

CERES/EOS/NPOESS/NPP Status

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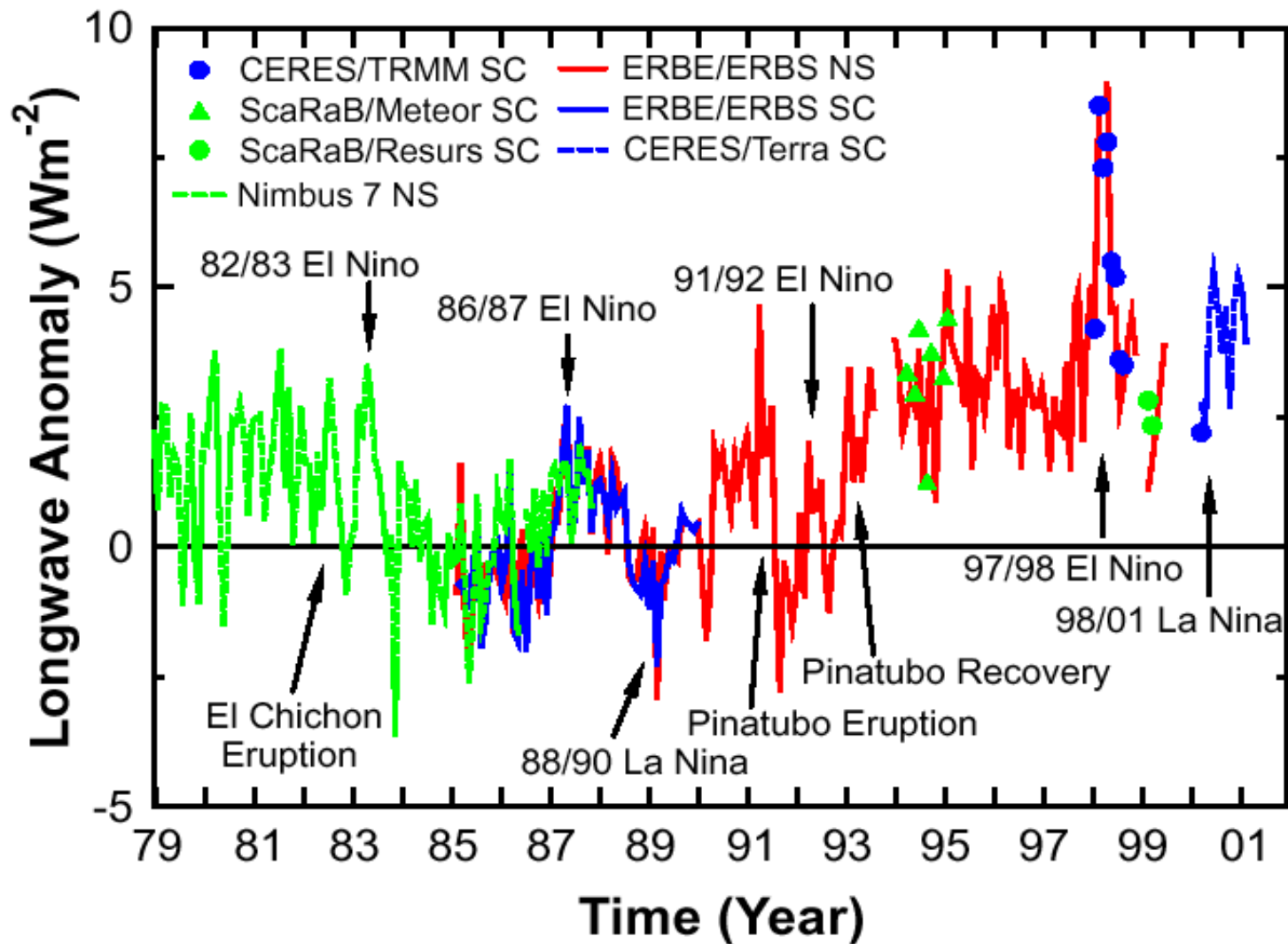
EOS Recompete Status

- **Latest word:**
 - NRA release late September (end of this week/or next)
 - Proposals due mid-January
 - Current funding levels through May 2003
 - Expect successful new funding to start June 1, 2003
- **Two types of proposals:**
 - Algorithm/Validation/Data Product Instrument team proposals
 - Science/Data Analysis proposals (including interdisciplinary studies)
- **If schedule slips, will continue current funding beyond May to avoid a gap**
- **We will keep you informed by email of any news.**

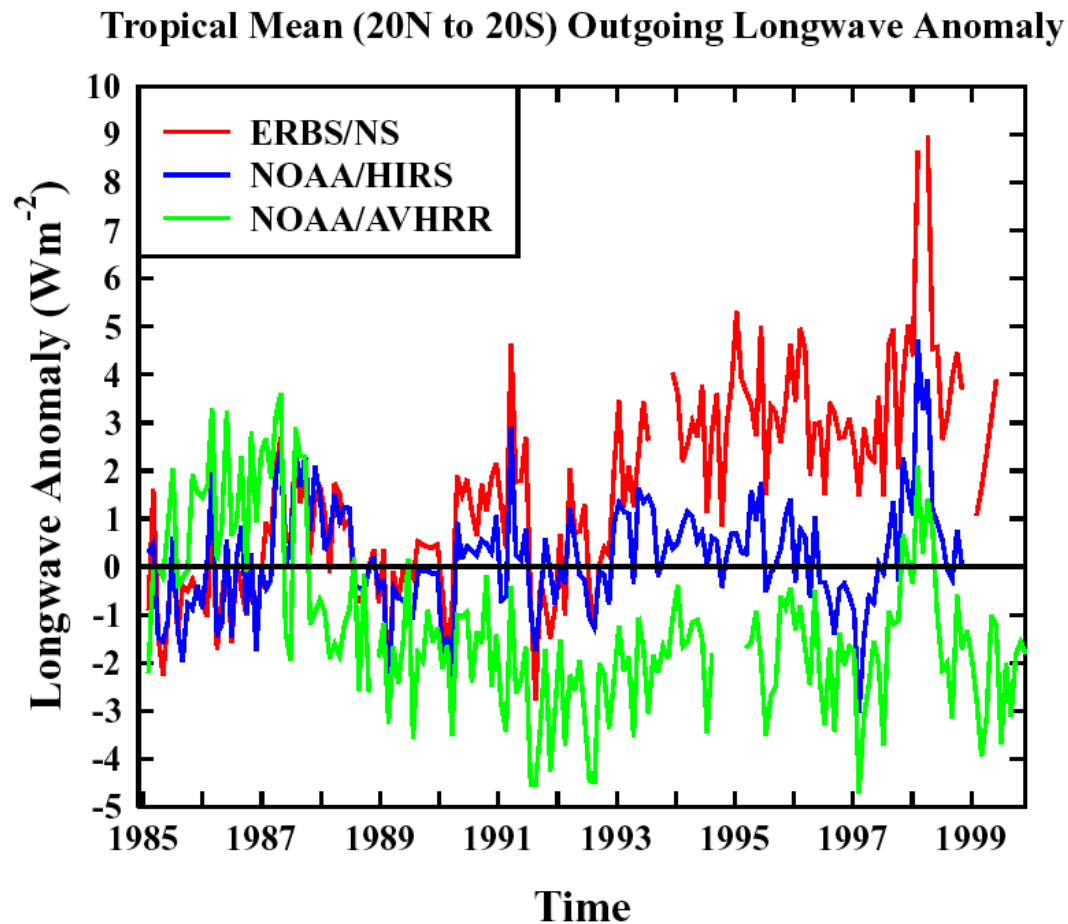
NPOESS

- **NPOESS prime contractor selected in August: TRW won the competition with Lockheed.**
- **CERES follow-on copies were included in the TRW proposal and included tight stability threshold/goals.**
- **Uncertain how much interaction with TRW: waiting for contact**
- **LaRC is likely to be a subcontractor to TRW in consulting on instrument build/calibration and for data product algorithms/code/possible processing.**
- **But TRW left this TBD, and funding is tight. Should know more in the next few months.**

An overlapping Earth radiation climate record: 22 years from Nimbus 7 to Terra.



What about the latest HIRS/AVHRR Pathfinder OLR Records? *Differences are as large as the signal*



HIRS and AVHRR include estimated corrections for calibration changes between instruments as well as NOAA orbit diurnal drifts.

AVHRR data set from Jacobowitz

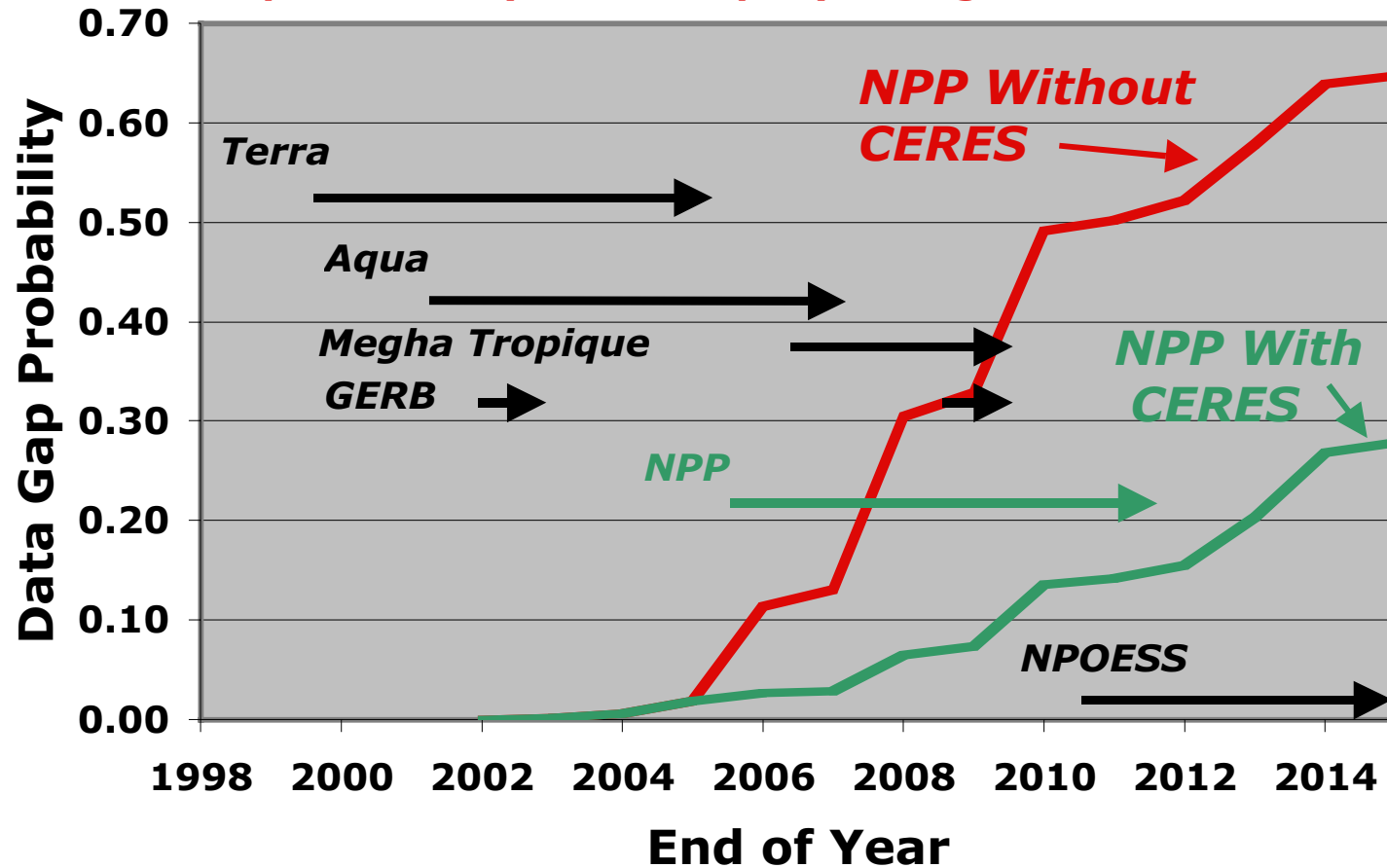
HIRS data set from Susskind with Robertson calibration/diurnal corrections.

Figure from Wielicki et al., Science Feb 02, 2002

Radiation Budget Data Gap Probability

(*Terra and Aqua satellites de-orbit at end of mission*)

Gap Probability Grows Rapidly if Single Point Failure

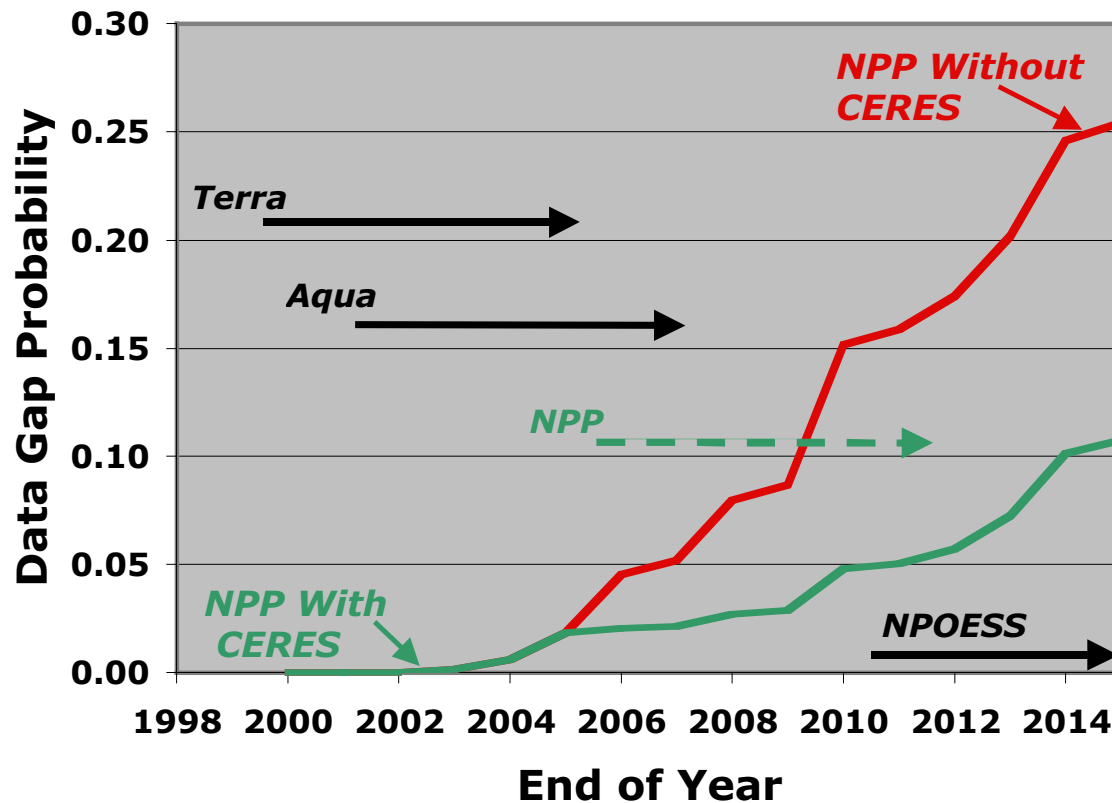


Analysis uses engineering models of spacecraft and instrument lifetimes to determine probability of failure with time from launch. Arrow lengths are design mission lifetimes.

Radiation Budget Data Gap Probability

(satellites only de-orbit after use of all available orbit control fuel)

Analysis includes GERB (2002, 2009), Megha-Tropique (2007)



Is 25% a reasonable risk to the climate record? 10%?

Gap likelihood decreases dramatically if add CERES last instrument (FM-5) to NPP gap filling mission. Also decreases if avoid de-orbit of Terra and Aqua missions until all fuel reserve is used.

Why care about a data gap?

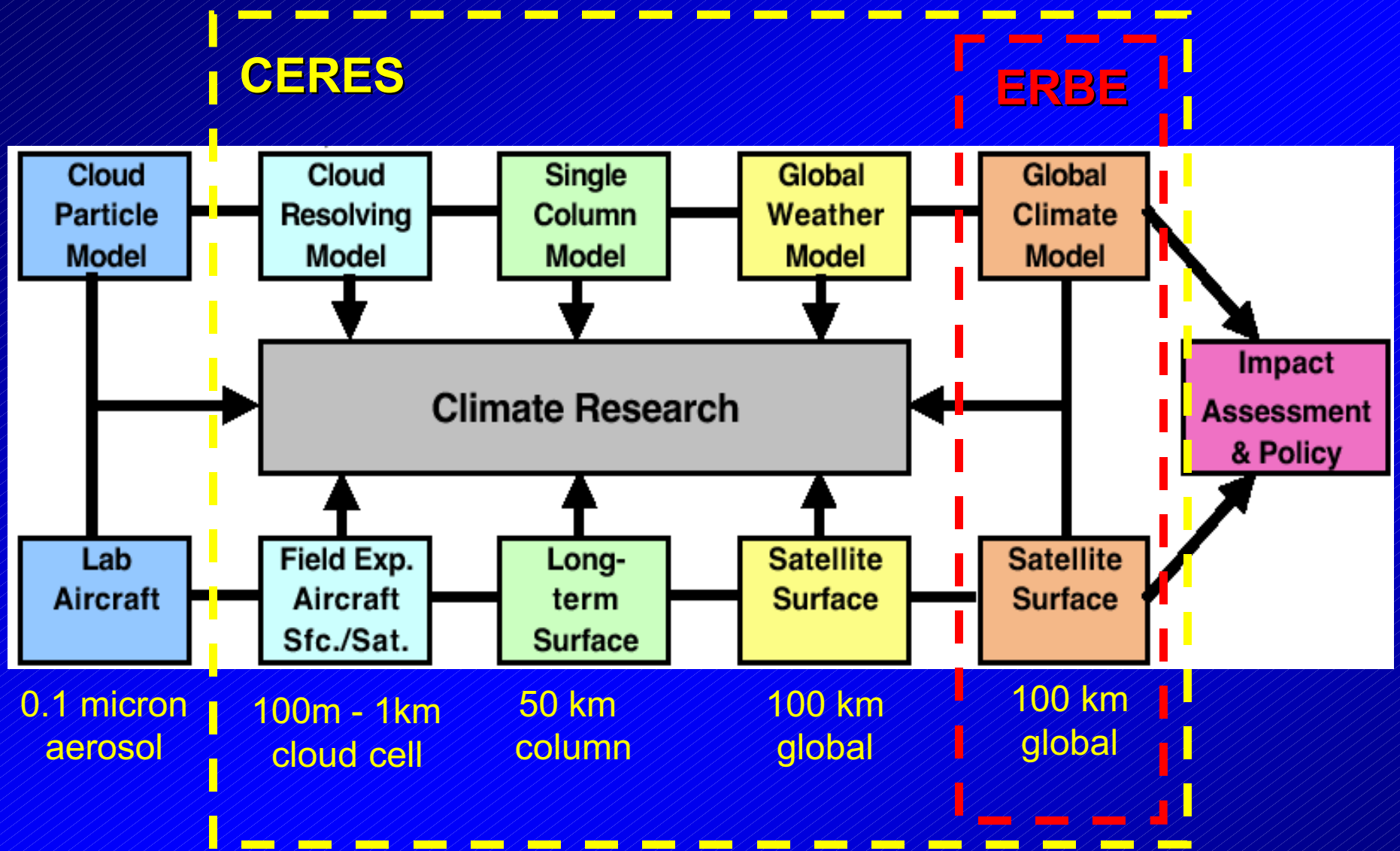
- Like the solar constant measurement: broadband instrument stability is much better than absolute calibration.
- For broadband radiation data like CERES:
 - stability is +/- 0.2 Wm⁻²
 - but absolute calibration is +/- 1 Wm⁻².
- Decadal climate signals are estimated to be 0.2 to 3 Wm⁻².
- This means that a data gap leads to a confidence of only 2.0 Wm⁻² in climate change signals before and after the gap.
- Yet these are the changes climate models must produce to be believed for global change forcings of 1 to 4 Wm⁻².
- We currently have an overlapped satellite record of broadband radiation from 1978 (N7) to current (24 yrs).
- Climate surprises will require independent verification: both rigorous broadband fluxes and climate components.

NPOESS Prep. Project (NPP)

- **Studies in July/Aug for NPP on cost (instrument mods, s/c, data system) to add the CERES FM-5 instrument in storage to NPP. Purpose to fill the gap from Aqua (end 2008) to NPOESS (start 2011).**
- **Much lower cost than original development CERES EOS data:**
 - Takes full advantage of EOS development efforts.
 - 2: Use Terra/Aqua angular models: one inst not two needed
 - 2: One orbit not two (combine with geostationary diurnal
 - 2: Existing instrument needs only electronics mods
 - Overall Inst, S/C, launch, data costs: factor of 6 cheaper per year of data than original EOS development effort.
- **Can meet NPP schedule (2006 launch) and spacecraft profile**
 - CERES instrument 1/5th size/power of typical. (50kg,50W)
 - Only require cross-track clear view since Terra/Aqua rotating azimuth plane data sampled full hemisphere of radiation by scene.
 - Does require additional rocket boosters (strap on delta 2)

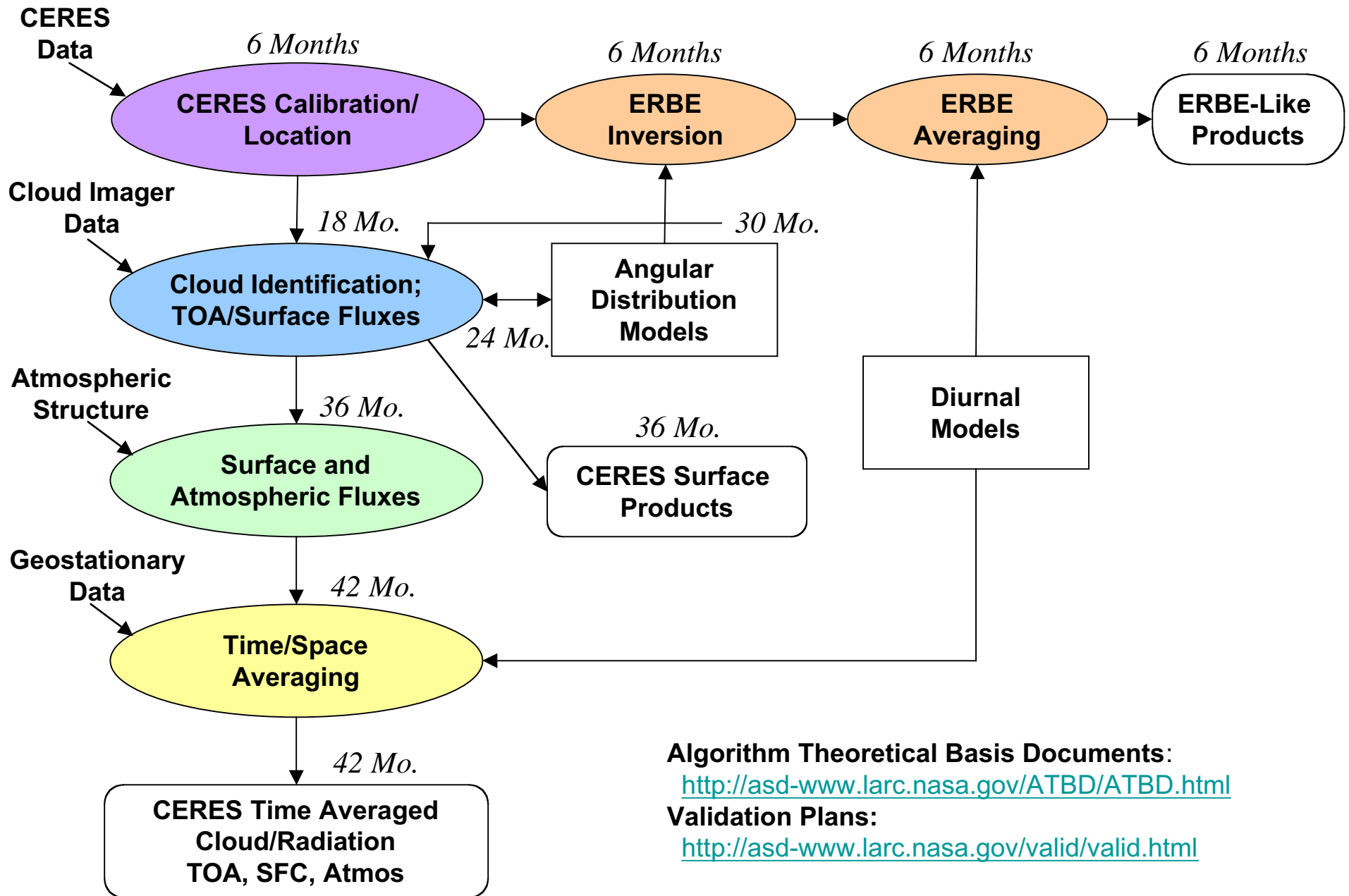
NPOESS Prep. Project (NPP)

- **Additional NPP cost, however is not zero, and must be borne by NASA, since there is no NPOESS risk reduction issue**
- **Processing data products:**
 - **Use CERES algorithms**
 - **Replace MODIS by VIIRS on NPP**
 - **Process at LaRC DAAC, same output data products/ordering.**
- **Waiting to hear from NASA HQ.**
- **Decision needs to be made soon to keep NPP launch schedule in 2006.**



Range of Cloud/Aerosol/Radiation Model Tests

CERES Data Processing Flow



Algorithm Theoretical Basis Documents:
<http://asd-www.larc.nasa.gov/ATBD/ATBD.html>

Validation Plans:
<http://asd-www.larc.nasa.gov/valid/valid.html>

Summary of CERES Advances

- **Calibration** **Offsets, active cavity calib., spectral char.**
- **Angle Sampling** **Hemispheric scans, merge with imager
matched surface and cloud properties
new class of angular, directional models**
- **Time Sampling** **CERES calibration + 3-hourly geo samples
new 3-hourly and daily mean fluxes**
- **Clear-sky Fluxes** **Imager cloud mask, 10-20km FOV**
- **Surface/Atm Fluxes** **Constrain to CERES TOA, Fu-Liou, ECMWF
imager cloud, aerosol, surface properties**
- **Cloud Properties** **Same 5-channel algorithm on VIRS,MODIS
night-time thin cirrus, check cal vs CERES**
- **Tests of Models** **Take beyond monthly mean TOA fluxes
to a range of scales, variables, pdfs**
- **ISCCP/SRB/ERBE** **overlap to improve tie to 80s/90s data.**
- **CALIPSO/Cloudsat** **Merge in 2004 with vertical aerosol/cloud**

Move toward unscrambling climate system energy components

CERES Reference List

- **CERES General Background**
 - CERES Brochure (on the CERES home page)
 - Role of Clouds and Radiation in Climate, Wielicki et al., BAMS, 76, 853-868, 1995.
 - CERES Experiment Overview: Wielicki et al., BAMS, 96, 853-868, 1996.
 - CERES Instrument Calibration: Priestley et al., J. Appl. Met, 39, 2249-2258, 2000.
- **CERES Data Products and Algorithms**
 - CERES Algorithm Theoretical Basis Documents (ATBDs) NASA Reference Publication 1376, Volumes 1 through 4, Dec. 1995. ATBD overview published in Wielicki et al., IEEE Trans Geoscience Rem Sens, 36, 1127-1141, 1998.
 - CERES Data Products Catalog: summary of data products
 - CERES Data Collection Guides: one per data product; defines formats/variables.
 - CERES Data Quality Summaries: one per data product; summarizes current estimates of the accuracy of variables in each validated archived CERES product.
 - The above can be found at: <http://asd-www.larc.nasa.gov/ceres/docs.html>
- **Tropical decadal variability**
 - Wielicki et al., Science, Vol 295, Feb 1, 2002, p841-844. (decadal radiation changes)
 - Chen et al., Science, Vol 295, Feb 1, 2002 p838-841. (hadley/walker hypothesis)
 - Trenberth, Science 295 (5576): U1-U2 Jun 21 2002 (letter to science)
 - Wielicki et al., Science 295 (5576): U2-U3 Jun 21 2002 (response)
 - Allan et al., J. Climate 15 (14): 1979-1986 Jul 2002 (UKMO runs)
 - Wang et al., GRL, 29, No. 10, 2002. (SAGE II cirrus height changes)

CERES Reference List, con't

- **1998 El Nino Radiative Anomalies**
 - Cloud Forcing Ratio Anomaly: Cess et al., J. Climate, 14, 2129-2137, 2001.
 - Cloud Forcing Ratio Anomaly/SAGE II cloud height anomalies: Cess et al., GRL, 28, 4547-4550, Dec 15, 2001
- **Iris tropical cloud negative feedback hypothesis**
 - The Iris Hypothesis: Lindzen et al., BAMS, 82, 417-432, 2001.
 - Cloud amount/SST relation: Hartmann and Michelson, BAMS, 83, 249-254, 2002.
 - Cloud radiative properties: Lin et al., J Climate, 15, 3-7, 2002.
 - Cloud radiative properties: Fu et al., Atm Chem Phys, 2, 31-37, 2002.
 - Improved cloud radiative properties using new CERES merged cloud/radiation data products (TRMM SSF): Chambers et al., J Climate, in press (for a pdf copy, contact I.h.chambers@larc.nasa.gov)

Where do I go for CERES data and documentation?

- CERES Documentation/Home Page at <http://asd-www.larc.nasa.gov/ceres/docs.html>
- CERES Data Orders at <http://eosweb.larc.nasa.gov/~latisweb>