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

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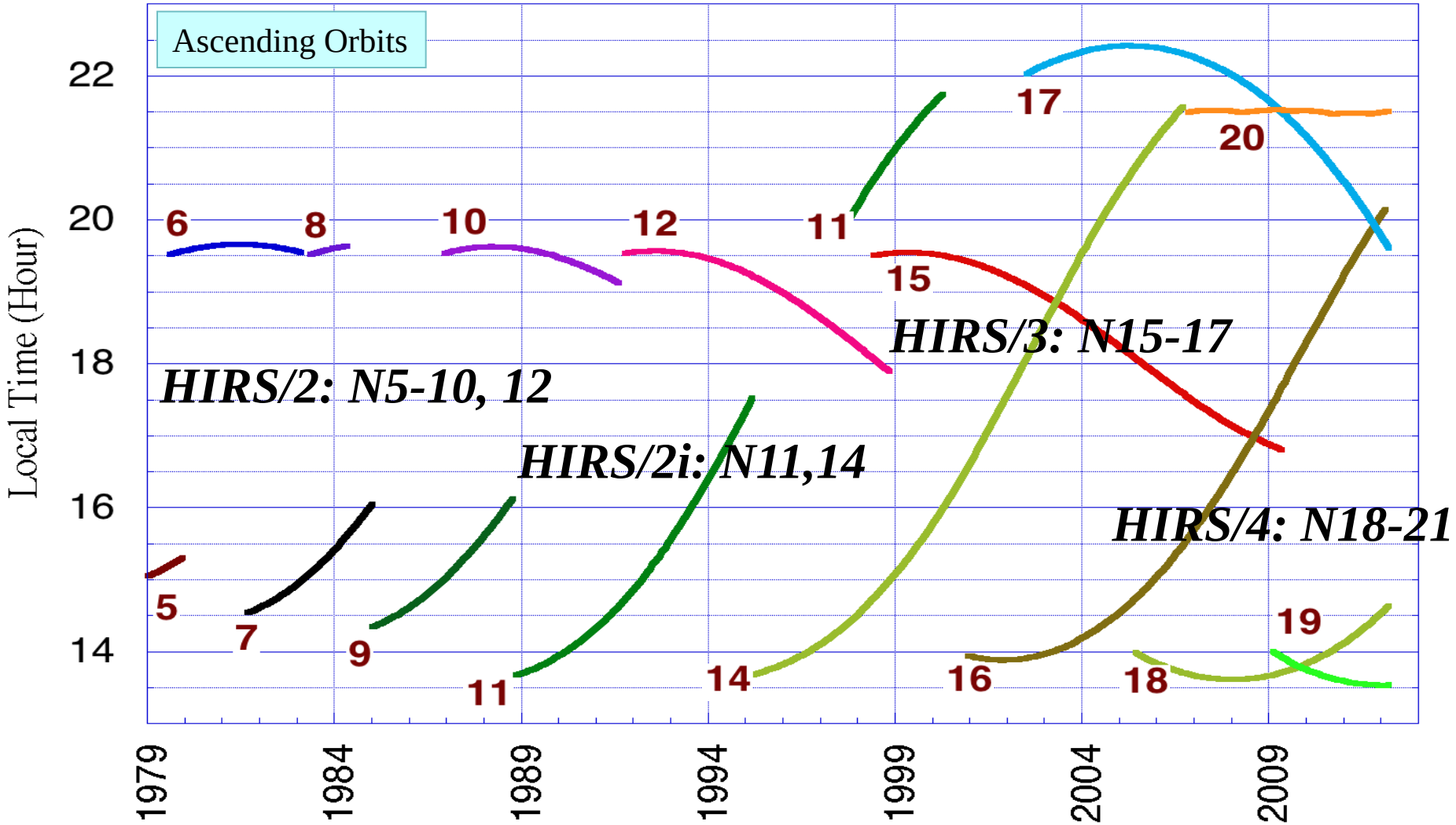
Datasets & Acknowledgments

- **HIRS** OLR Climate Data Record v2.2/v2.3 1979.01-2012.03 (*UMD-CICS/NCDC CDR Program*)
- CERES **EBAF Ed2.6r**, **Terra/Aqua SSF1deg/SYN1deg Ed2.6**. 2000.03-2011.06 (*NASA LaRC ASDC*)
- NCEP Climate Forecast System Reanalysis (**CFSR**) 1979.01-2009.12 (*NCAR CISL Data Research Archive*)
- ECMWF European Reanalysis (**ERA**) Interim 1979.01-2011.12 (*ECMWF*)
- NASA Modern-Era Retrospective Analysis for Research and Applications (**MERRA**) 1979.01-2012.02 (*NASA GES DISC*)

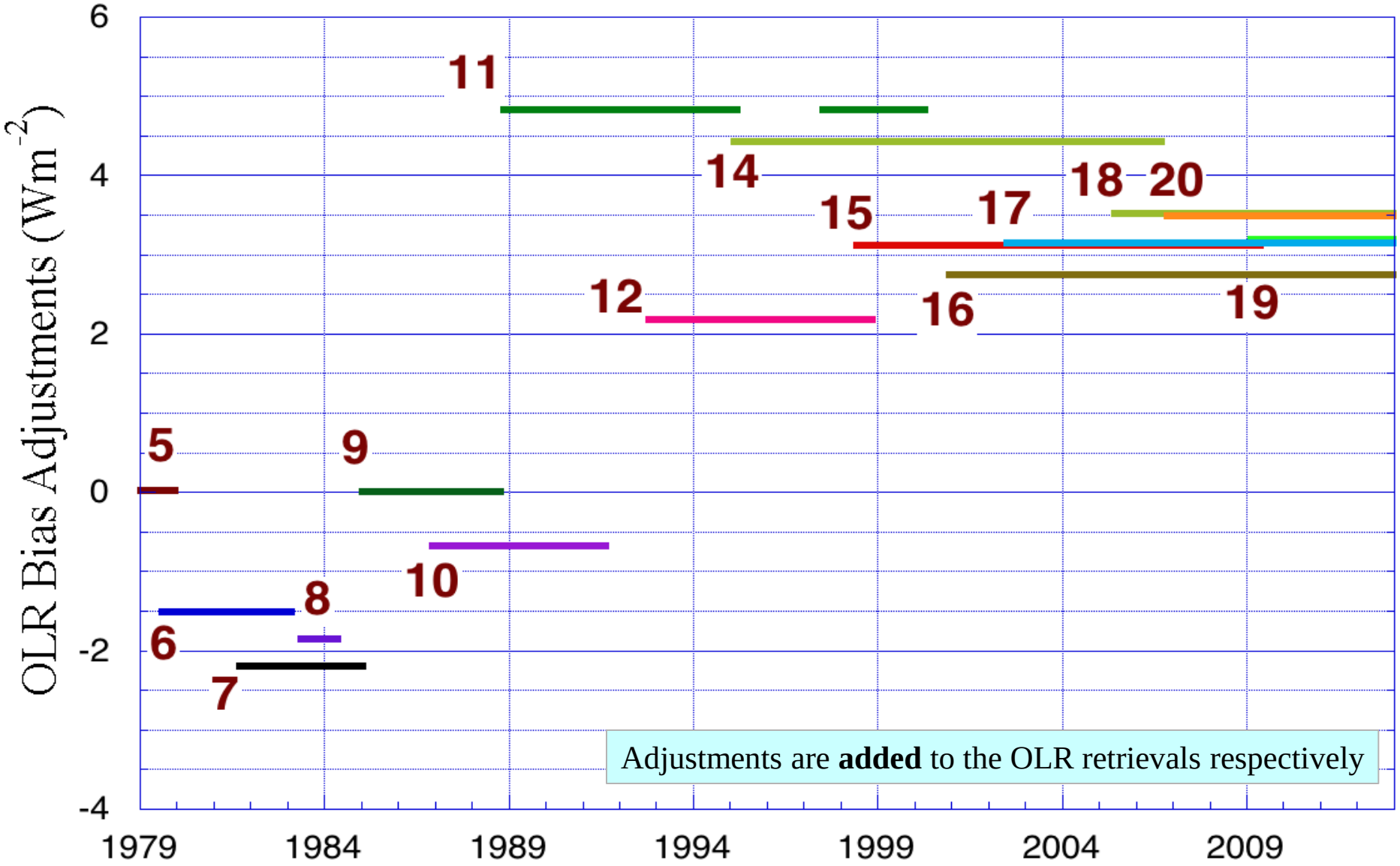
Preface

HIRS Family and Time of Observations

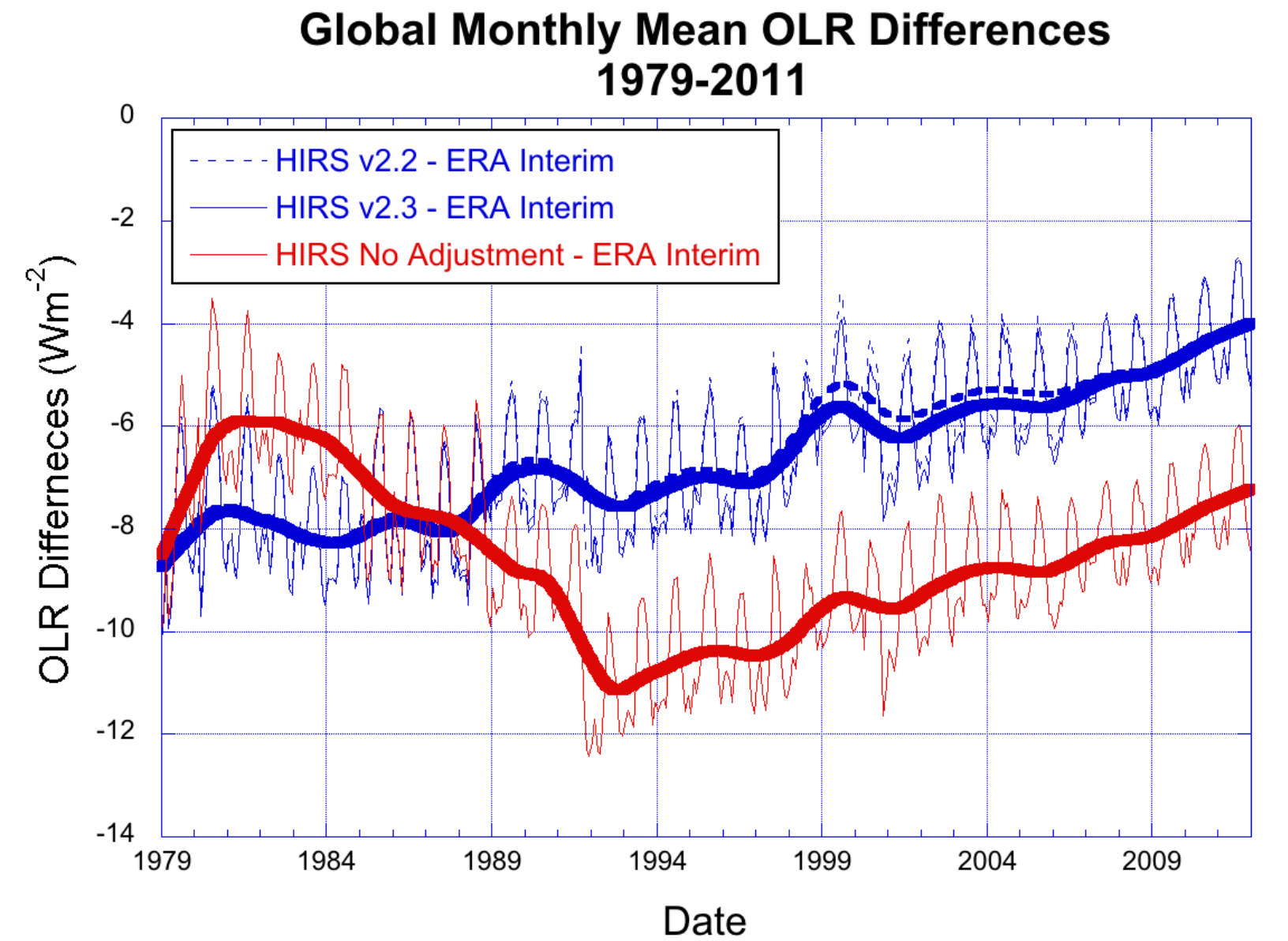


5=TIROS-N; 6-19: NOAA; 20=MetOp-2

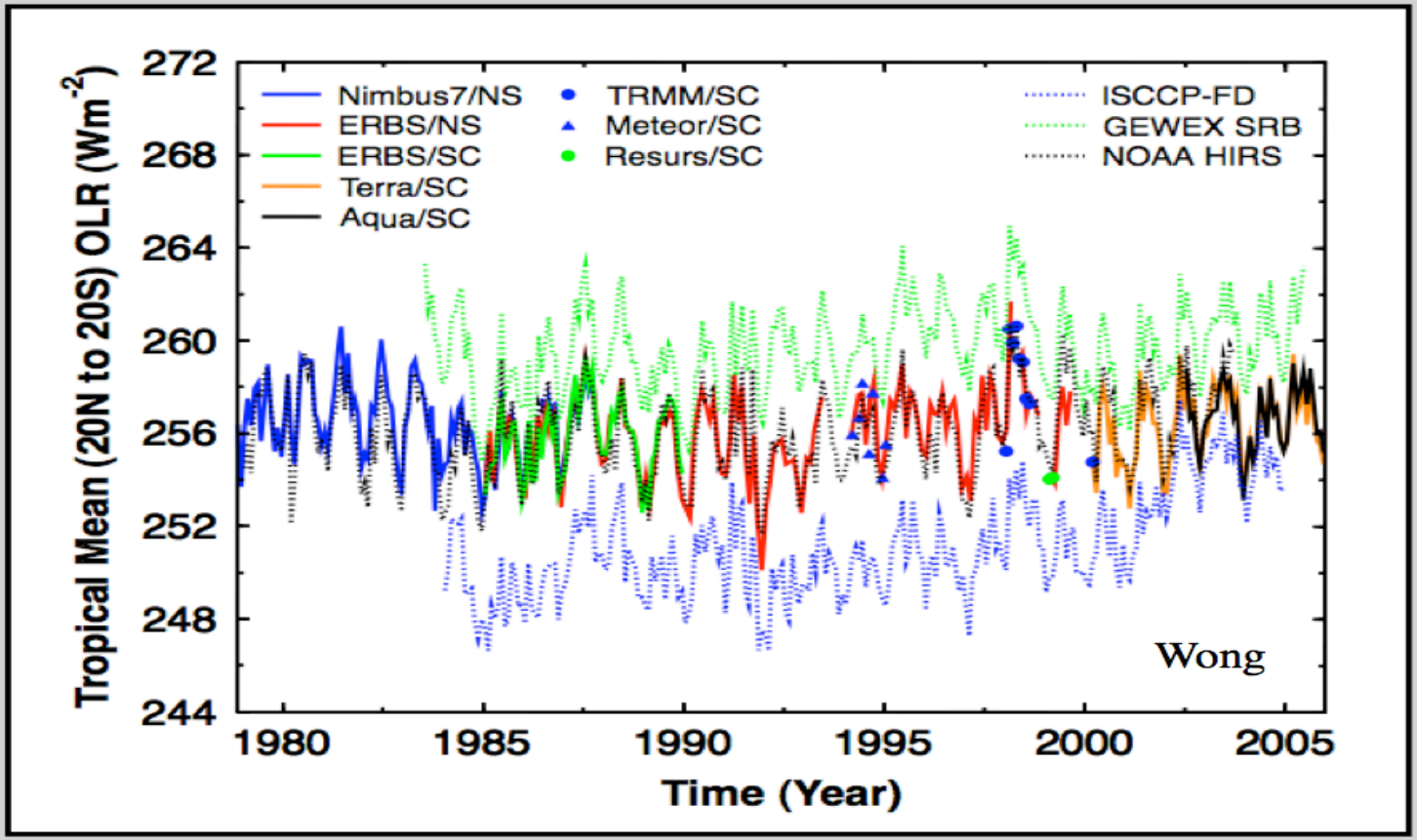
HIRS OLR Bias Adjustments v2.3



Effects of HIRS Intersatellite Calibration



Tropical OLR with Broadband Overlap Adjustment



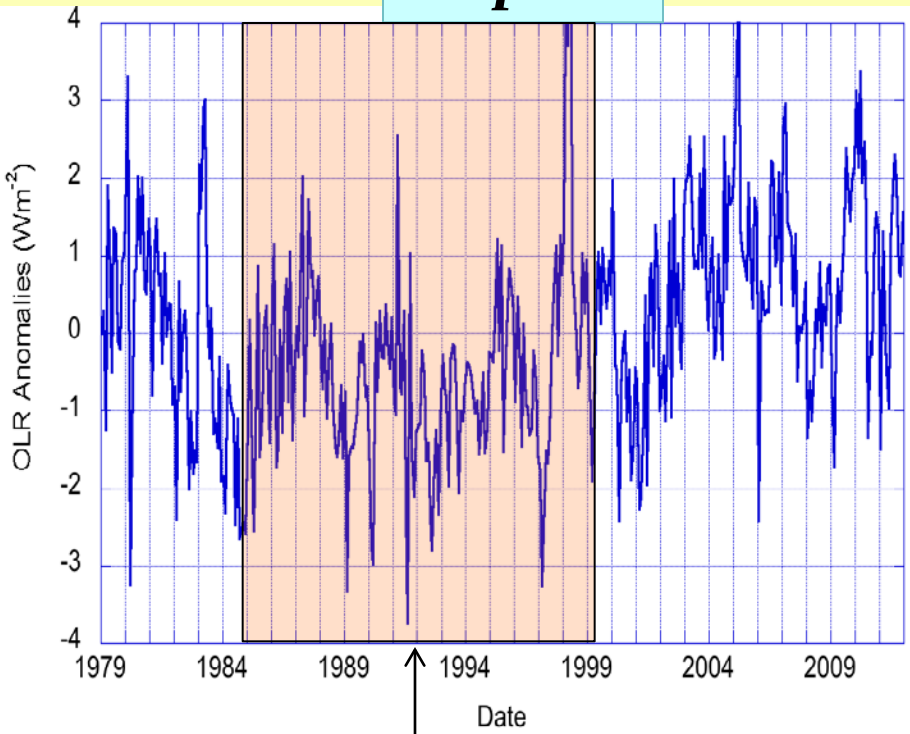
Proposed adjustment uses overlap points from TRMM/Terra/Resurs, TRMM/ERBS-NS, ERBS-NS/SC, and Nimbus7-NS/ERBS

Total change to ERBS/Nimbus nearly 5 W m^{-2}

- The inter-comparisons show that the HIRS OLR agrees very well to the composite broad-band OLR time series in variability and in absolute radiometry in the tropics.
- HIRS OLR is shown to have a stability comparable to the ERBS non-scanner (WFOV) OLR product, within 0.3 Wm^{-2}/decade.

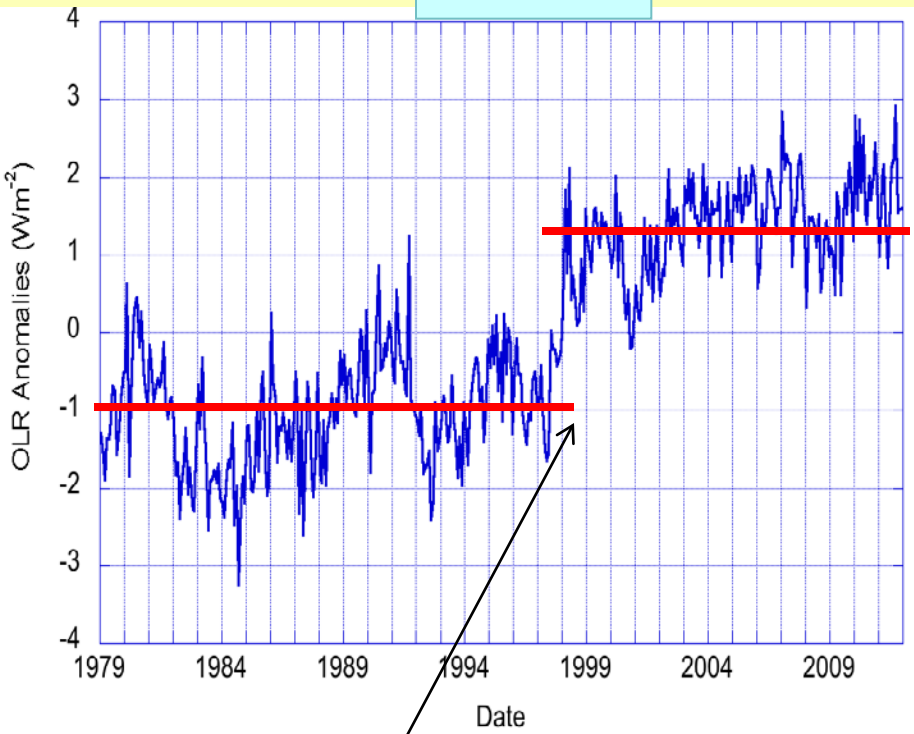
HIRS OLR Anomalies 1979-2011

Tropical



ERBS_NS data period

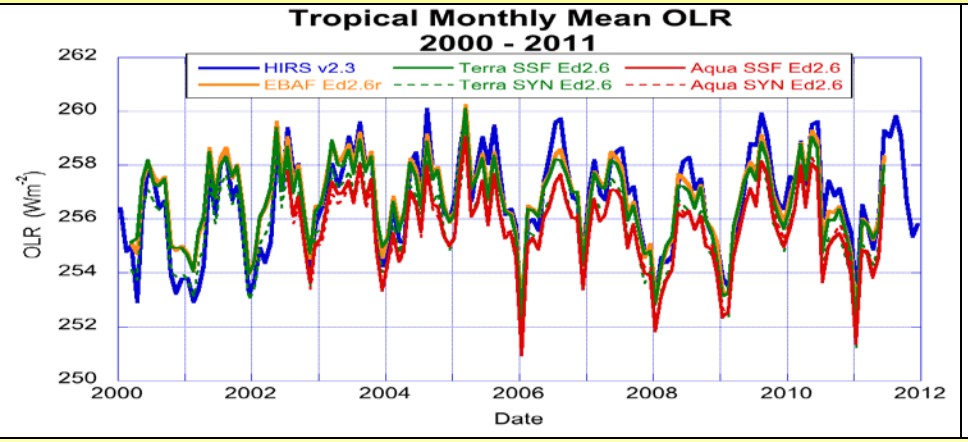
Global

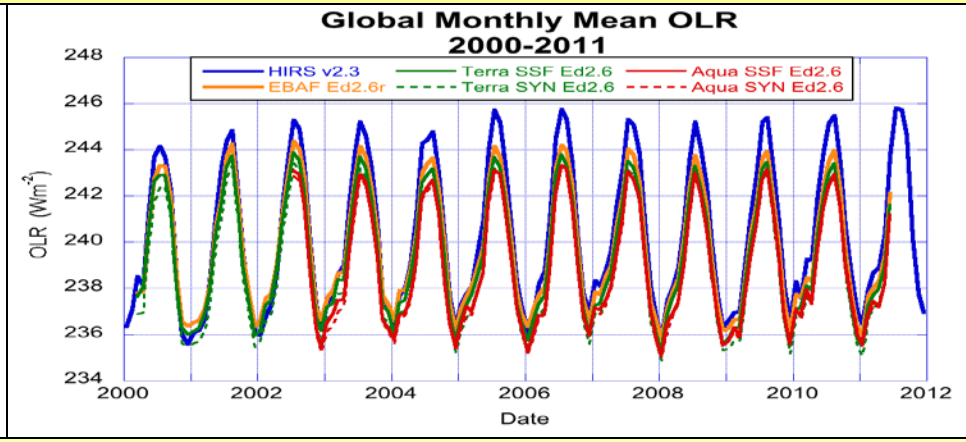


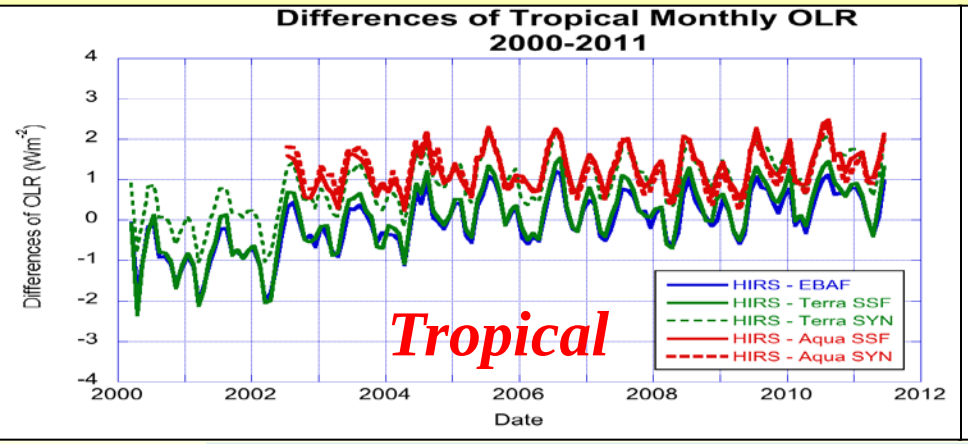
1998: Jump; Largest El Niño; NOAA-KLM starts; TRMM CERES

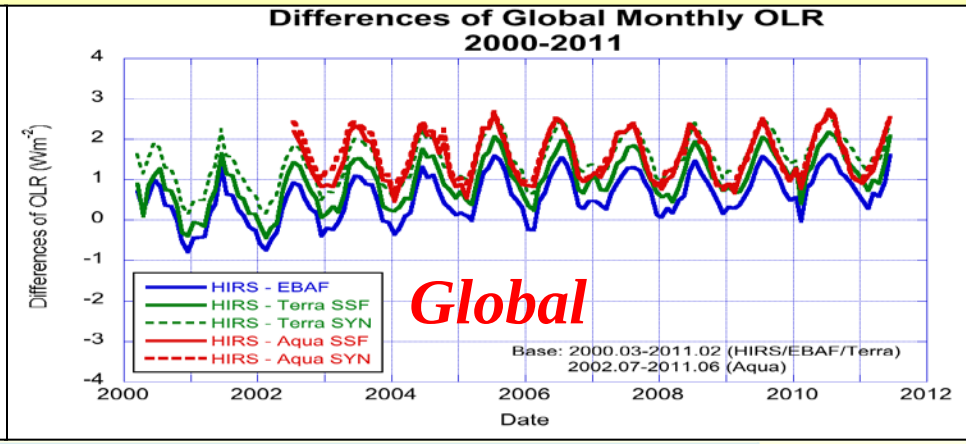
HIRS vs. CERES

2000.03-2011.06



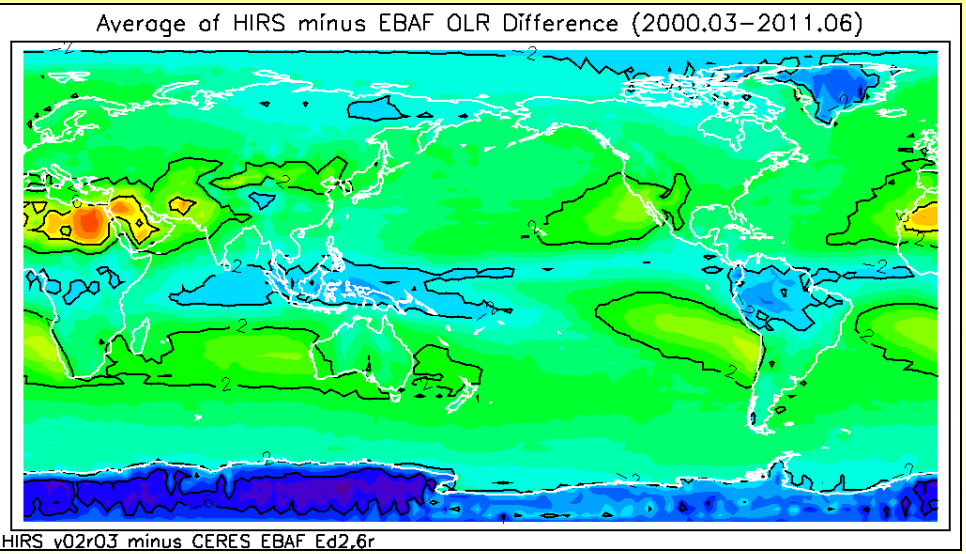


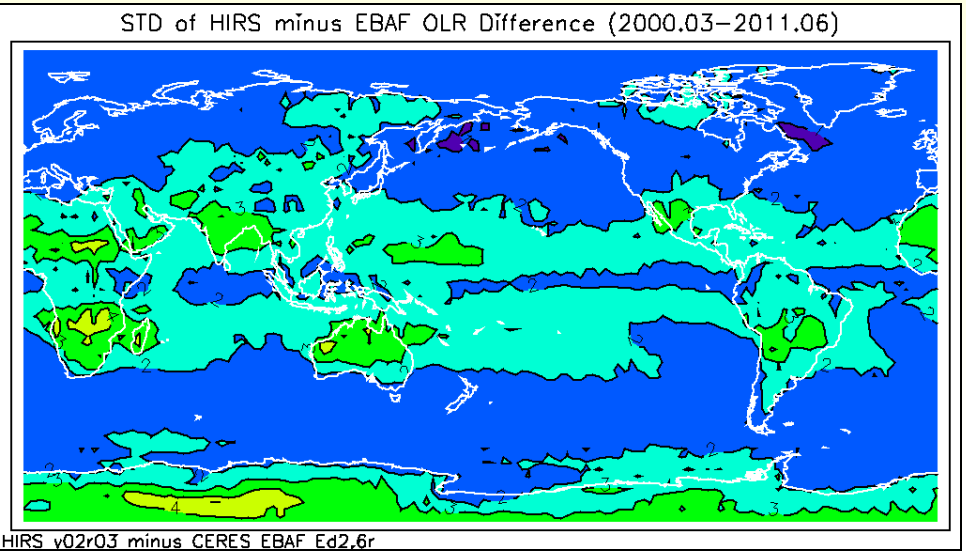


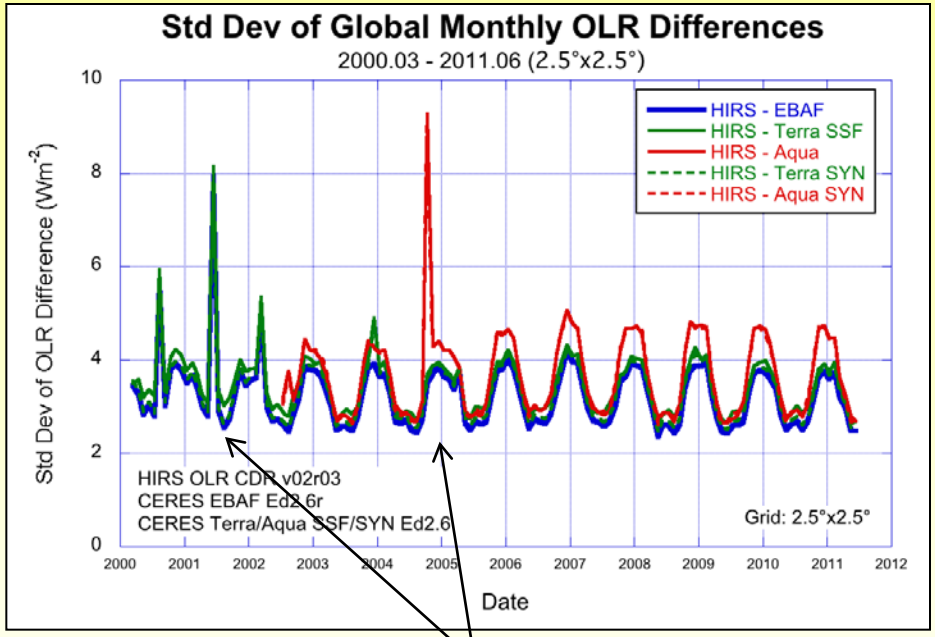


Ave (Std) diff (Wm^{-2})	Tropical	Global
HIRS - EBAF	**-0.1 (0.7)**	**0.6 (0.6)**
HIRS – Terra SSF	0.0 (0.8)	1.0 (0.6)
HIRS – Terra SYN	0.9 (0.7)	1.5 (0.6)
HIRS – Aqua SSF	1.3 (0.5)	1.6 (0.6)
HIRS – Aqua SYN	1.2 (0.5)	1.6 (0.6)
Terra - Aqua	**(0.3)**	

Spatial & Temporal Distribution
HIRS – EBAF OLR Differences

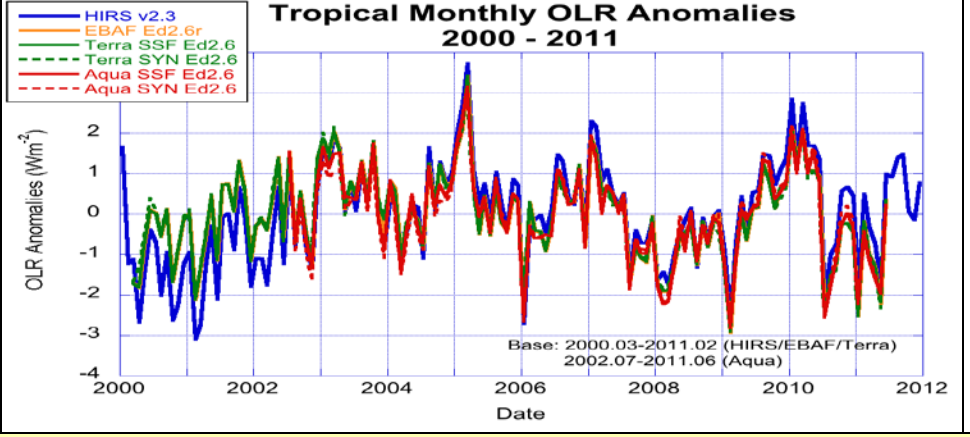


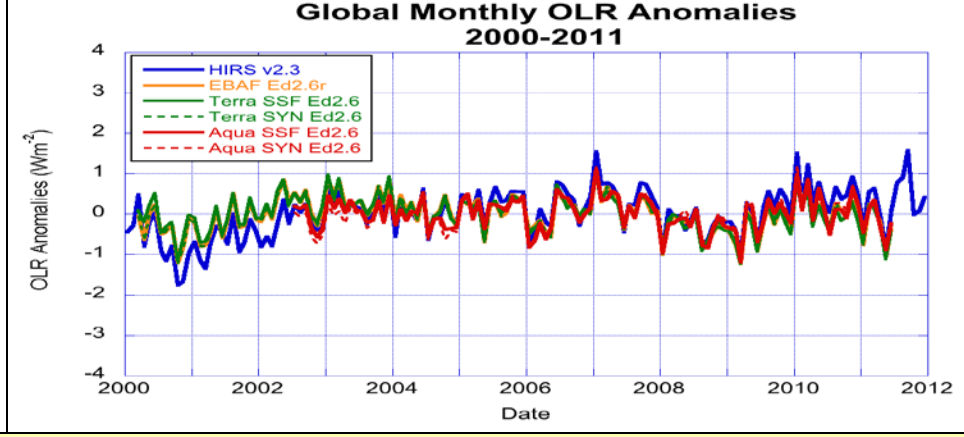


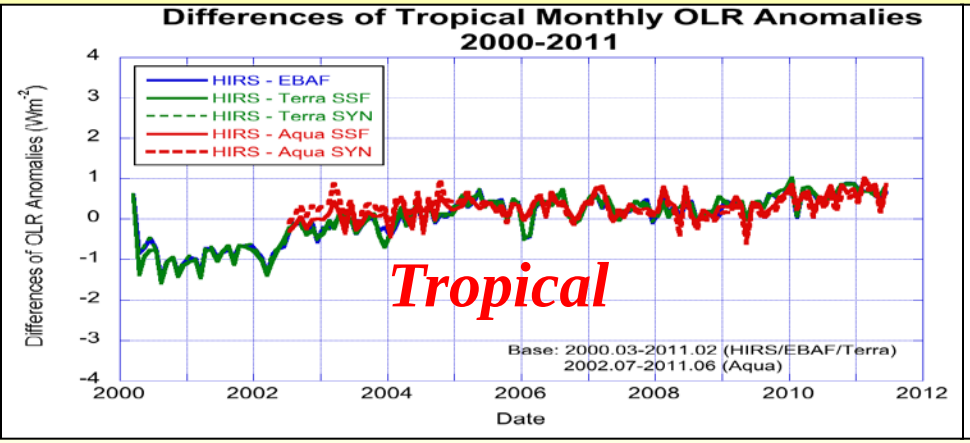


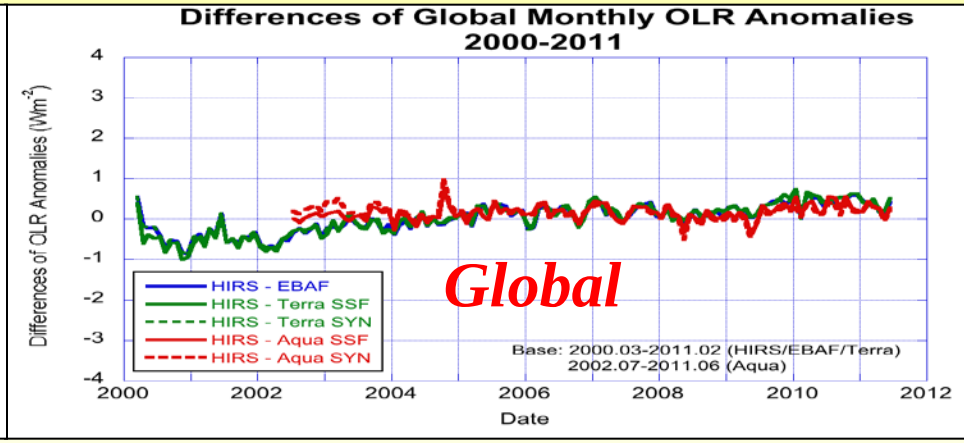
Spurious large OLR differences found in some months relative to:
EBAF/Terra: 2000.08, 2001.06*, 2002.03
Terra: 2003.12
Aqua: 2004.10*.
* CERES data gaps noted in DQS

Average Std HIRS-EBAF Diff = 3.2 Wm^{-2}





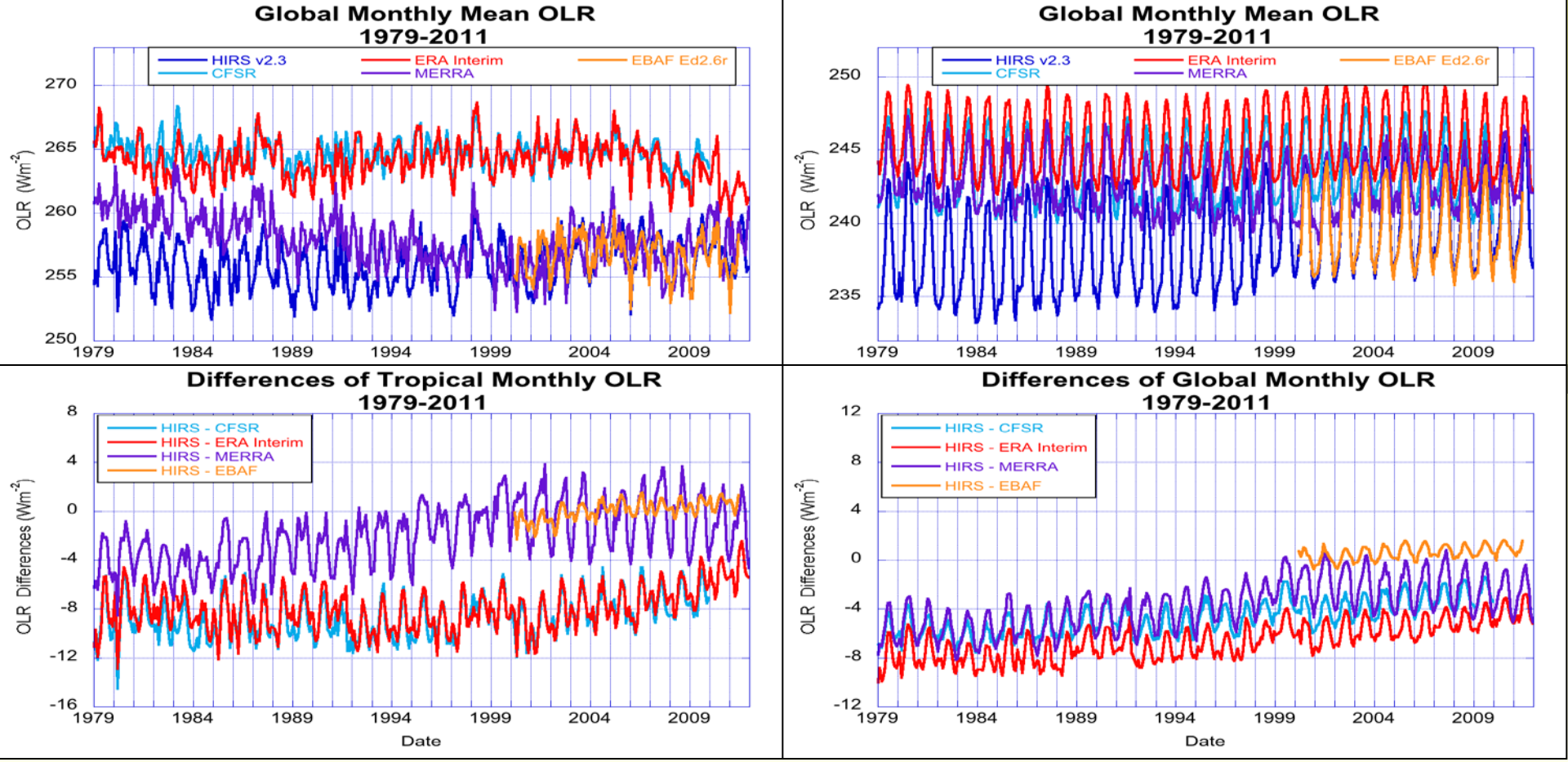




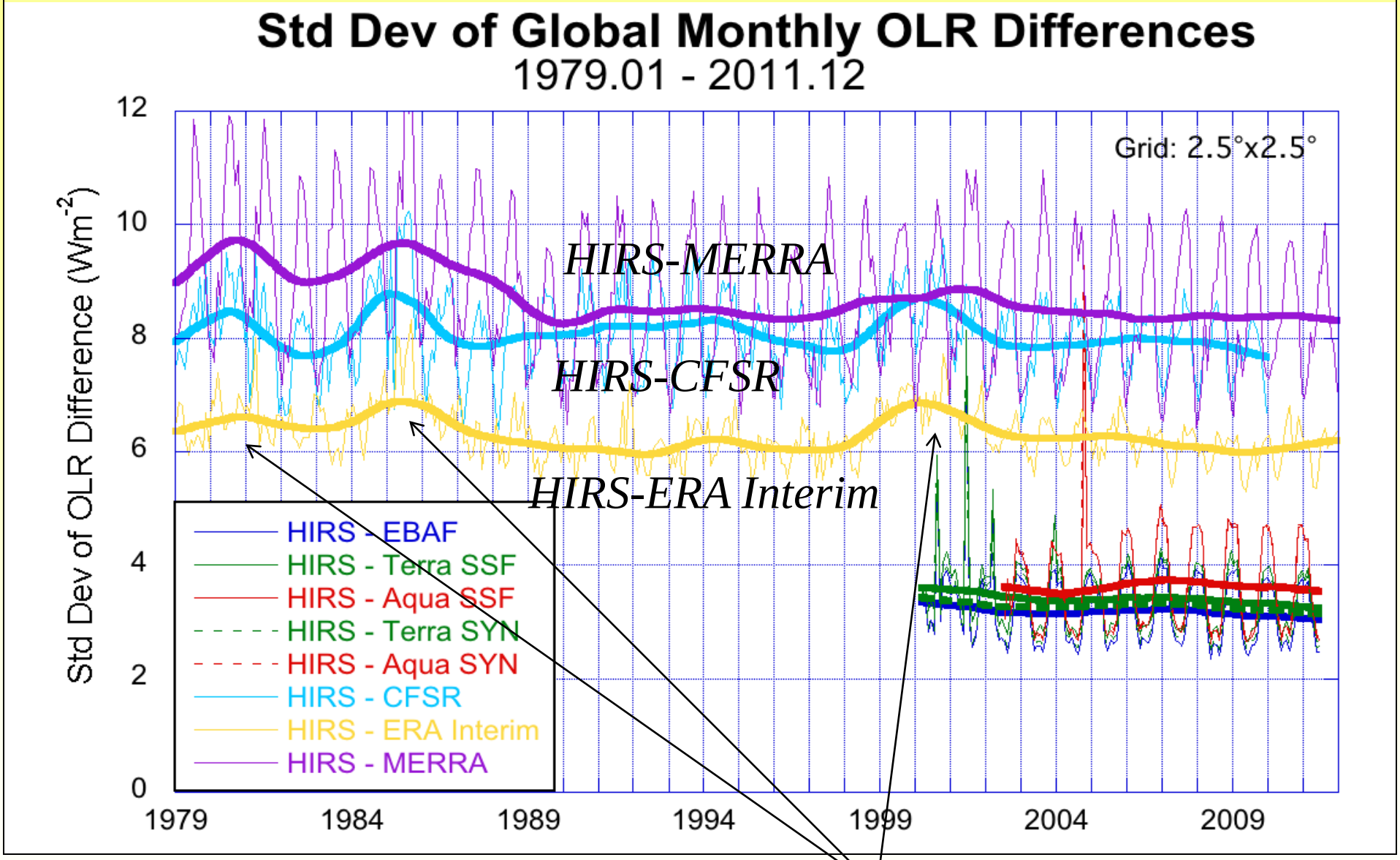
Slope of Diff ± 1-σ: Wm^{-2}/decade	**Tropical**	**Global**
HIRS - EBAF	**1.36 ± 0.09**	**0.84 ± 0.06**
HIRS – Terra SSF	1.50 ± 0.09	0.97 ± 0.06
HIRS – Terra SYN	1.36 ± 0.09	0.84 ± 0.06
HIRS – Aqua SSF	0.64 ± 0.10	0.20 ± 0.07
HIRS – Aqua SYN	**0.12** ± 0.10	**-0.11** ± 0.07
Terra SYN - Aqua SYN	**-0.76** ± 0.10	**-0.83** ± 0.07

HIRS vs. Reanalyses

1979 – 2011



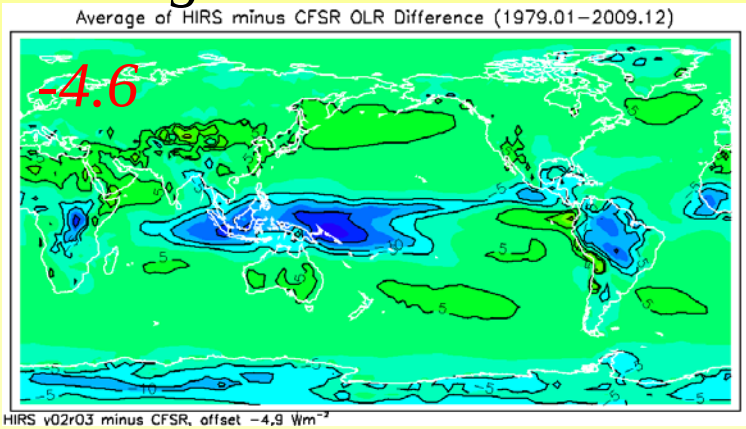
Ave (Std) diff (Wm^{-2})	Tropical	Global
HIRS - CFSR	-8.7 (1.7)	-4.7 (1.4)
HIRS – ERA Interim	-8.1 (1.8)	-6.6 (1.5)
HIRS – MERRA	-2.0 (2.5)	-3.7 (2.0)
HIRS – EBAF	*-0.1 (0.7)*	*0.6 (0.6)*

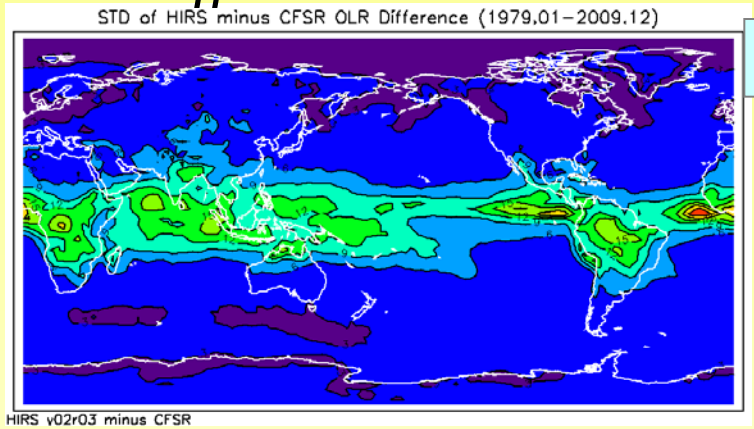


"Bumps" are indicative of problems –
Is it HIRS?

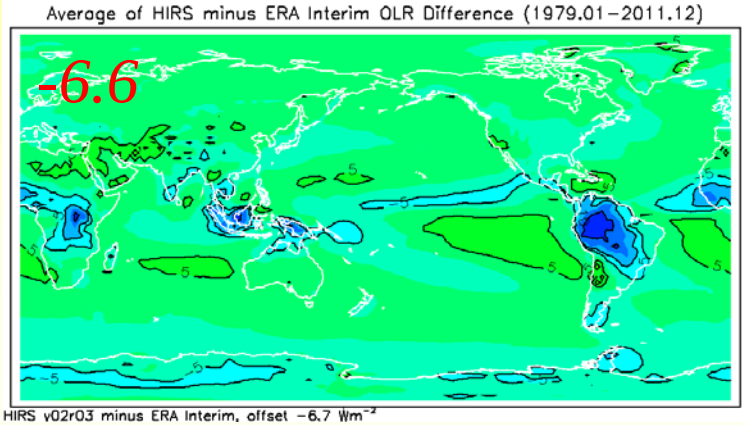
Global Monthly OLR Differences 1979-2011

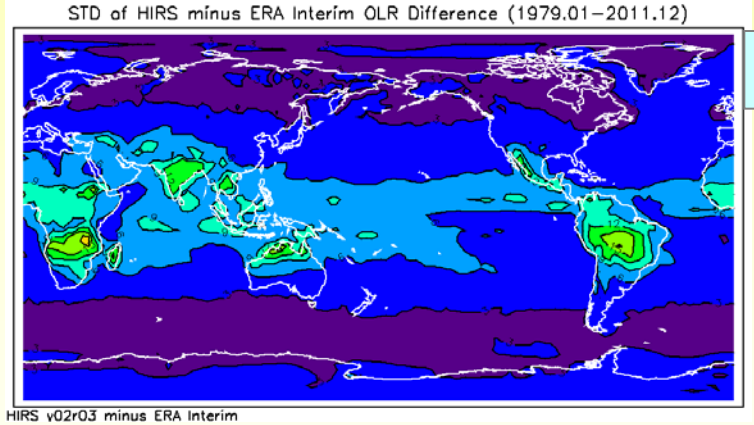
Average Mean differences removed *Std Diff*



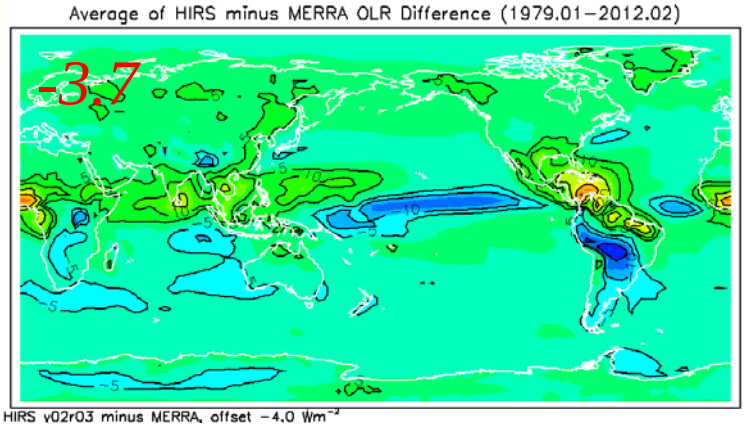


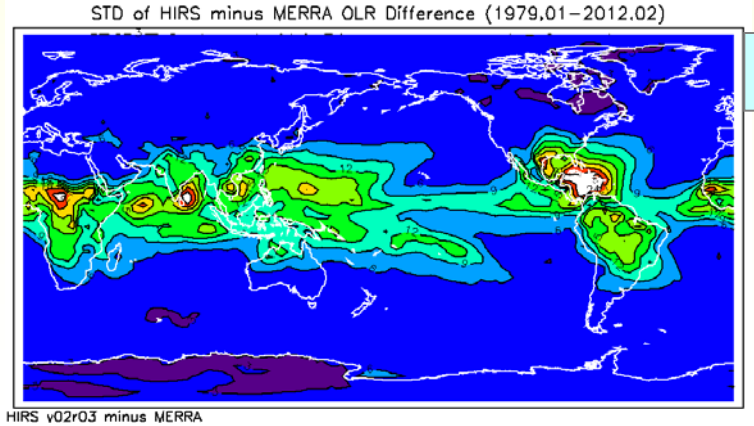
HIRS-CFSR



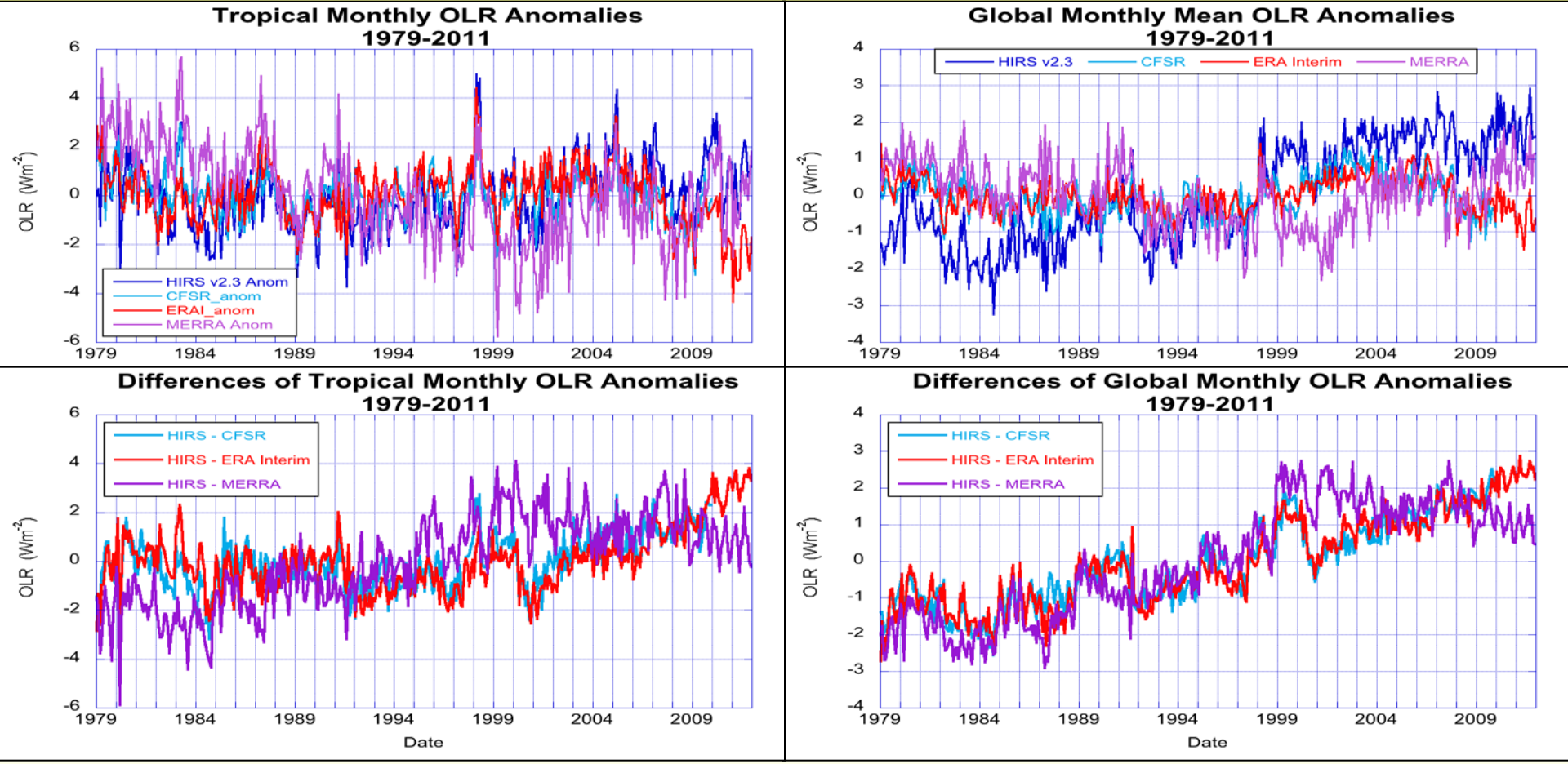


HIRS-ERAI



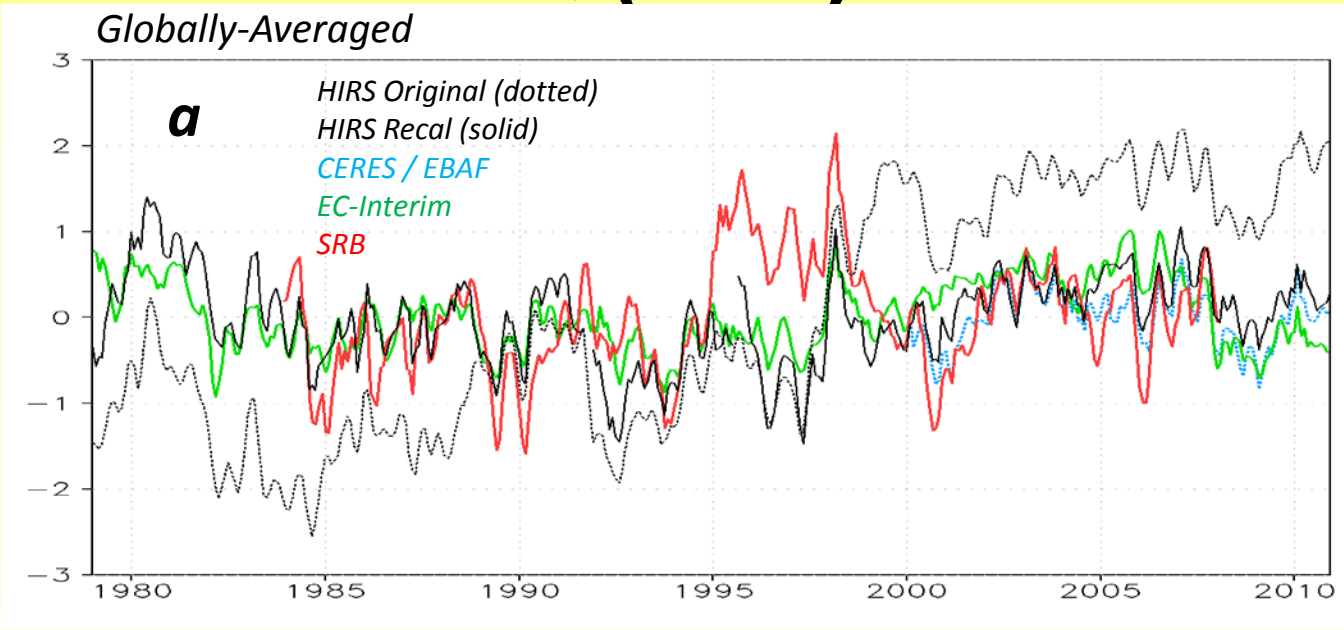


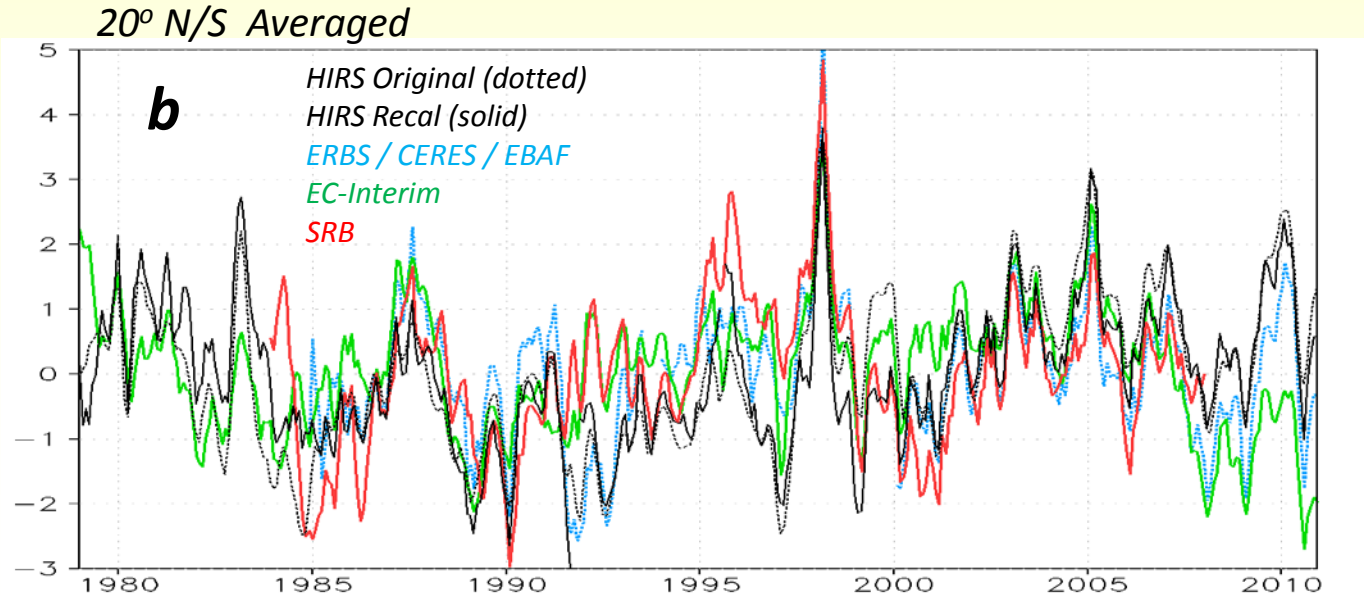
HIRS-MERRA



Slope of Diff ± 1-σ: Wm^{-2}/decade	**Tropical**	**Global**
HIRS - CFSR	0.57 ± 0.06	1.09 ± 0.03
HIRS – ERA Interim	0.61 ± 0.06	1.17 ± 0.03
HIRS – MERRA	1.47 ± 0.06	1.38 ± 0.04
HIRS – ERBS_NS 1984.11-1999.09	***-0.21 ± 0.15***	

Alternative Intersatellite Calibration
Franklin R. (Pete) Robertson



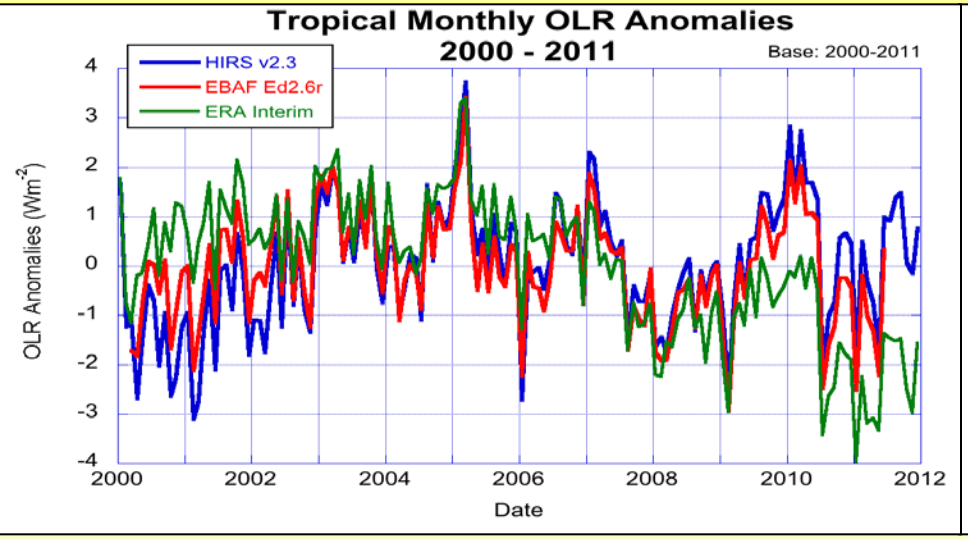


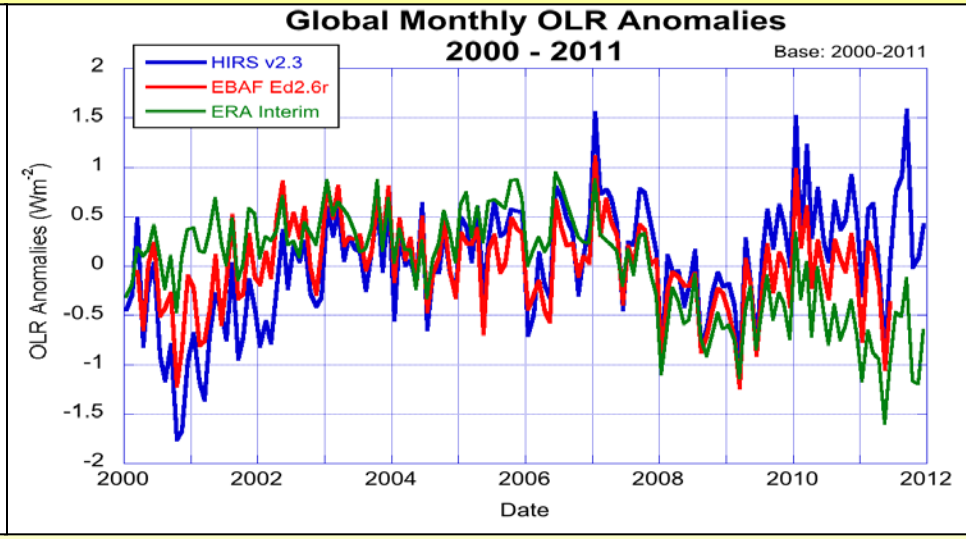
Future Works

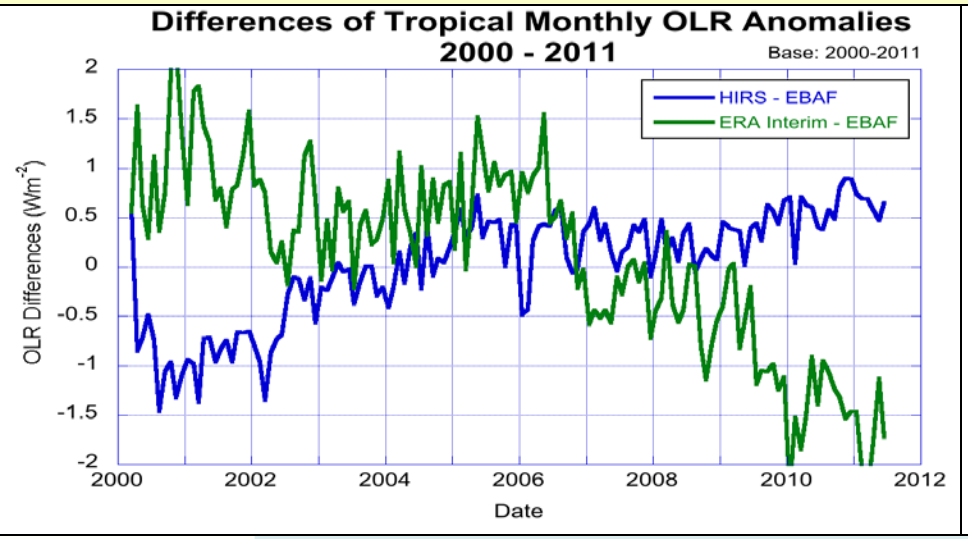
- Revise OLR regression models:
  - Improve consistencies in sensitivities and error characteristics
  - Reduce regional/scene-dependent biases through Gaussian mixture modeling
- Detailed check of HIRS radiance data from NOAA-15, 16 and 18:
  - Require ad-hoc QC procedures to ensure quality radiance input.
- Scene and Time-dependent inter-satellite bias adjustments

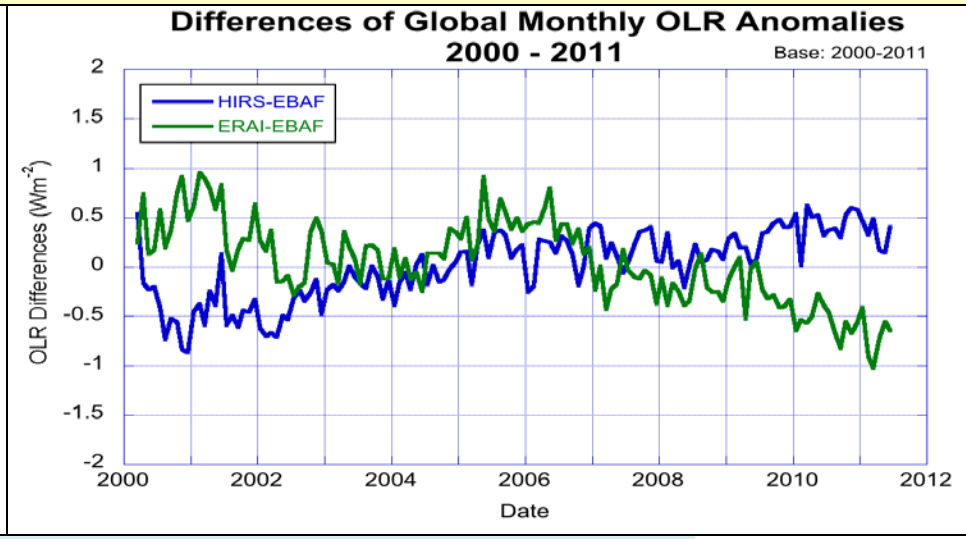
BACKUP SLIDES

HIRS / ERA Interim vs EBAF (2000-2011)



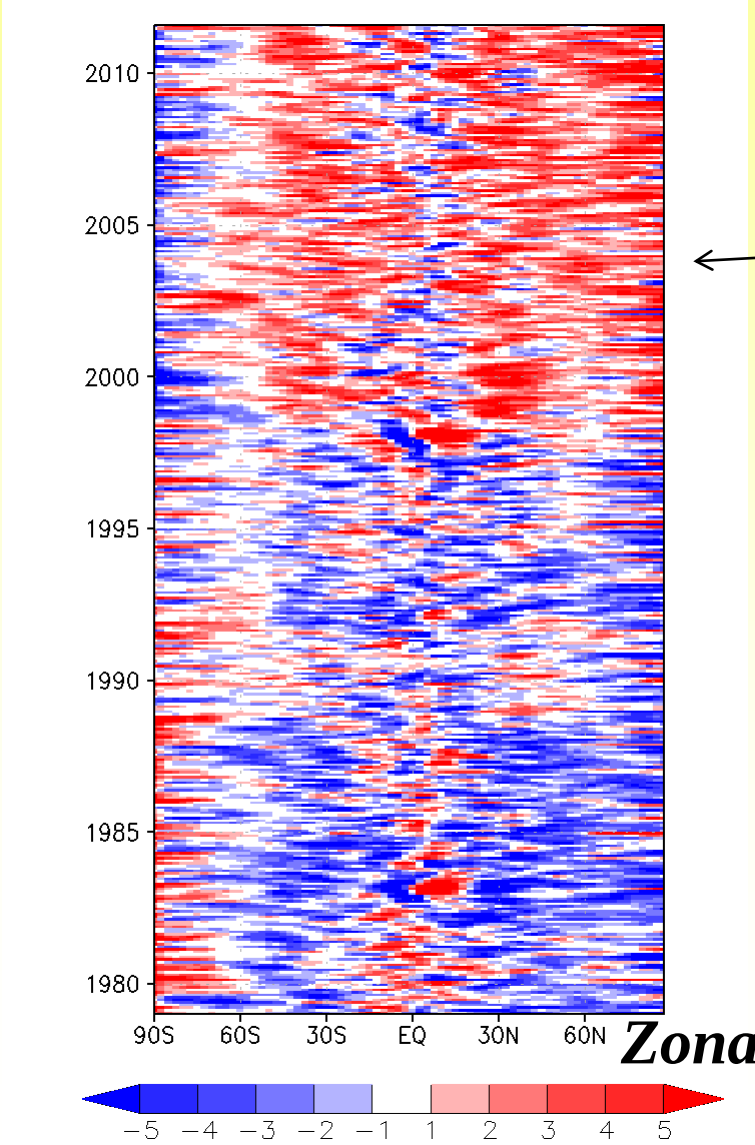






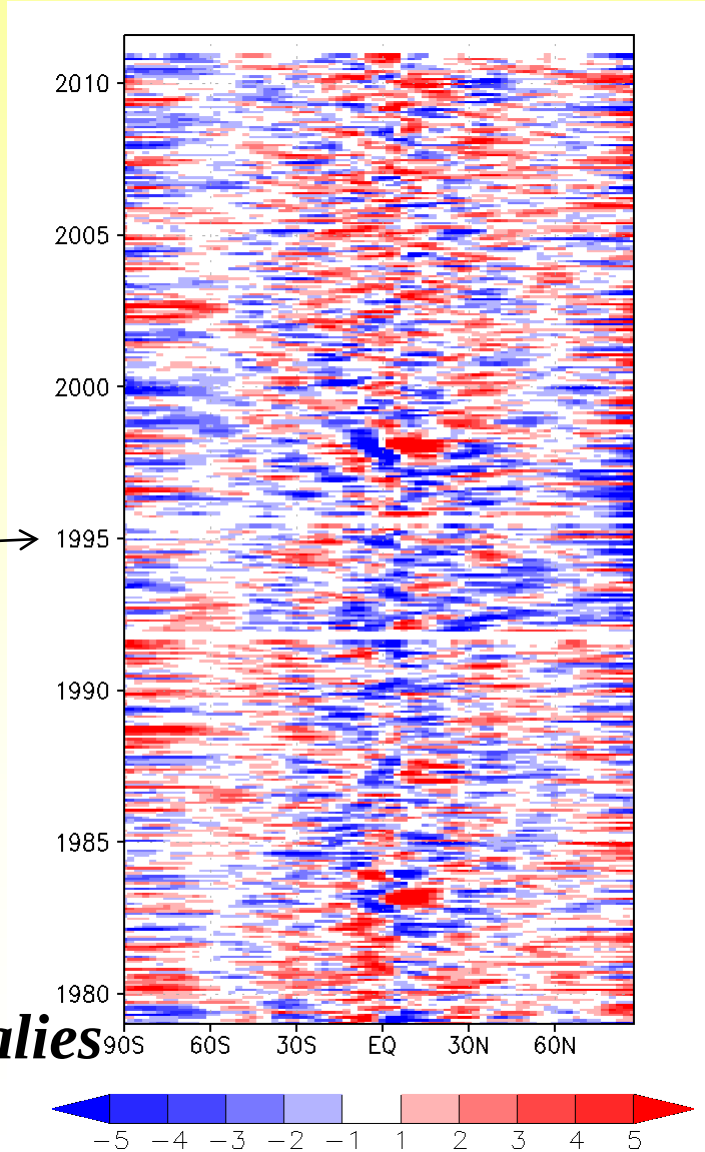
Wm^{-2}/decade	Tropical	Global
HIRS - EBAF	1.36 ± 0.09	0.84 ± 0.06
ERA Interim - EBAF	-2.34 ± 0.15	-0.89 ± 0.08

Alternative Intersatellite Calibration
Franklin R. (Pete) Robertson



Before

After

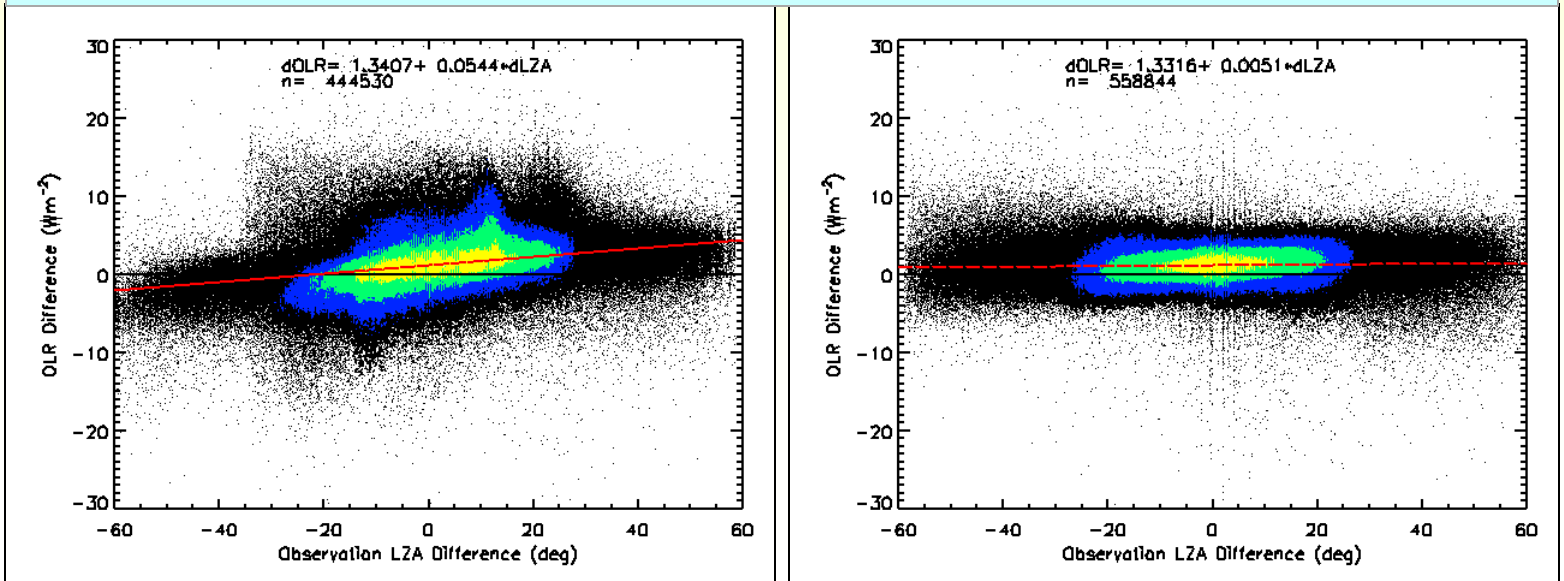


Zonal OLR Anomalies

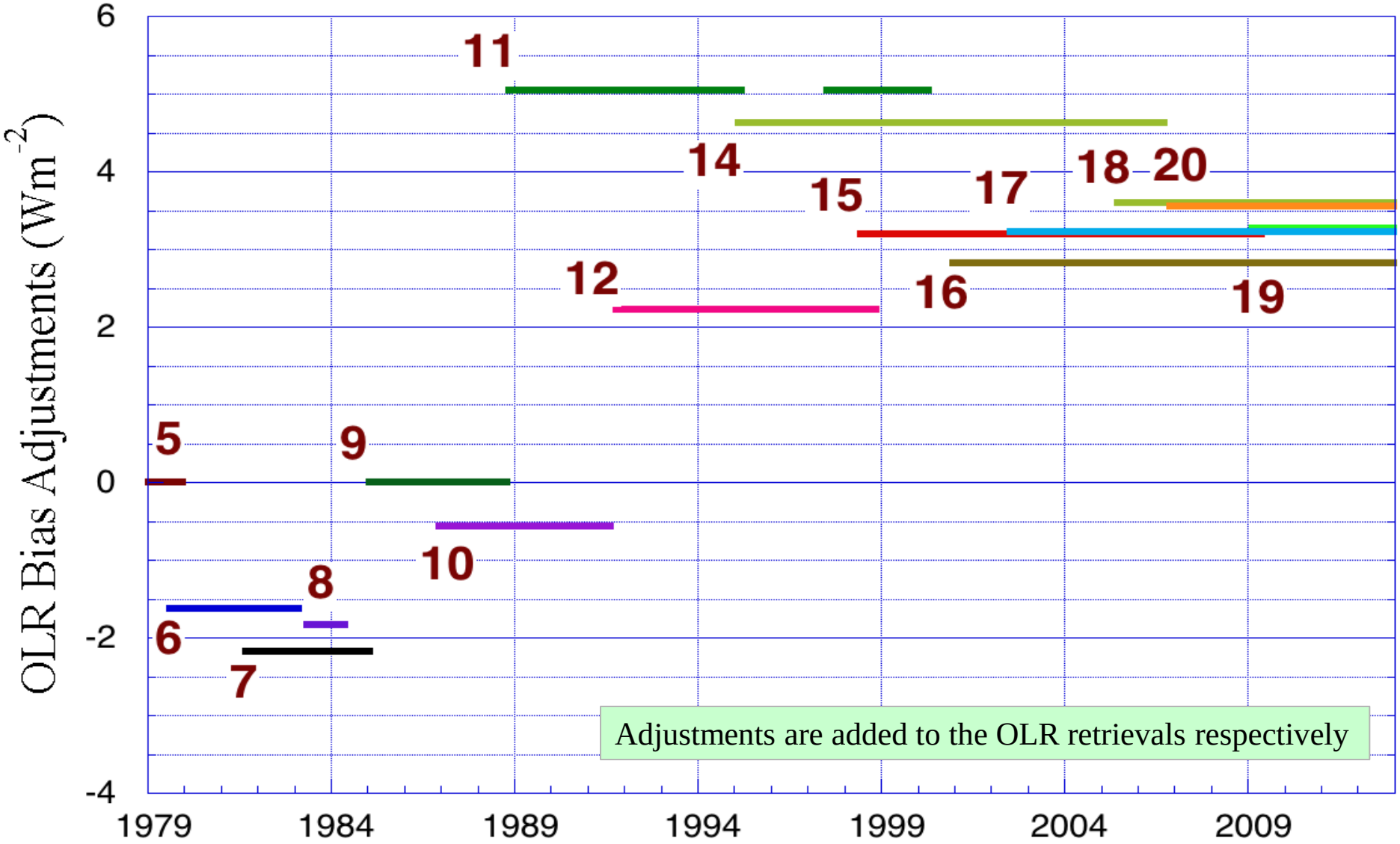
HIRS OLR v2.3 Changes

- Corrected NOAA-14 LZA errors – LZA given by HIRS level-1b data was shifted by about 20° since March 17, 1999.
- Updated inter-satellite bias adjustments.

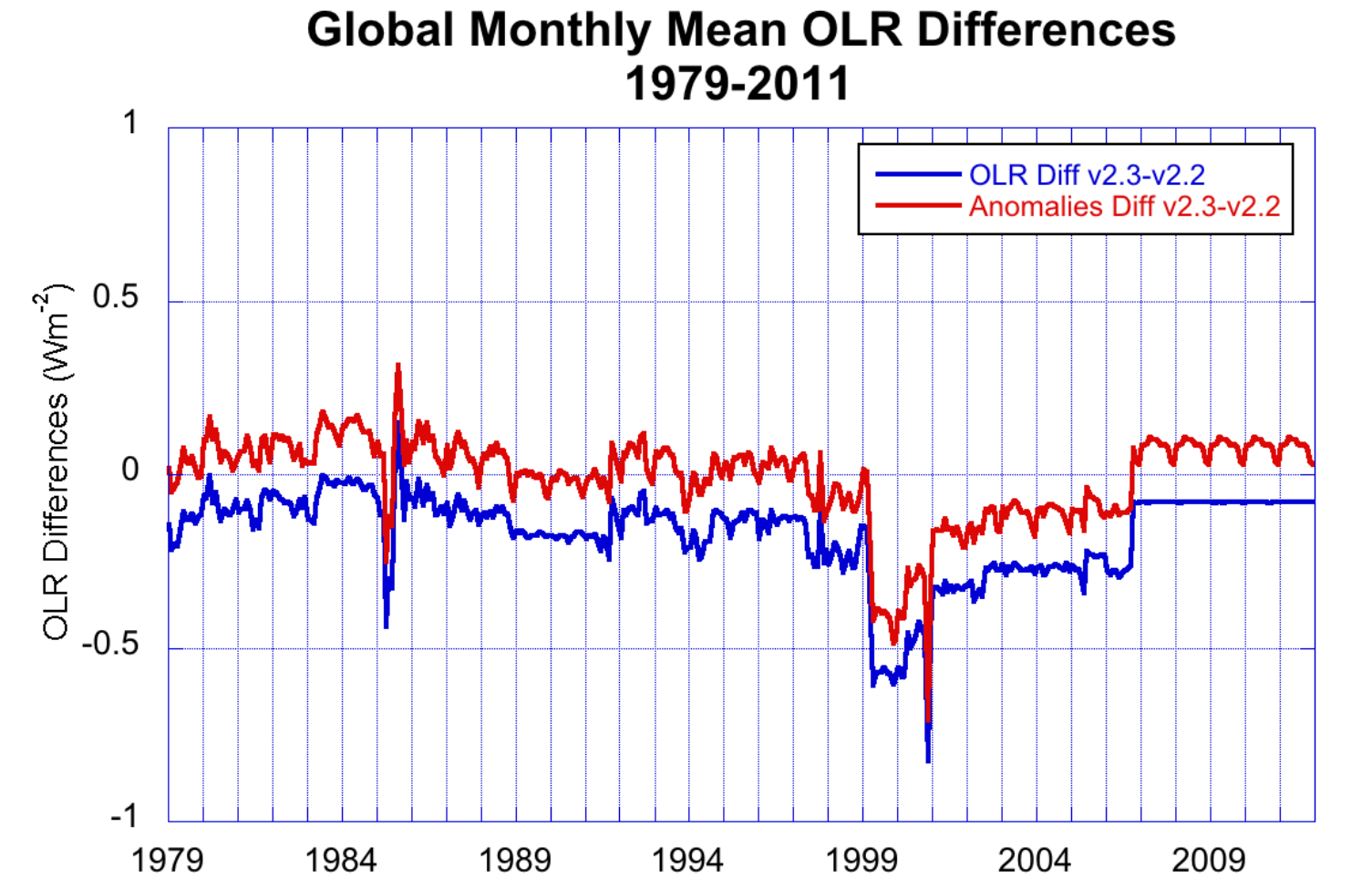
N15-N14 OLR Differences v2.2 (left) vs v2.3 (right)



HIRS OLR Bias Adjustments v2.2



Changes in HIRS v2.3 Update



Intersat Calibration Ed2.2 vs Ed2.3

Satellite	Ed2.2 (Wm^{-2-})	Ed2.3c (Wm^{-2-})
N05	0.00	0.02
N06	-1.62	-1.51
N07	-2.18	-2.20
N08	-1.84	-1.86
N09	0.00	0.00
N10	-0.57	-0.68
N11	5.04	4.83
N12	2.22	2.18
N14	4.63	4.42
N15	3.19	3.11
N16	2.82	2.74
N17	3.22	3.14
N18	3.60	3.52
N19	3.27	3.19
N20	3.56	3.48

Note: The biases are to be ADDED to the OLR retrievals respectively.