Microwave Brightness Temperatures for Climate Studies

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Outline

- Brief Project Overview
- Approach (1-2 slides)
- Results/Accomplishments (1-3 slides)
- Validation Strategy/Results (1-2 slides)
- Algorithm/Product Maturity
- Issues/Risks & Work-Off Plans
- Schedule
- Research-to-Operations or Delivery Plan
- Resources

Overview

- Goals -
  - Produce climate-quality time series of bulk-layer atmospheric temperatures from microwave data
- Source Data -
  - Radiance Counts from NOAA/NASA satellites
- Deliverables
  - Daily large-scale averages and monthly grids of TLT, TMT, TLS
- ECVs addressed (as applicable) - bullets
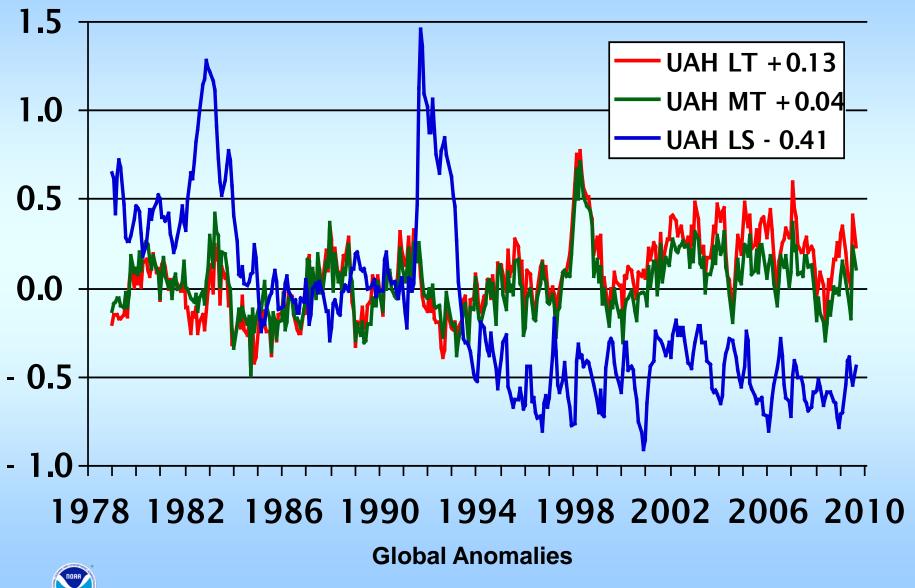
Overview

- Current/expected user communities (especially non-research sectors, e.g., Health, Defense, etc.)
    - Media
    - Policy
    - Energy
    - Science
    - Legal

Approach

- Satellites
    - Operational MSUs TIROS-N to NOAA-14
    - Operational AMSUs NOAA-15 to -16
    - Science Satellite AMSU AQUA
- Reference Brightness Temperature
    - Make AMSU backward compatible to MSU
- Diurnal Drift
    - Empirically calculated from multiple AMSUs
- Bias
    - Direct, latitude by latitude calculation
    - Single direct "backbone" path (T-N to N-6 to N-9 to N-10 to N-11 to N-12 to N-14 to N-15 to AQ)
- Instrument Temperature dependency
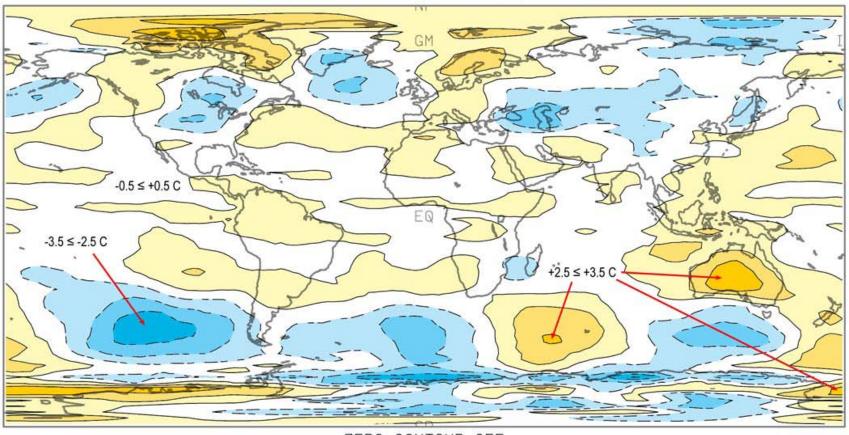   - Linear relationship between hot-target anomalies and calibration anomalies
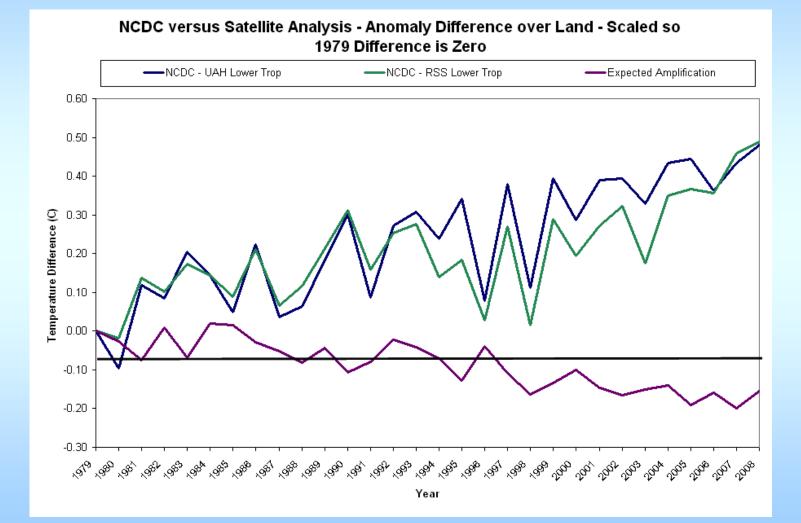
Results/Accomplishments

Global Anomalies

Results/Accomplishments

AUG 2009
LAYER = LT LOWER TROPOSPHERE

-0.5 ≤ +0.5 C

-3.5 ≤ -2.5 C

+2.5 ≤ +3.5 C

ZERO CONTOUR OFF

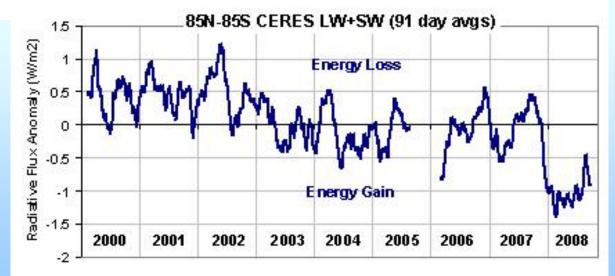CONTOUR FROM   -10.500   TO   10.500   CONTOUR INTERVAL OF   1.0000   PT(3,3)=   0.35000

Broken lines outline areas that were cooler than seasonal norms; solid lines outline areas that were warmer than seasonal norms. Each contour represents one degree Celsius, starting at -0.5 and +0.5 degrees C.

Results/Accomplishments
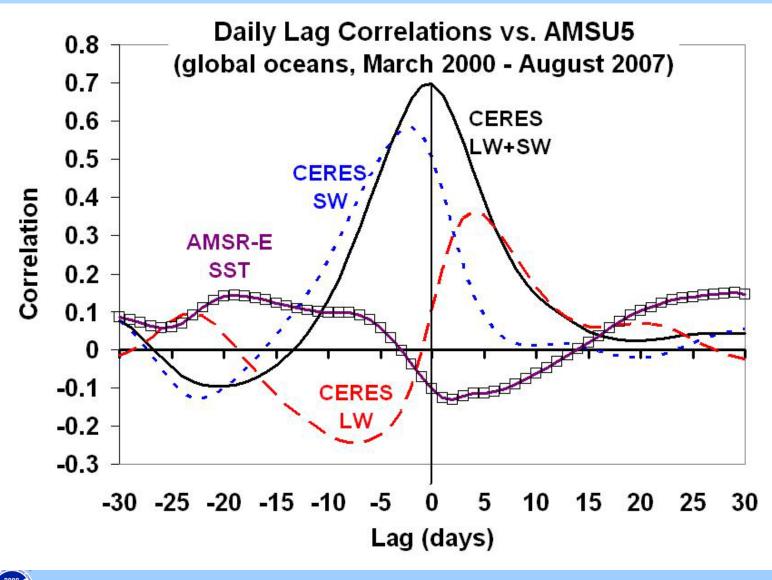# Klotzbach et al 2009

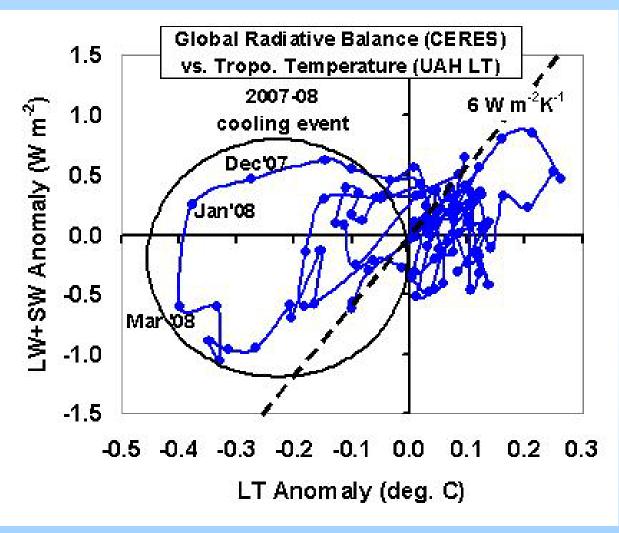# Results/Accomplishments
Spencer and Braswell 2008, Subm.

Results/Accomplishments
Spencer and Braswell 2007, 2008

Daily Lag Correlations vs. AMSU5 (global oceans, March 2000 - August 2007)

Results/Accomplishments
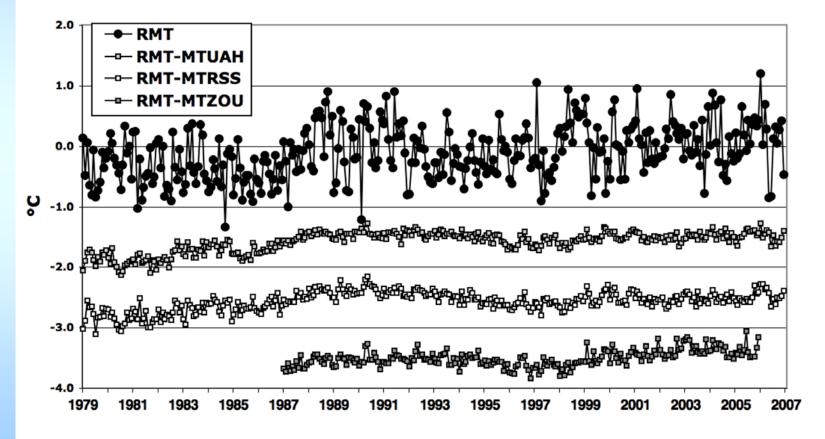# Spencer and Braswell 2008, Subm.

Feedback Calculation

+0.17°C/Wm-2

Model Calculation

+0.6 to +0.8 °C/Wm-2

Validation Strategy/Results
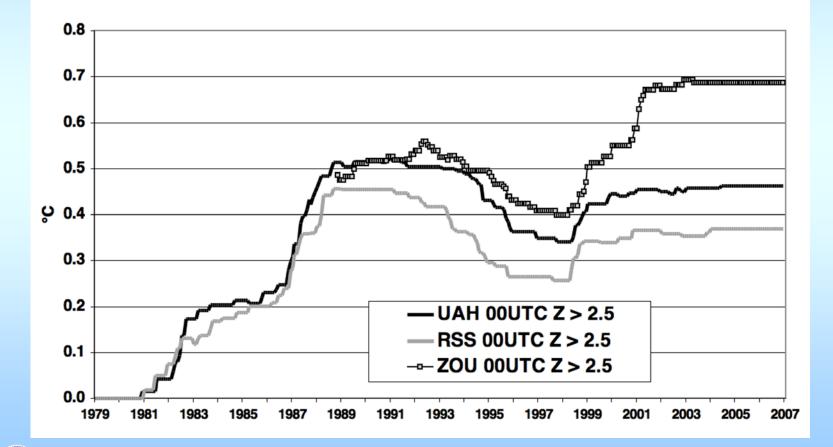# Christy and Norris 2009

**Australian Radiosonde Anomalies (RMT)
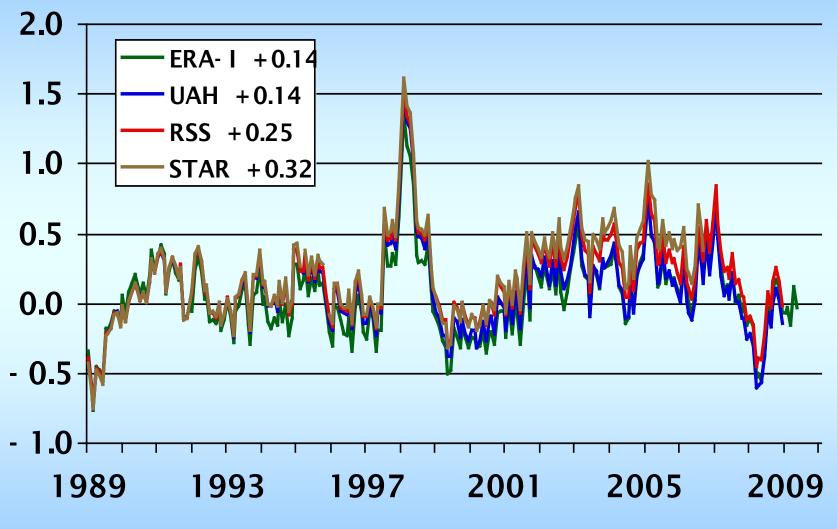with differences vs. UAH, RSS and ZOU MT**

Validation Strategy/Results Christy and Norris 2009

Satellite-Defined Shifts in Australian Radiosondes MT, Z > 2.5

Validation Strategy/Results
Bengtsson and Hodges 2009

Legend:
- ERA-I +0.14
- UAH +0.14
- RSS +0.25
- STAR +0.32
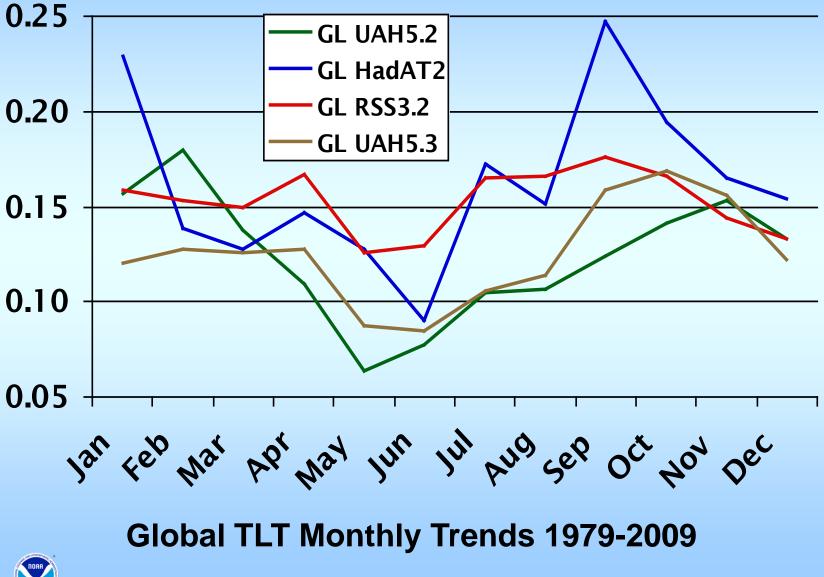
Tropical Ocean TMT Anomalies

Product Maturity

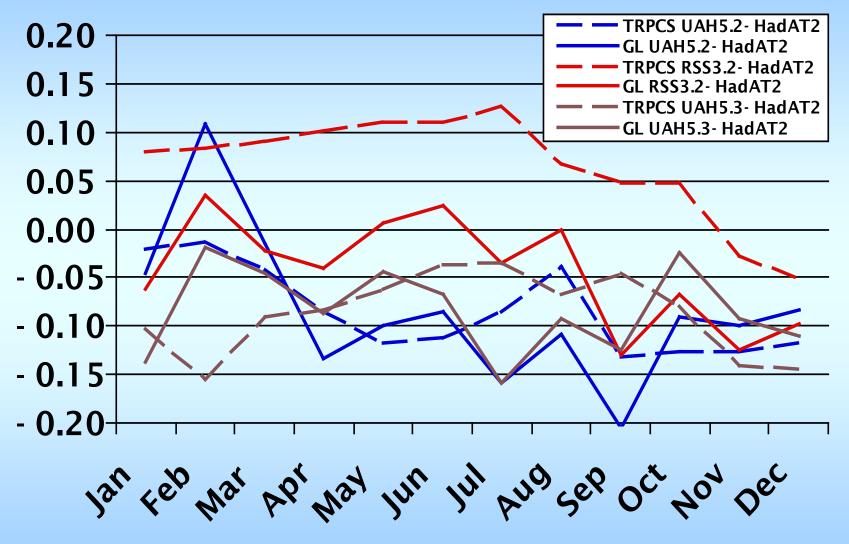| Maturity	Sensor Use	Algorithm stability	Metadata & QA	Documentation	Validation	Public Release	Science & Applications
1	Research Mission	Significant changes likely	Incomplete	Draft ATBD	Minimal	Limited data availability to develop familiarity	Little or none
2	Research Mission	Some changes expected	Research grade (extensive)	ATBD Version 1+	Uncertainty estimated for select locations/times	Data available but of unknown accuracy; caveats required for use.	Limited or ongoing
3	Research Missions	Minimal changes expected	Research grade (extensive); Meets international standards	Public ATBD; Peer-reviewed algorithm and product descriptions	Uncertainty estimated over widely distribute times/location by multiple investigators; Differences understood.	Data available but of unknown accuracy; caveats required for use.	Provisionally used in applications and assessments demonstrating positive value.
4	Operational Mission	Minimal changes expected	Stable, Allows provenance tracking and reproducibility; Meets international standards	Public ATBD; Draft Operational Algorithm Description (OAD); Peer-reviewed algorithm and product descriptions	Uncertainty estimated over widely distribute times/location by multiple investigators; Differences understood.	Data available but of unknown accuracy; caveats required for use.	Provisionally used in applications and assessments demonstrating positive value.
5	All relevant research and operational missions; unified and coherent record demonstrated across different sensors	Stable and reproducible	Stable, Allows provenance tracking and reproducibility; Meeting international standards	Public ATBD, Operational Algorithm Description (OAD) and Validation Plan; Peer-reviewed algorithm, product and validation articles	Consistent uncertainties estimated over most environmental conditions by multiple investigators	Multi-mission record is publicly available with associated uncertainty estimate	Used in various published applications and assessments by different investigators
6	All relevant research and operational missions; unified and coherent record over complete series; record is considered scientifically irrefutable following extensive scrutiny	Stable and reproducible; homogeneous and published error budget	Stable, Allows provenance tracking and reproducibility; Meeting international standards	Product, algorithm, validation, processing and metadata described in peer-reviewed literature	Observation strategy designed to reveal systematic errors through independent cross-checks, open inspection, and continuous interrogation	Multi-mission record is publicly available from Long-Term archive	Used in various published applications and assessments by different investigators

Issues/Risks & Work- Off Plans

- **Please note**
  - current or possible future problems, and
  - approaches to get around or mitigate the problem(s), as appropriate
- **Possible Annual Cycle Error Signal**
  - Spurious annual cycle post 2000?
  - Simple "fix" is being examined

Issues/Risks & Work- Off Plans

Global TLT Monthly Trends 1979-2009

Issues/Risks & Work- Off Plans

Tropical TLT Monthly Trends 1979-2009

Legend:
- TRPCS UAH5.2
- TRPCS HadAT2
- TRPCS RSS3.2
- TRPCS UAH5.3

Issues/Risks & Work- Off Plans

TLT Monthly Trends 1979-2009

Legend:
- TRPCS UAH5.2- HadAT2
- GL UAH5.2- HadAT2
- TRPCS RSS3.2- HadAT2
- GL RSS3.2- HadAT2
- TRPCS UAH5.3- HadAT2
- GL UAH5.3- HadAT2

Schedule

Research- to- Operations or Delivery Plan

Place products on public website by 10th of each month

Resources

- 3 "employed" (~3% each)
- Key equipment or observatories used
  - Already own equipment and connections
- Key collaborating projects or personnel
  - (Klotzbach, Pielke Sr., Hermann, Sakamoto, Spencer, Bengtsson, etc.)
- NOAA points-of-contact or collaborators, as applicable
  - (C-Z Zou, Powell)
- Target NOAA Data Center (if known)
  - NCDC