How do cloud-types affect inter-satellite biases?

Paul W. Staten, Brian Kahn, and Mathias Schreier

*NASA JPL/Caltech*

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What we do:

We combine HIRS radiances...
with AVHRR cloud types....
at the pixel scale.

What we see:

$T_b$’s confirm validity of interpolated cloud grid.
Statistics highlight instrument differences.

What now?

Homogenize the data record.
Calculate observed and modeled radiance trends.
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HIRS instruments span* the last 30 years

- NOAA 8:
  - primary oscillator
  - ch 1-12 lost

- NOAA 9:
  - status unknown

- NOAA 10:
  - status unknown

- NOAA 11:
  - motor wheel

- NOAA 12:
  - jitter filter wheel

- NOAA 13:
  - noise & filter wheel trouble

- NOAA 14:
  - jointer

- NOAA 15:
  - filter wheel repeatedly stalls

- NOAA 16:
  - all longwave ch’s degraded

- NOAA 17:
  - undervoltage

- NOAA 18:
  - IR ch noise “unusable”

- NOAA 19:
  - good
  - marginal
  - bad

- METOP A:
  - status unknown

Timeline:
- '83
- '85
- '90
- '95
- '00
- '05
- '10
- '13
HIRS channels are selected for atmospheric sounding

credit: Irina N. Sokolik, Georgia Tech
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1. AVHRR 4 km imager data
   - global coverage
   - visible and near-IR

2. CLAVRx processing algorithm
   - NCEP/NCAR reanalysis background
   - Bayesian approach
   - Mixed Daytime and daytime/nighttime output

3. Cloud typing
   - Daytime & nighttime CLAVRx cloud type
     (Pavolonis et al., 2005)
   - Daytime ISCCP cloud type (isccp.giss.nasa.gov)
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**at the pixel scale.**

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Each HIRS pixel contains info from several AVHRR pixels

- $T_b$ from 19 HIRS channels
- Fractions of 13 CLAVRx cloud types (including clear)
- Fractions of 10 ISCCP cloud types (including clear)
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What we do:

What we see:

What now?

- NOAA-18
- Oct–Nov 2009
- NE Pacific
- Overshooting classification stands out
- HIRS/4 $T_b$'s coincide with channel weighting functions
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What we do:

What we see:

What now?

- Overshooting cirrus opaque ice overlapping supercool water water near surface probably clear clear
- Stratus stratocumulus cumulus nimbostratus altostratus altocumulus deep convection cirrostratus cirrus clear

- NOAA-19 – NOAA-18
- Mean $\Delta T_b$
- Scene-radiance dependent biases (Shi et al., 2008)
- Large biases only for “slicing” channels.
What we do:

What we see:

What now?

- NOAA-19 – NOAA-18
- $\Delta \sigma_{Tb}$
- Lower $\sigma_{Tb}$ for most channels for low- and mid-level clouds.
- Same channels show $\Delta T_b$ and $\sigma_{Tb}$ differences.
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What we do:

- Spectral response function shifts (Chen et al., 2013)
- Diurnal cycle (Foster & Heidinger, 2013)
- HIRS, IASI, and AIRS differences

What we see:

What now?
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What we do:

- Cloud type changes
- Type-specific radiance trends
- Modeled cloud statistics

What now?
Modeled AIRS $T_b$’s from retrieved profiles match observed AIRS $T_b$’s for some cloud types.

Adapted from Schreier and Sušelj, 2014 (in prep)

But higher-order stats match poorly.
What about models?
Thanks.

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Andy Heidinger & Hai-tien Lee