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What can we learn from 11 years of AIRS observations?

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Jet Propulsion Laboratory / California Institute of Technology

2014 STAR JPSS Science Teams Annual Meeting

13 May 2014

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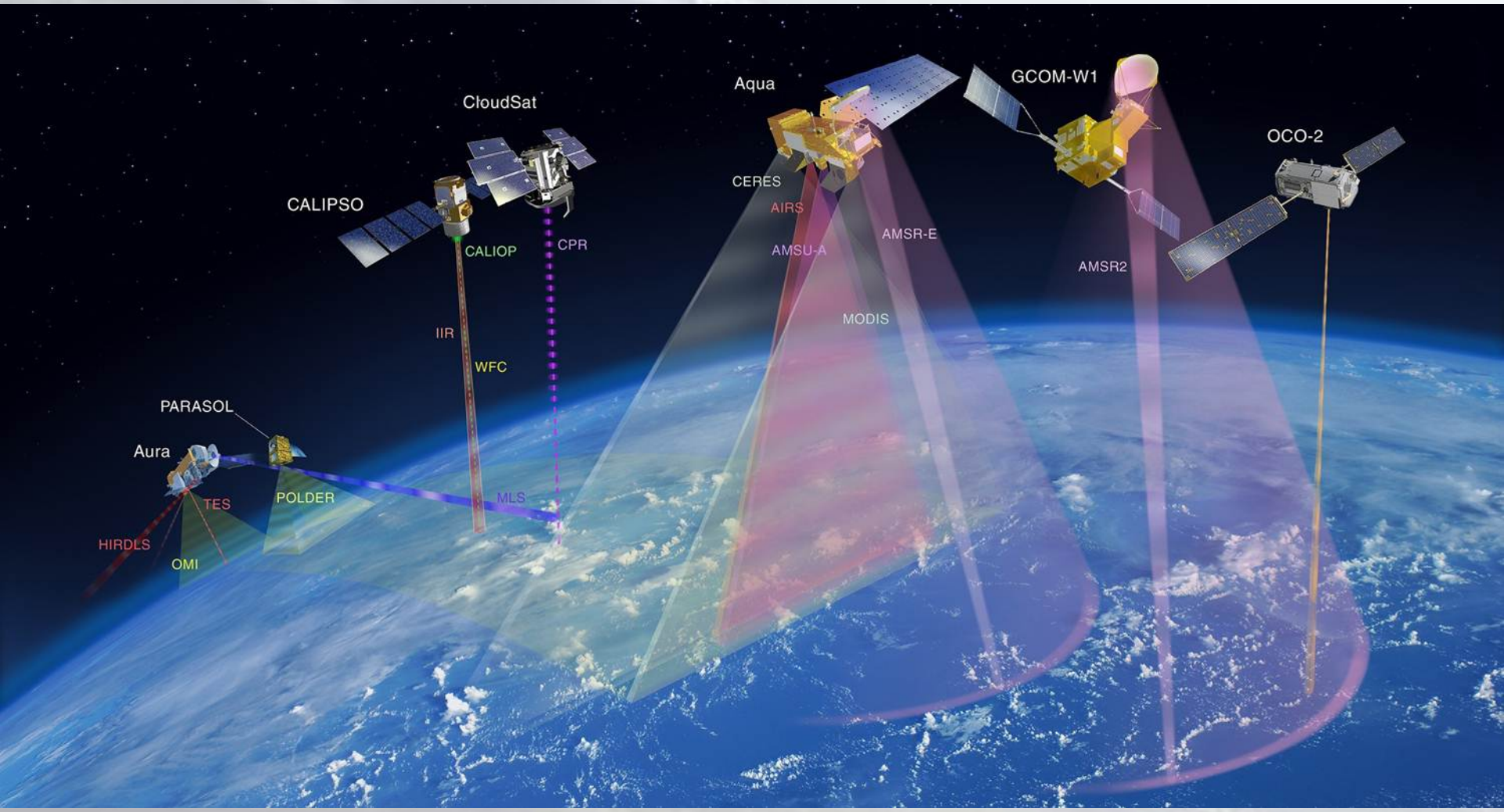
Atmospheric Infrared Sounder on Aqua in the A-Train



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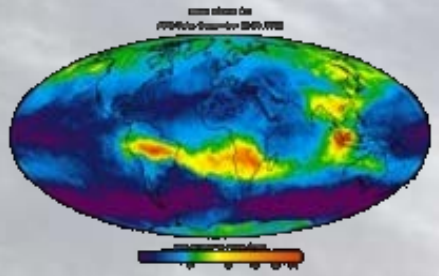
AIRS Key Level 2 Products

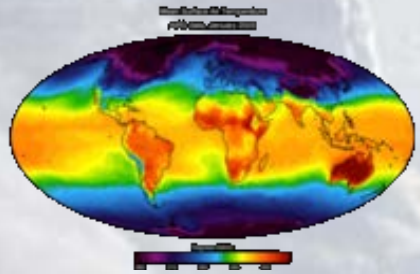
Clouds and Water Vapor Feedback

CO

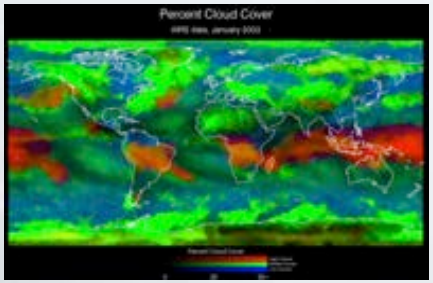


Greenhouse Gas Forcing

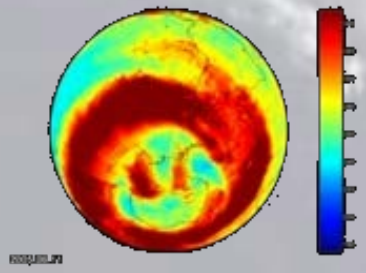
Atmospheric Temperature



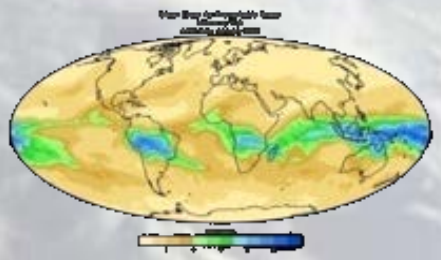
Cloud Properties



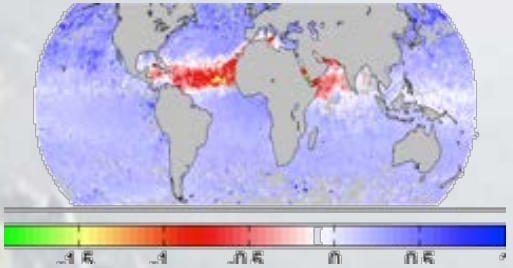
Ozone



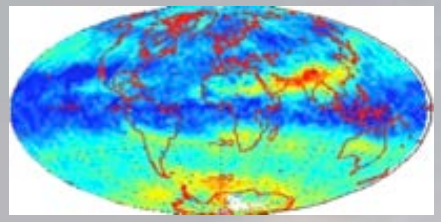
Atmospheric Water Vapor



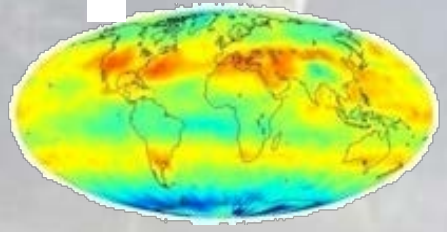
Dust



Methane

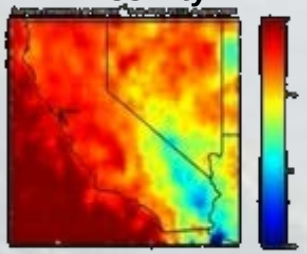


CO2



SO2

Emissivity



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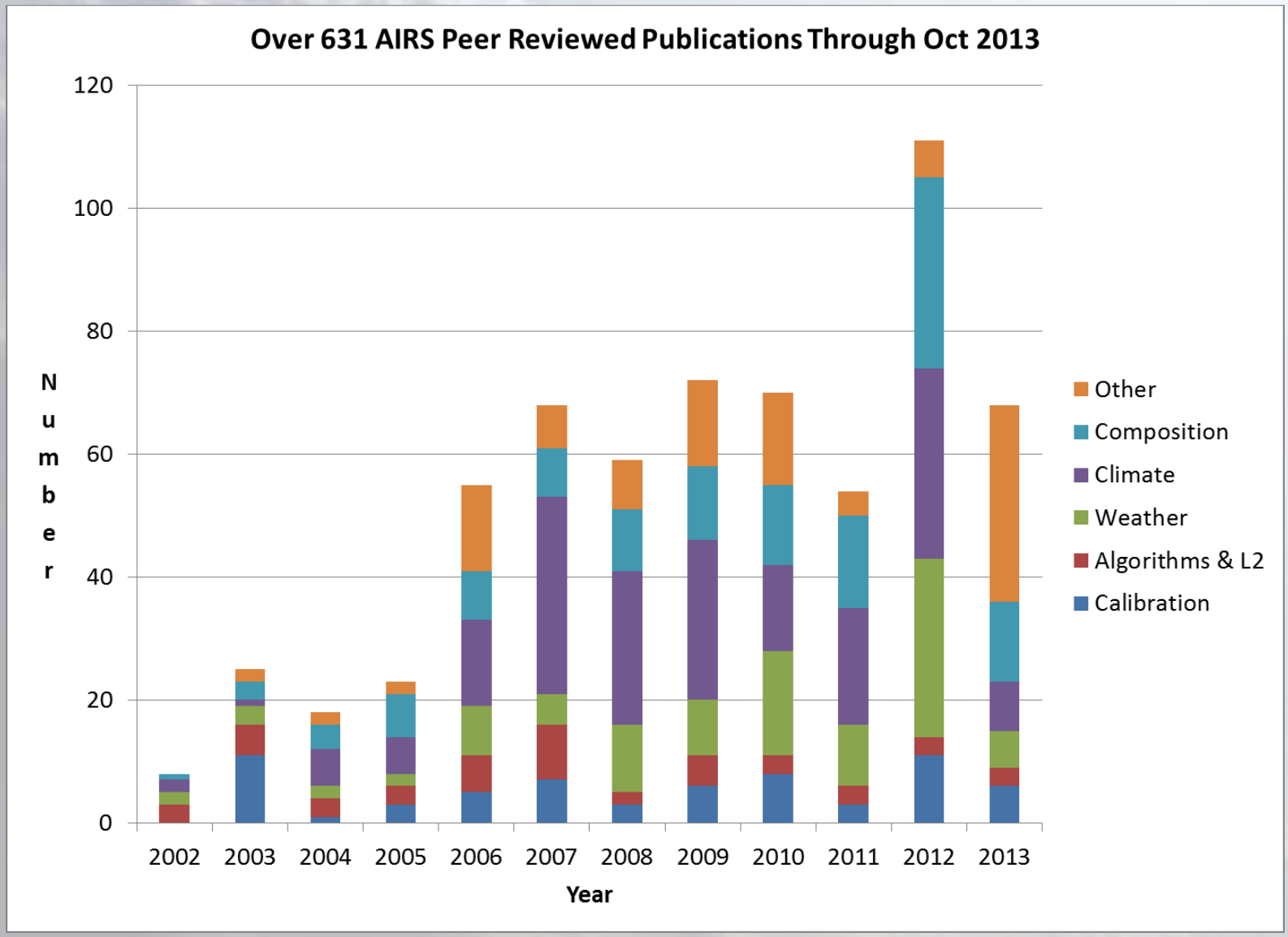
AIRS Supporting Research



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The Strengths of AIRS

Most pertain to CrIS and IASI

- **High infrared spectral resolution and coverage**
  => *highest vertical resolution from the IR.*
- **Information about temperature and water vapor profiles, trace gases, etc. obtained simultaneously.**
- **Global coverage.**
- **11+ years of data (10 billion spectra, 1 billion retrievals).**

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AIRS Challenges

- **In cloudy scenes most information is obtained in the microwave**

  $\Rightarrow$ ***Lower vertical resolution than IR.***

- **Global coverage.**

- **11+ years of data (10 billion spectra, 1 billion retrievals).**

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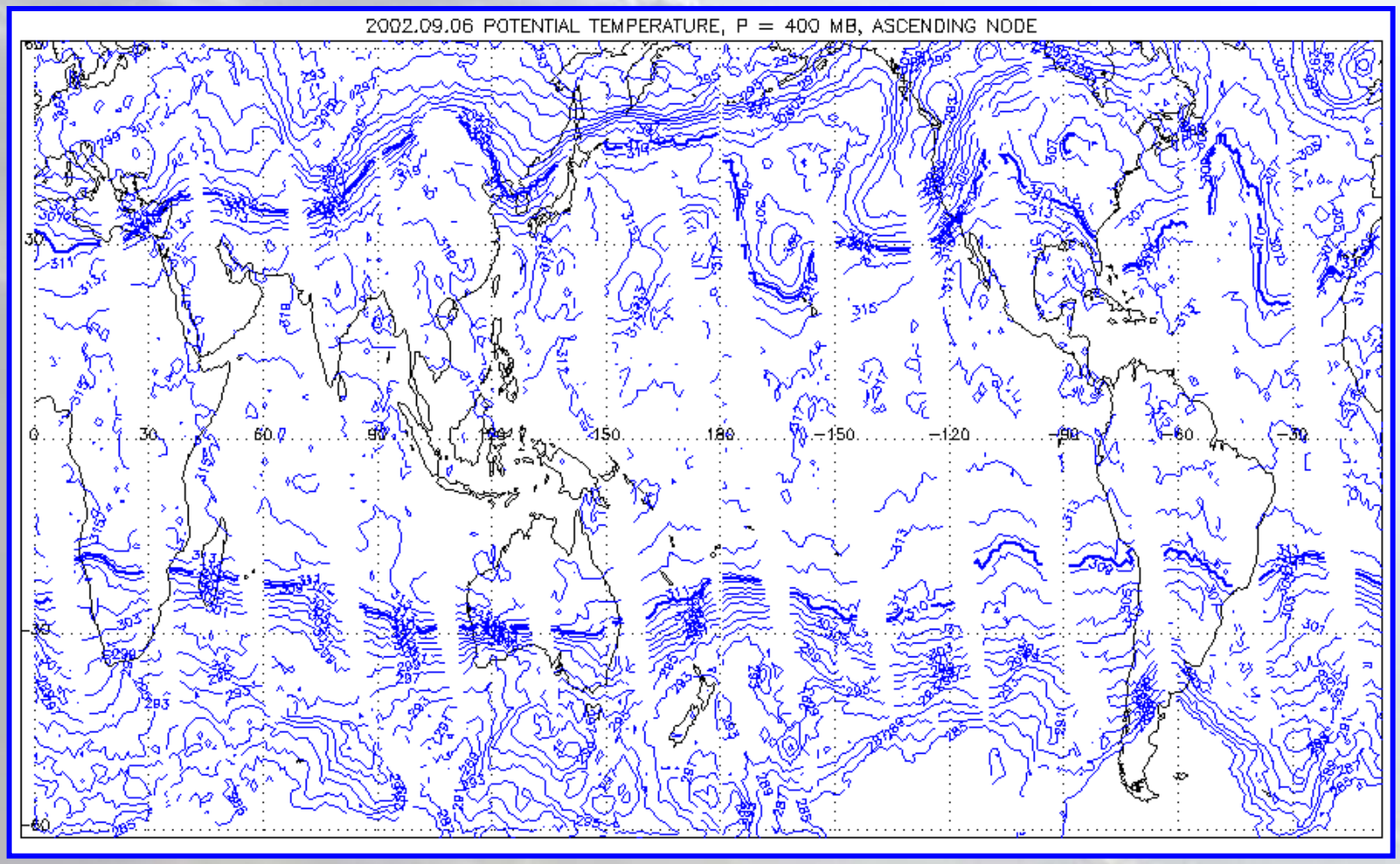
Defining Tropical Conditions at 400 hPa:
Potential Temperature > 310 K
6 Sep 2002



Level 3 Data

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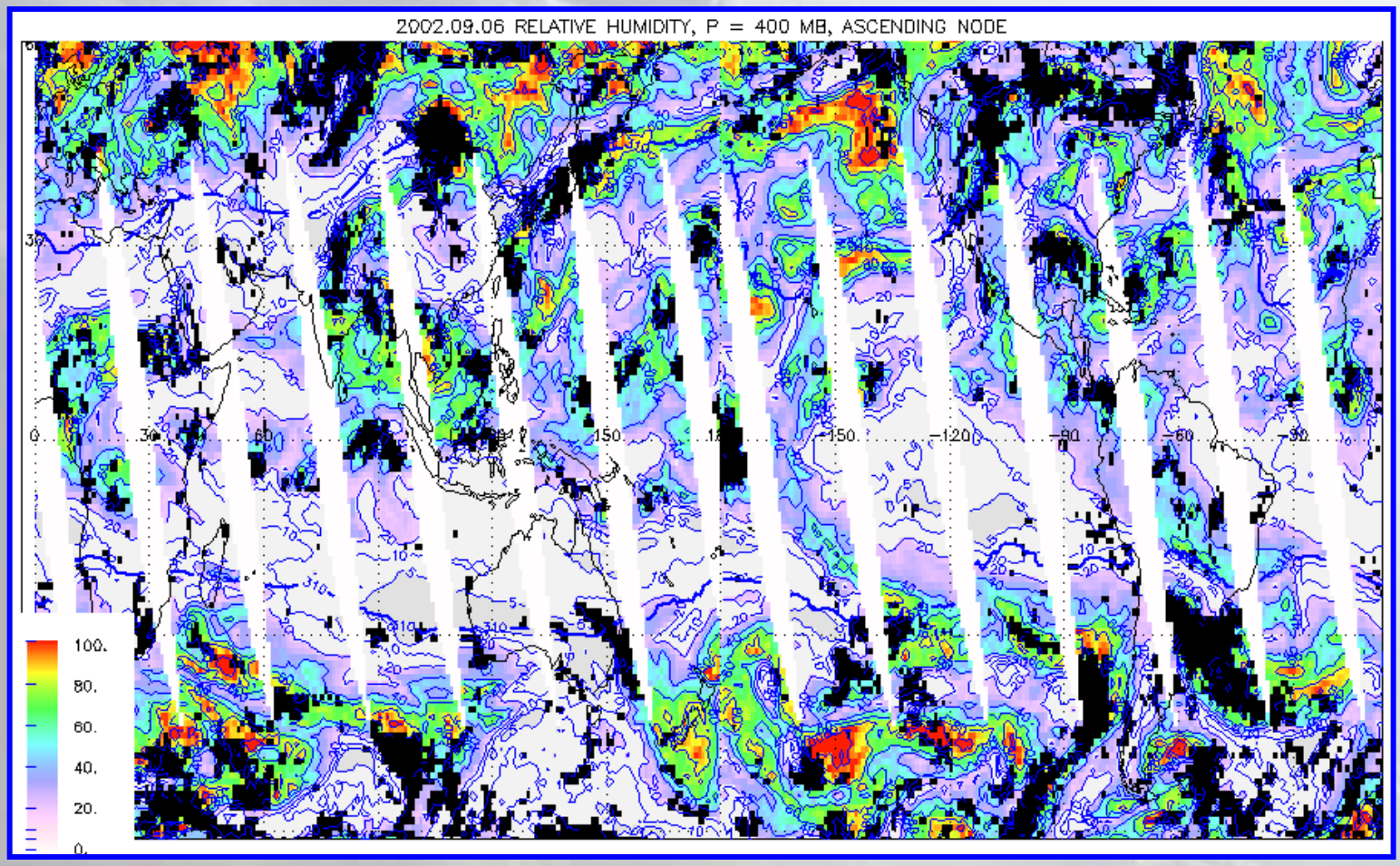
Exploiting AIRS Strengths

Relative Humidity at 400 hPa

6 Sep 2002

Extremely demanding quality control (<100% yield for 1x1° boxes in black).



Level 3 Data

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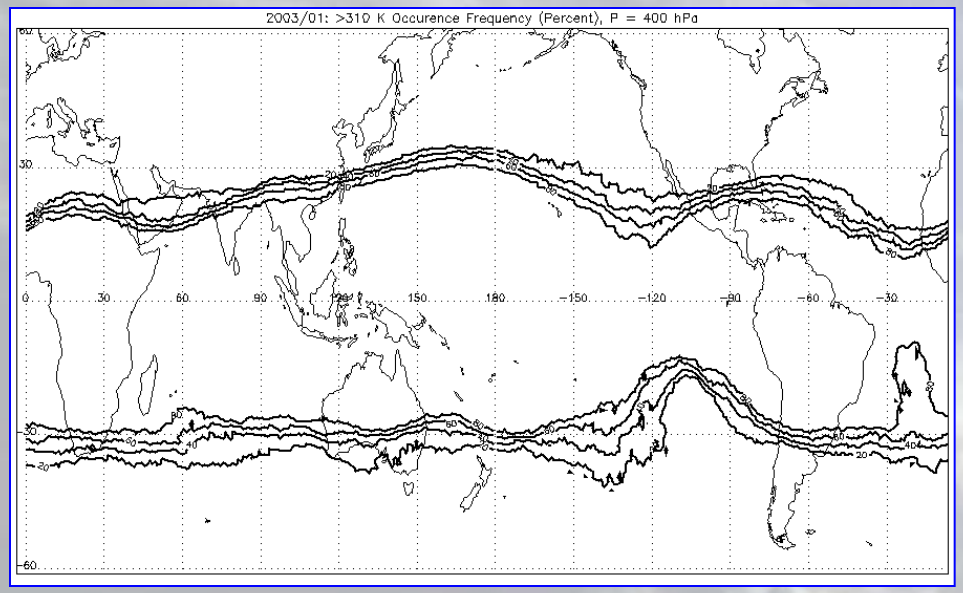
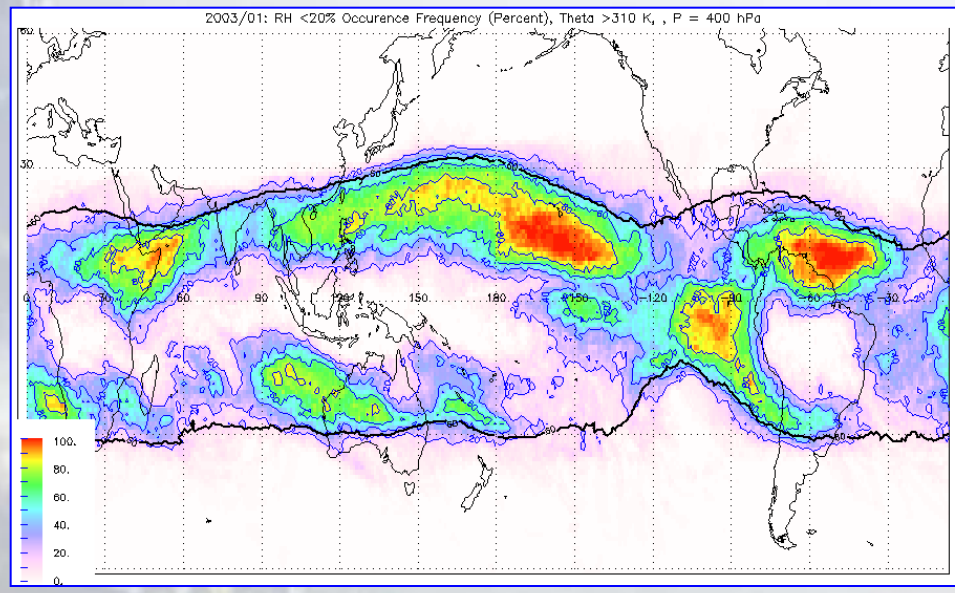
‘Tropical’ Conditions
January 2003





Occurrence Frequency, θ > 310 K at 400 hPa

Occurrence Frequency,
Relative Humidity < 20% at 400 hPa
(NOT mean RH)

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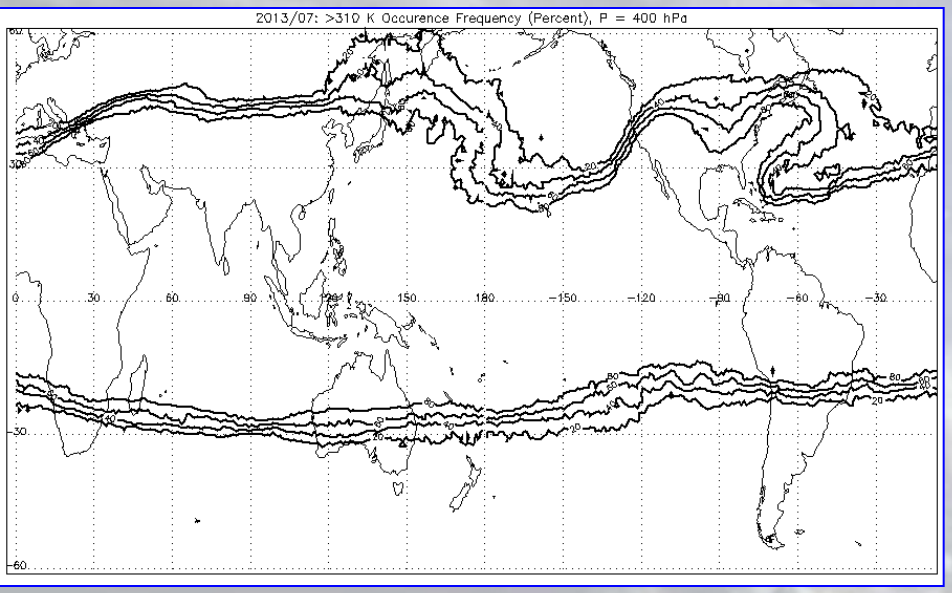
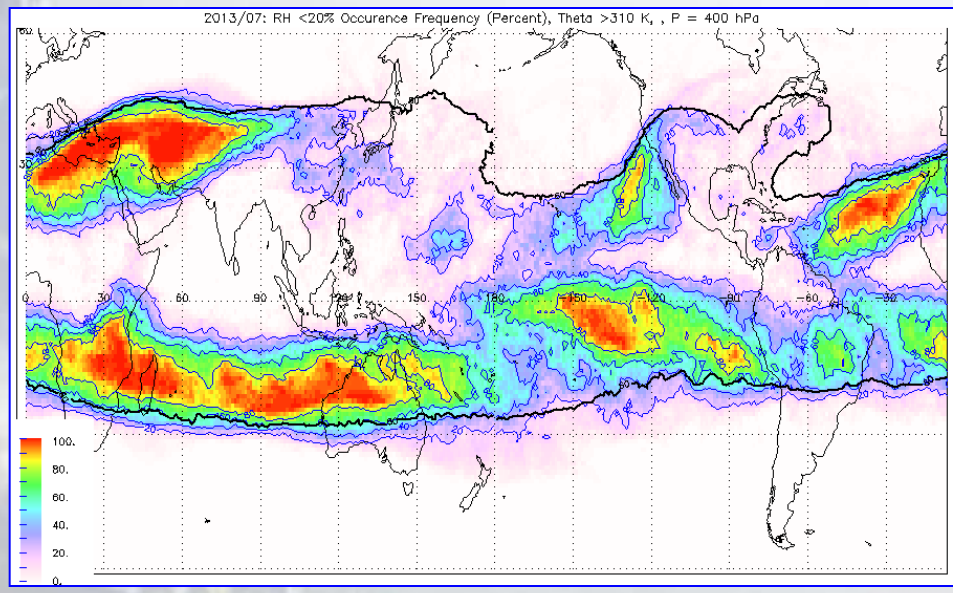
Defining 'Tropical' Conditions Dynamically
July 2013





Occurrence Frequency, θ > 310 K at 400 hPa

Occurrence Frequency,
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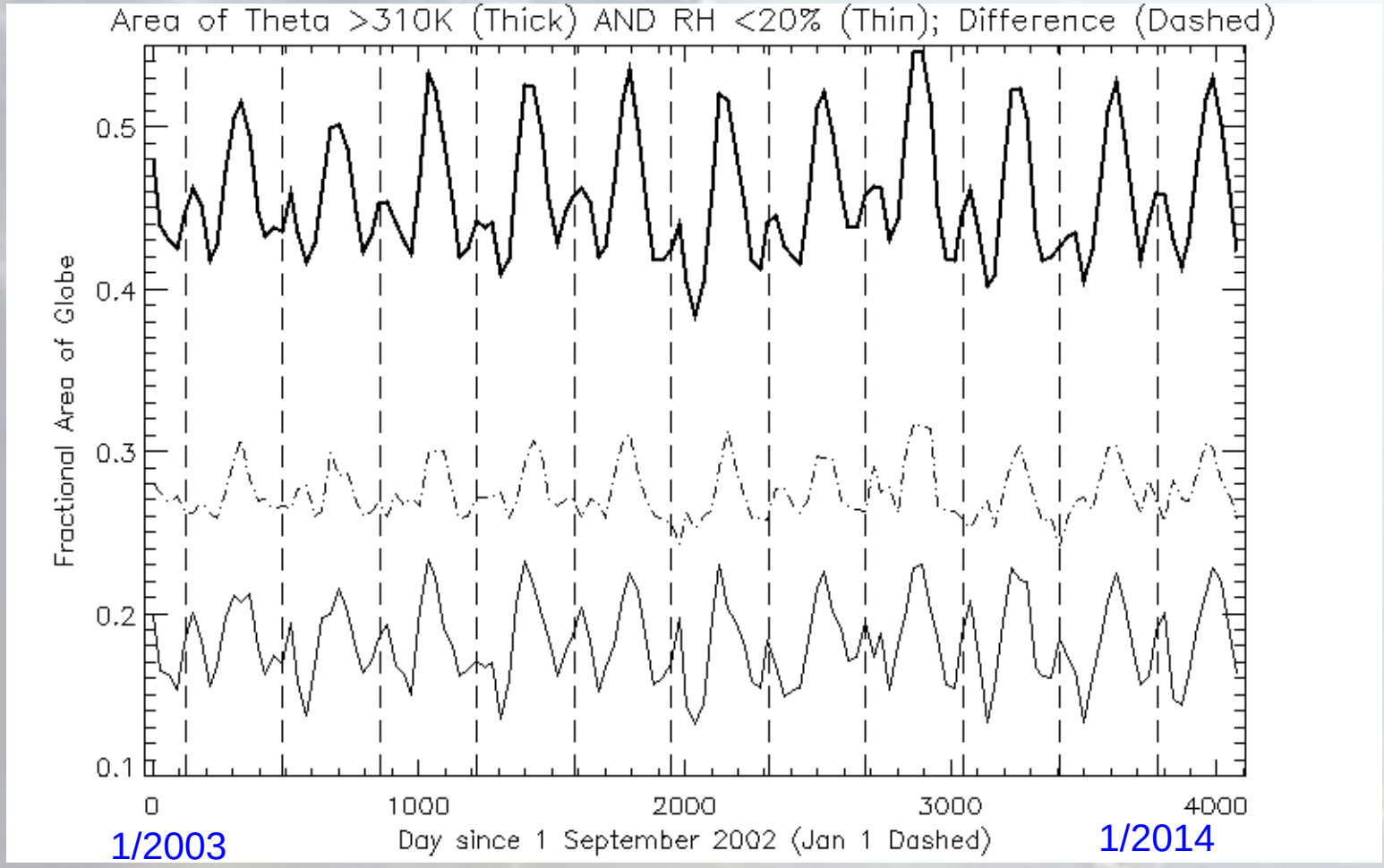
400 hPa: Occurrence Frequency Weighted Area

θ > 310 K (thick)

RH < 20% (thin)

Their difference (dashed)



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Conclusions: Some Inside Information

- **AIRS has most information in clearer scenes**
  - ***cloud-free conditions not required!***

- **Processes in the dry subtropics may be driving climate sensitivity. See:**
  - ***Fasullo and Trenberth, 2013, Science.***
  - ***Sherwood et al., 2014, Nature.***

- **With 11 years of observations, AIRS likely contains useful climate indices (like relative humidity quantities) in the dry tropics and subtropics.**
  - ***Today's study is a preliminary attempt at creating one index.***