Global precipitation time series
- Tropical expansion investigations
- MJO diagnostics
- Monsoon forecast

HIRS Monthly Mean OLR for July 2010



Product Delivery Description

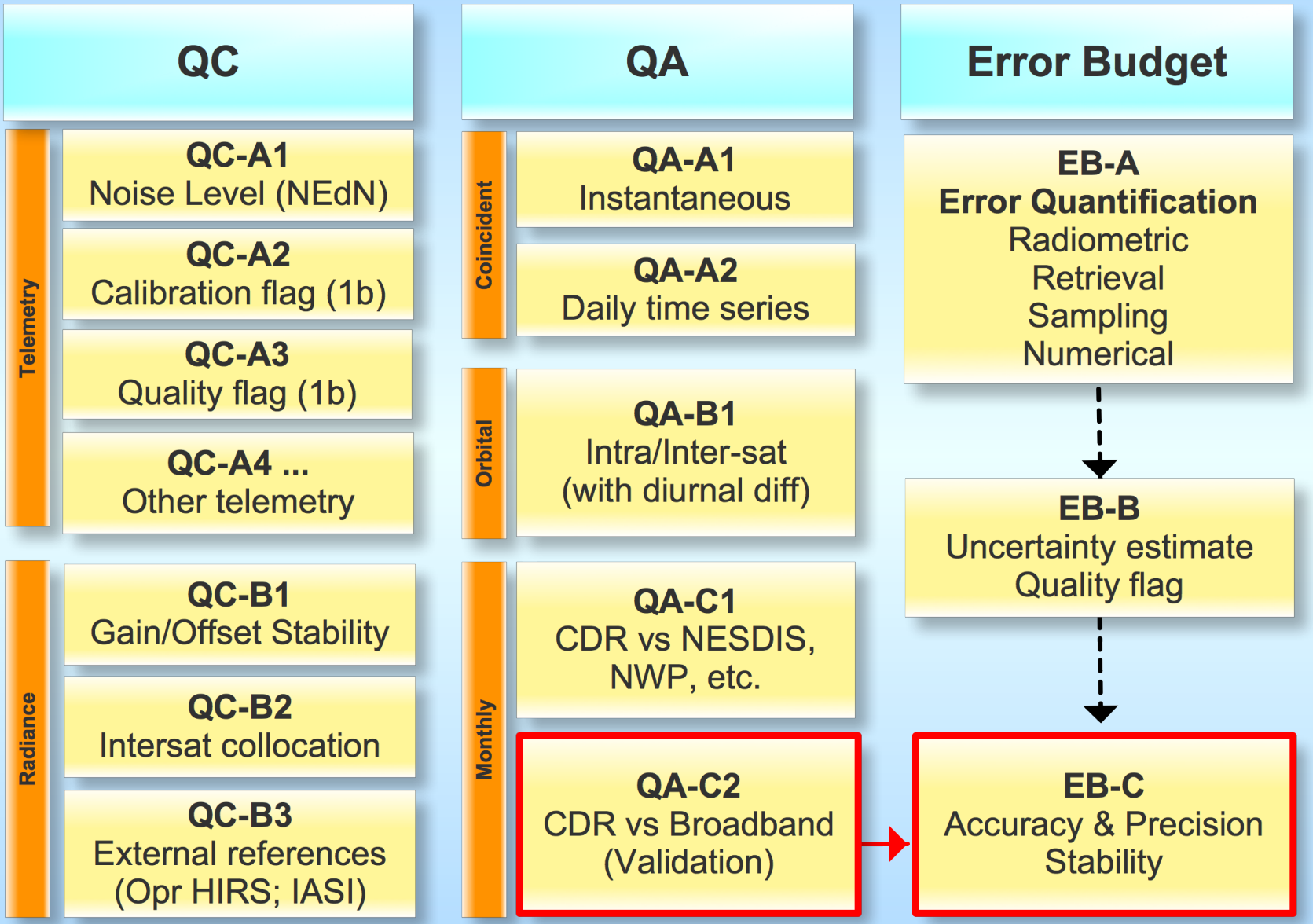
CDR(s)	Period of Record	Temporal Resolution	Update Frequency	Update Lag	Spatial Resolution	Data file distinction criteria	Do you publicly serve the CDR at your institution?
HIRS OLR Monthly CDR v02r02	Jan1979 – Dec2010 to be extended	Monthly	Monthly	5 day	2.5˚ gridded Global	hirs_olr_mon_v02r02_197901_201012.nc	Yes, but not publicized, no auto tracking, no report
HIRS OLR Daily CDR v01r00	Jan1979 - present	Daily	Daily	24 hr	1˚ gridded Global	hirs_olr_day_v01r00_1979.nc (one per year)	Yes & NCDC upload

- No collateral products

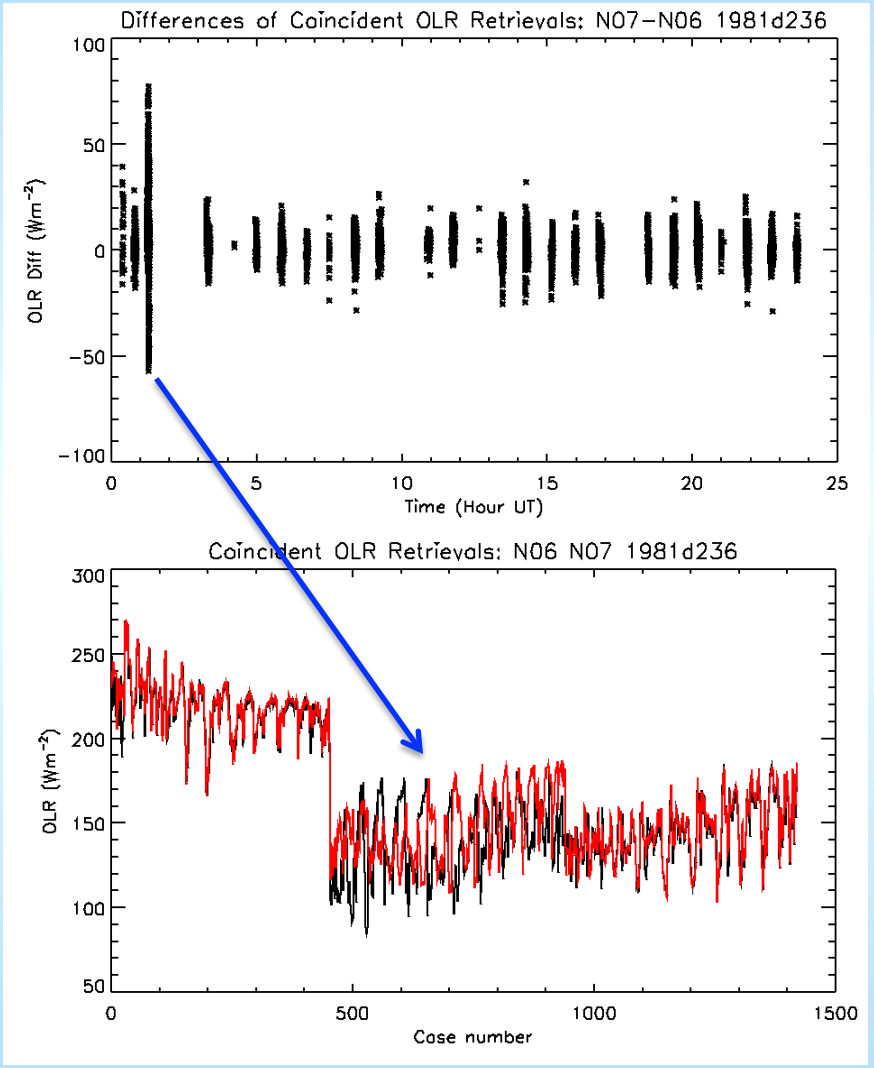
Validation & Quality Assurance

- Validation Works
  - V2.3 validation with CERES Ed2.6 products (CERES STM, May2012;
  - Address discontinuity issues (IRS'2012, Aug2012).
  - New intersat calibration and preliminary V2.4 validation with CERES Ed2.6 products (CERES STM, May2013)
  - Using IASI to assess intersat calibration errors (Eumetsat/AMS Satellite Conf., Sep2013)
- Quality Assurance
  - OLR retrieval range check
  - Production monitoring logs (no. of satellites, input data amount, no. of missing)
  - Graphing and animation of OLR maps for visual inspection.
  - Time series of StDev of area-averaged OLR differences
  - QC/QA blocks (many yet to be automated and implemented)
  - Error Budget and error estimation (to be developed)

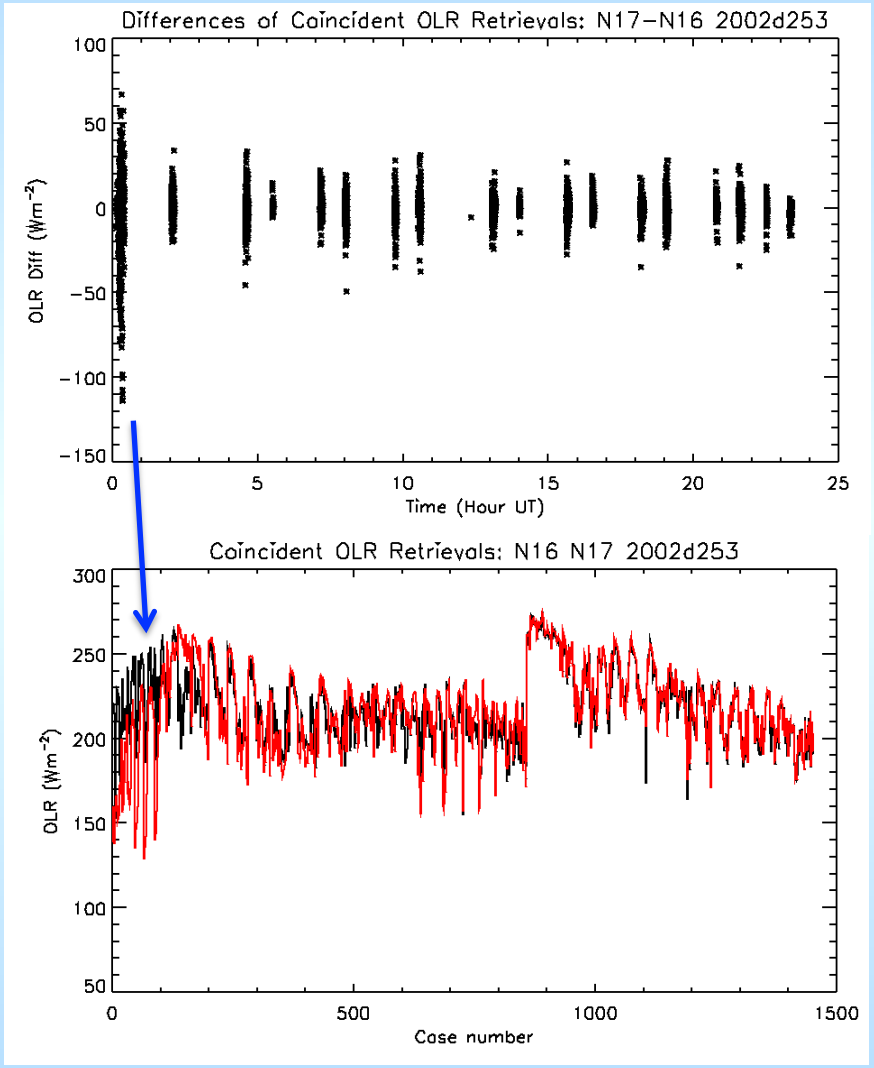
HIRS OLR CDR QC/QA Diagram



QA-A1 OLR Retrieval Anomalies



N06 (black), N07 (red)



N16 (black), N17 (red)

Concerns, Risks and Issues

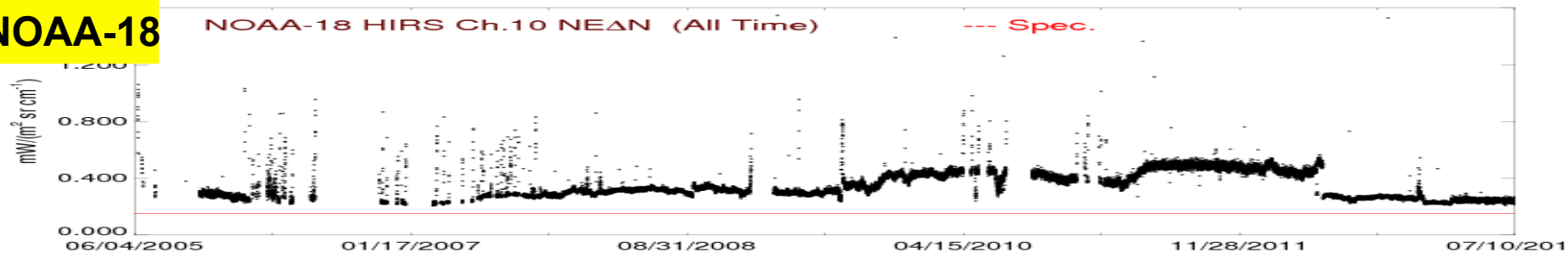
- Major Issues: Discontinuity and long-term trend artifacts
  - Inaccuracies in intersatellite bias adjustments have caused discontinuity and spurious trend in the OLR CDR time series.
  - Largest source of errors originates from disparity in OLR models.
  - Using IASI emulation framework to assess intersatellite biases – towards the v2.4 interim CDR

- Risk for 1˚ daily OLR product
  - Sampling and drift – use of GridSat

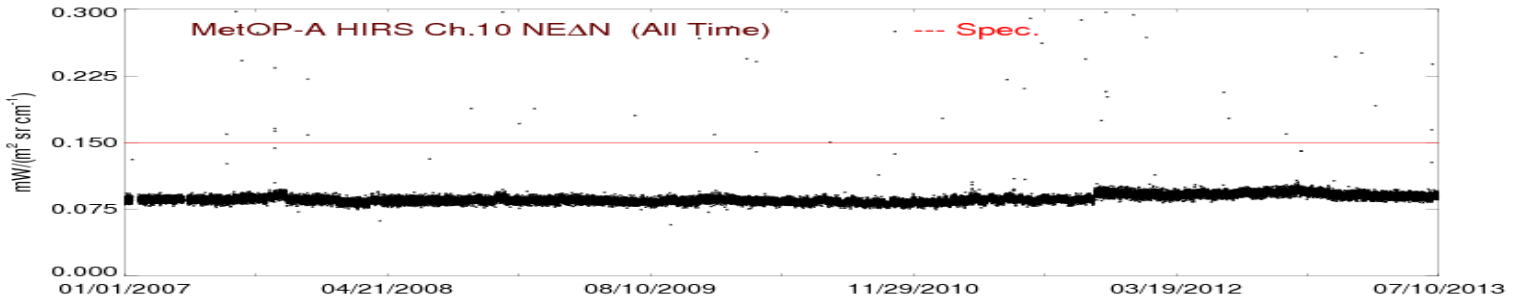
- Technical risks and issues
  - Degradation in HIRS observations (NOAA-18, NOAA-19, MetOp-B)
  - Mitigations:
    - Alternative OLR Models
    - Revisit QC/QA
    - MetOp IASI and NPP CrIS

HIRS Ch10 NEdN (2005-2013)

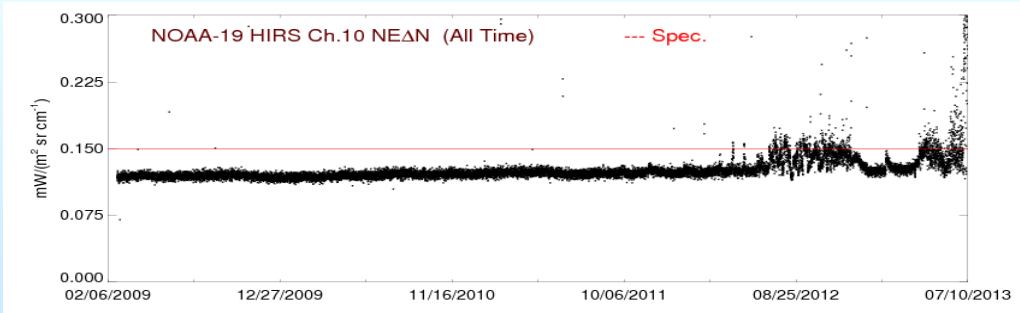
NOAA-18



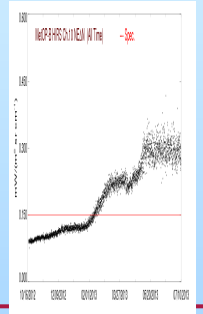
MetOp-A



NOAA-19



MetOp-B



All but MetOp-A is out of spec for HIRS Channel 10 since March 2013.

Uses & Applications

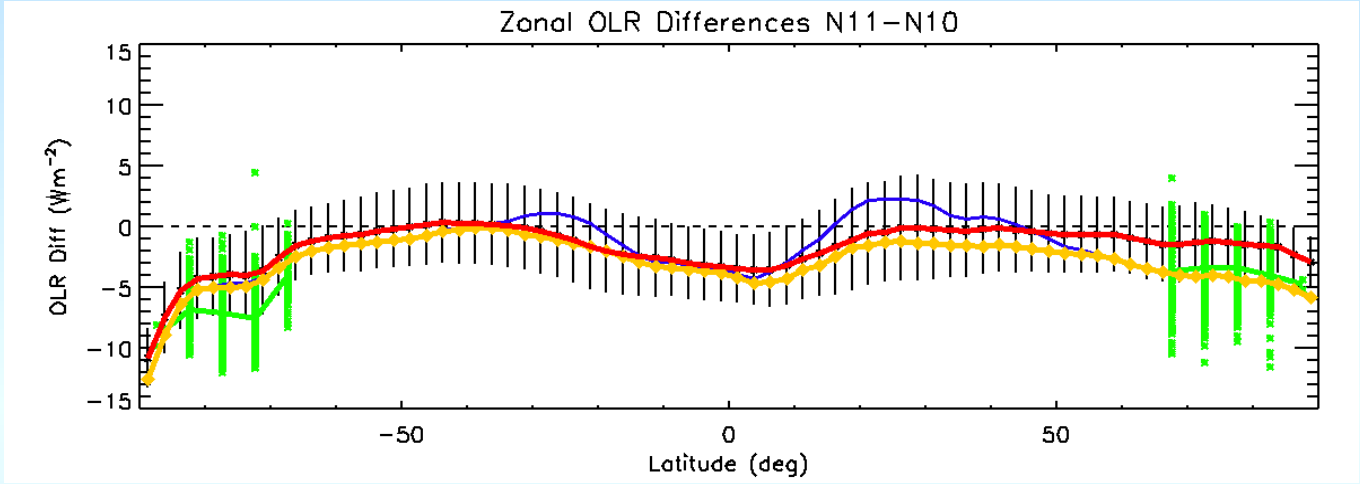
- Non-academic (business, public, government)
  - Forecast for Solar power via MJO diagnostics – Carl Schreck (NCDC)
  - Monsoon rainfall prediction – Randhir Singh Huda (ISRO, India)
    - Randhir Singh, C M Kishtawal, Danish Hussain, P K Pal and Hai-Tien Lee: A new technique for prediction of Indian summer monsoon rainfall using satellite observed outgoing longwave radiation. In submission, May 2013. (Indian Spa. Res. Org., India)
  - Precipitation index – Pingping Xie (NCEP/CPC)

- Academic
  - Using the HIRS OLR as an independent index from satellite observations to quantify the tropical expansion in last thirty years – Qiang Fu (U Washington)
  - Diagnosing Hadley Centre Global Environmental Model (HadGEM2-A) – Emma Turner (U. Edinburgh, UK)
    - Emma C. Turner & Simon F. B. Tett: Using longwave HIRS radiances to test climate models. Submitted to Climate Dynamics. July 2013
  - Improvement of GPCP precipitation time series – George Huffman (GSFC)/ Pingping Xie (CPC)

Key Scientific Findings

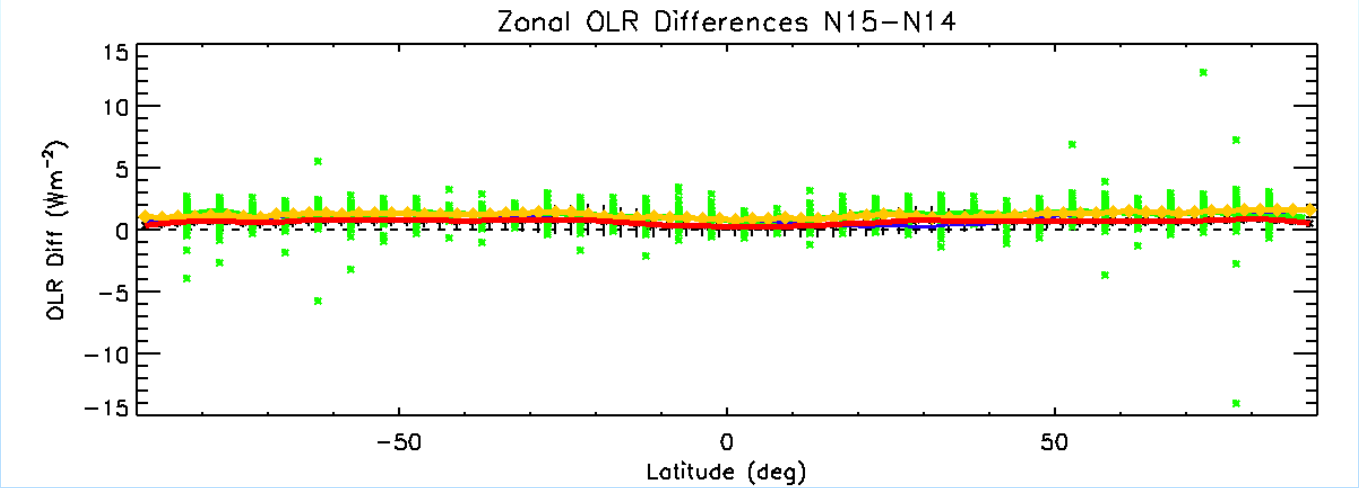
Hard lessons learned

- Collocation limitation and "bad" assumptions caused large Inter-satellite correction errors in 1989-1998



HIRS/2 vs HIRS/2i

Collocation data (green) do not have sufficient data to depict scene-dependent OLR retrieval differences from different HIRS instruments. Use of global average introduced large errors.

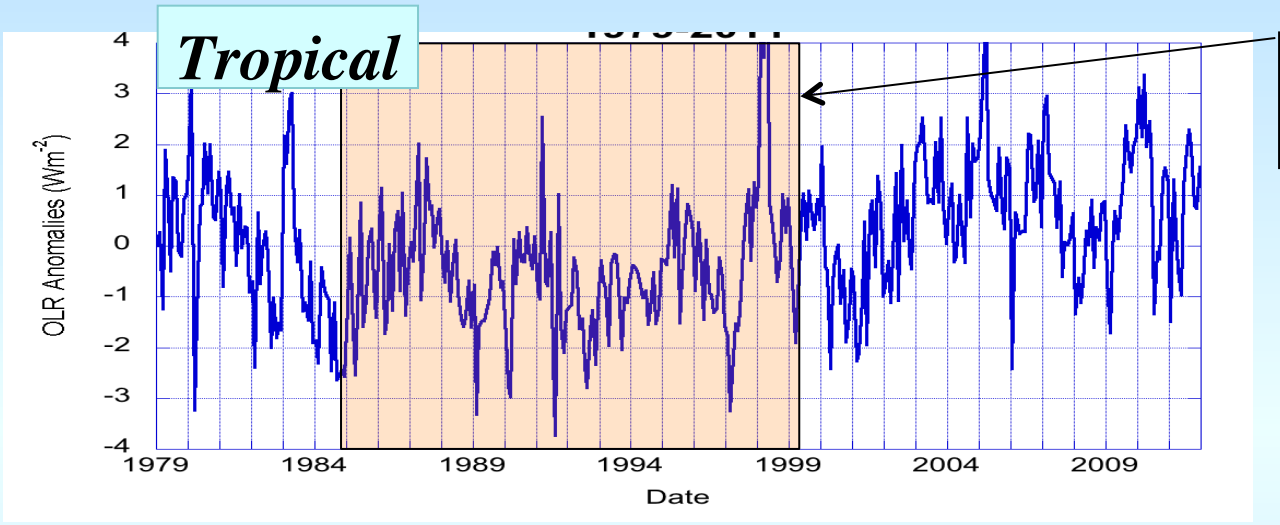


HIRS/2i vs HIRS/3

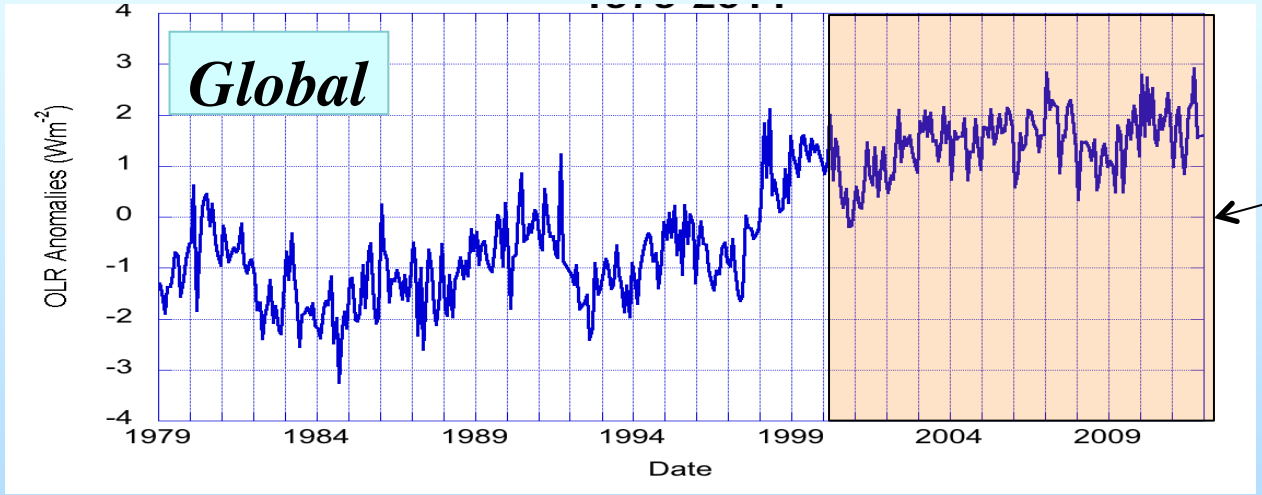
Lesser problems in intersat calibration for instruments within a family or with similar algorithm.

Key Scientific Findings (cont.)

- Validation source limitations



ERBS_NS data period



CERES Terra/Aqua data period

Schedule

- CDR status
  - IOC since Sept 2010. Plan to attain FOC in 2014.
  - Current public release is v02r02 Jan1979-Dec2010
  - To upgrade to v02r03 w/ monthly delivery
  - To upgrade to interim v02r04 for stability issue (under evaluation)
  - Work towards v02r05 with OLR model revision
- 1-3 Year Planning Horizon
  - v02r03: NOAA14 LZA correction (completed, to be delivered)
  - v02r04: revise Intersatellite calibration as interim fix to improve stability
  - v02r05: revise OLR regression models to improve OLR retrieval consistency and time series stability
  - v03r00: Inclusion of IASI/CrIS OLR (to avoid gaps and to prolong OLR CDR)
- Requests/Recommendations for the CDR Program
  - Funding for IASI/CrIS OLR algorithm development
  - User services and outreach (e.g., NOAA/ESRL/PSD, Eumetsat CM-SAF)

Publication and Presentations

- Lee, H.-T., and R. G. Ellingson, 2013: Improvement of HIRS OLR CDR inter-satellite calibration using IASI observations. 2013 joint EUMETSAT/AMS Meteorological Conference, 16-20 September 2013, Vienna, Austria (Poster)
- Randhir Singh, C M Kishtawal, Danish Hussain, P K Pal and Hai-Tien Lee: A new technique for prediction of Indian summer monsoon rainfall using satellite observed outgoing longwave radiation. In submission, May 2013. (Indian Spa. Res. Org., India)
- Emma C. Turner & Simon F. B. Tett: Using longwave HIRS radiances to test climate models. *Climate Dynamics*. In submission July 2013. (Univ. Edinburgh, UK)
- Lee, H.-T., 2013: Assessment of HIRS OLR CDR intersatellite calibration errors. The CERES II Science Team Meeting, May 7-9, 2013, Hampton, VA
- Lee, H.-T. and R. G. Ellingson, 2013: HIRS OLR Climate Data Record - Production and Validation Updates. *Proceedings of the 2012 International Radiation Symposium (IRS'2012)*. AIP Conf. Proc., 1531, 420 (2013); doi: 10.1063/1.4804796
- Robertson, F. R. and Hai-Tien Lee, 2012: An alternative inter-satellite calibration of the UMD HIRS OLR retrievals. AGU Fall 2012. December 3-7, 2012. San Francisco, CA. (Poster)
- Lee, H.-T., 2012: Comparisons of Monthly Mean OLR Between HIRS OLR CDR v2.2/v2.3, CERES EBAF/SSF/SYN Ed2.6(r), ERA-Interim, CFSR & Merra Reanalyses. The CERES II Science Team Meeting, May 1-3, 2012 Newport News, VA
- Lee, H.-T., 2011: HIRS OLR Climate Data Record – Production and Future Plans. NASA Sounder Science Team Meeting. Greenbelt, Maryland, Nov 8-10, 2011
- Lee, H.-T., 2011: Sustainability of HIRS OLR Climate Data Record - From Research to Operation. First Conference on Transition of Research to Operations: Successes, Plans and Challenges. 91st AMS Annual Meeting. Seattle, Washington, January 23-27, 2011.
- Lee, H.-T., R. G. Ellingson, and A. Gruber, 2010: Development of IASI outgoing longwave radiation algorithm. *Proceedings of the 2nd IASI International Conference*, Annecy, France, January 25-29, 2010.