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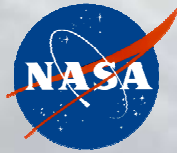
Using AMSR-E to Diagnose Sampling Biases in AIRS/AMSU/HSB

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**AMSR-E Science Team Meeting
San Diego, CA**

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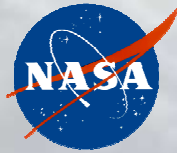
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Basic Approach

- **Premise: AMSR-E microwave observations are less affected by clouds than AIRS infrared observations.**
 - *Exploit this to understand biases in AIRS/AMSU/HSB methodology.*

Reported in

Fetzer, E. J., B. H. Lambrigtsen, A. Eldering, H. H. Aumann, and M. T. Chahine, 2006: Biases in total precipitable water vapor climatologies from Atmospheric Infrared Sounder and Advanced Microwave Scanning Radiometer, J. Geophys. Res., 111, D09S16, doi:10.1029/2005JD006598.

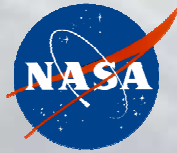


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Goals of This Study

- **Show good agreement between AMSR-E and AIRS/AMSU/HSB somewhere, under some conditions.**
- **Use AMSR-E to diagnose**
 - ***Biases in AIRS retrievals as cloudiness increases.***
 - essentially none.
 - ***AIRS biases with and without HSB***
 - As great as 25% at high latitudes.
 - ***possible cloud-induced sampling biases in AIRS full (including IR) retrievals.***
 - important implication for AIRS height-resolved water vapor climatologies.
 - As large as 50% or more.



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Procedure

- **Match AIRS and AMSR-E fields of view**
 - *simple nearest neighbor*
- **Consider only matched pairs where both systems have a 'best' retrieval.**
 - *Qual_Temp_Profile_Bot = 0 or 1 for AIRS.*
 - *No error flagging for AMSR-E.*
- **Look at mean climatologies**
 - *Many matches will have good AMSR-E but poorer AIRS retrieval.*



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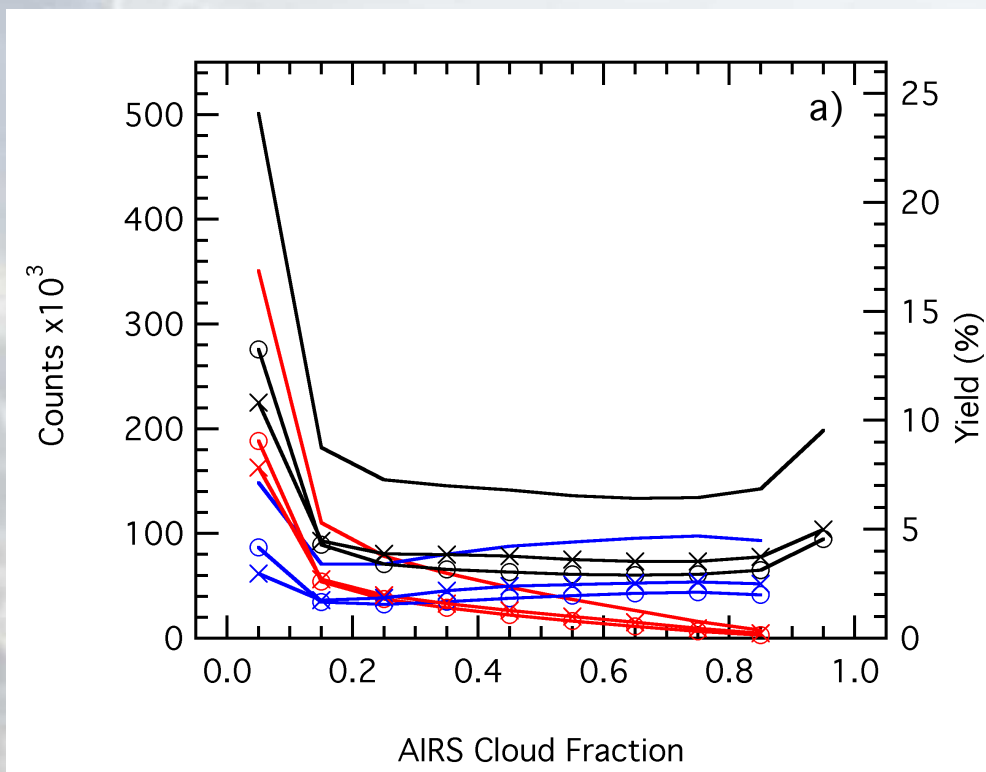
Exploiting higher AMSR-E yields to diagnose AIRS sampling biases.

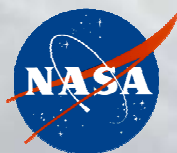
AIRS IR retrieval yields (red) decrease strongly with cloud fraction.

AIRS MW yields (blue) more constant with cloud amount.

AMSR-E yields (black = red + blue) not strong function of cloud amount.

AMSR-E and AIRS yields





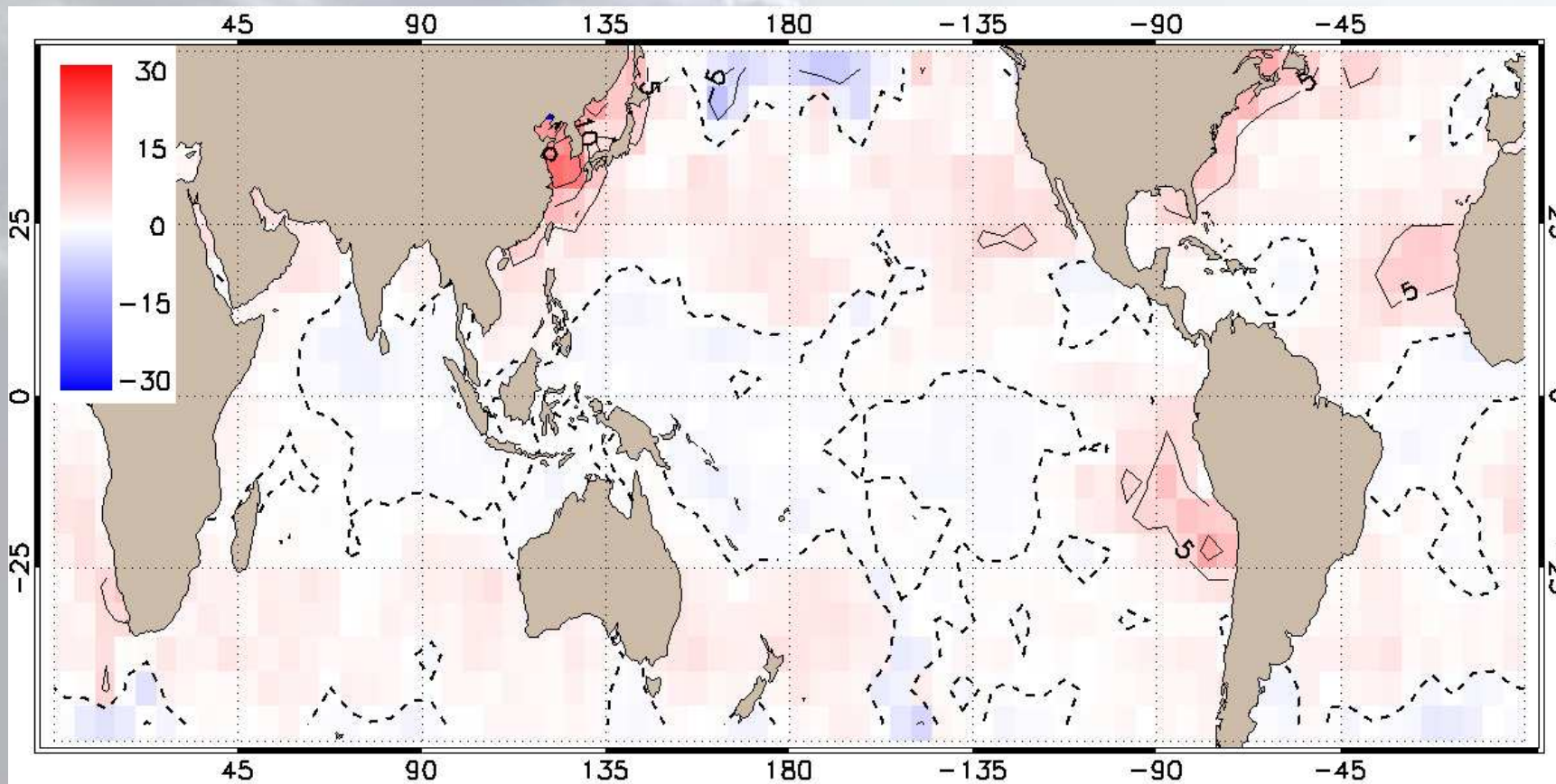
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AIRS/AMSU/HSB and AMSR-E total water vapor

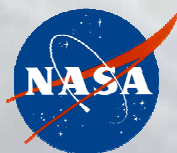
Good agreement for *matched* observations with HSB

Consistency to ~5 % implies both systems work well.



$100 \times (\langle \text{AIRS} \rangle - \langle \text{AMSR-E} \rangle) / \langle \text{AMSR-E} \rangle$; $\langle \rangle$ == Time Mean

26 Dec 02 - 9 Jan 03



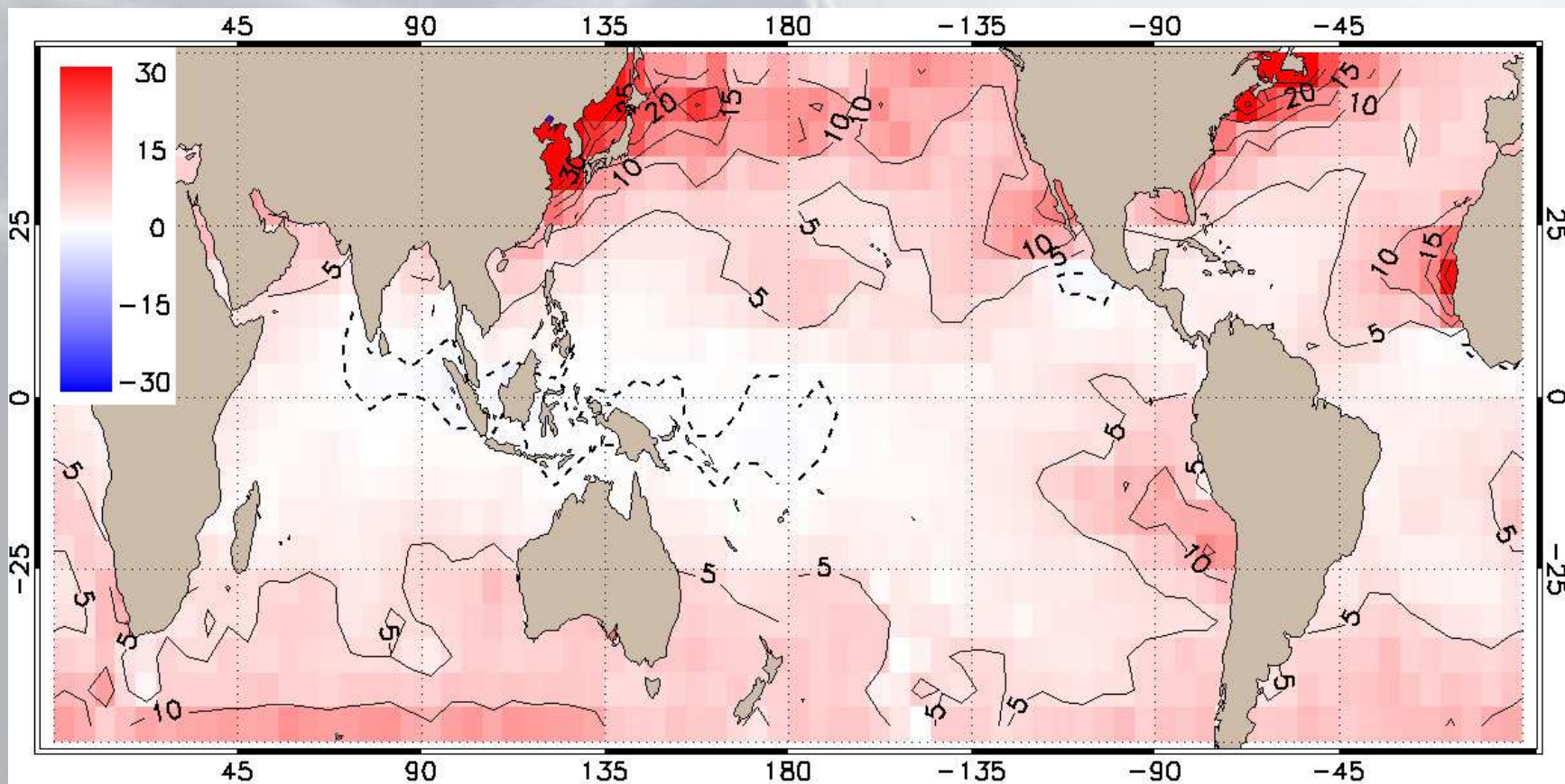
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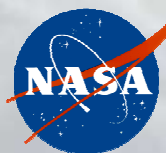
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AIRS/AMSU/HSB and AMSR-E total water vapor

Not so good for *matched* observations with AMSU only

Much larger biases in cold air outbreaks than previous figure.

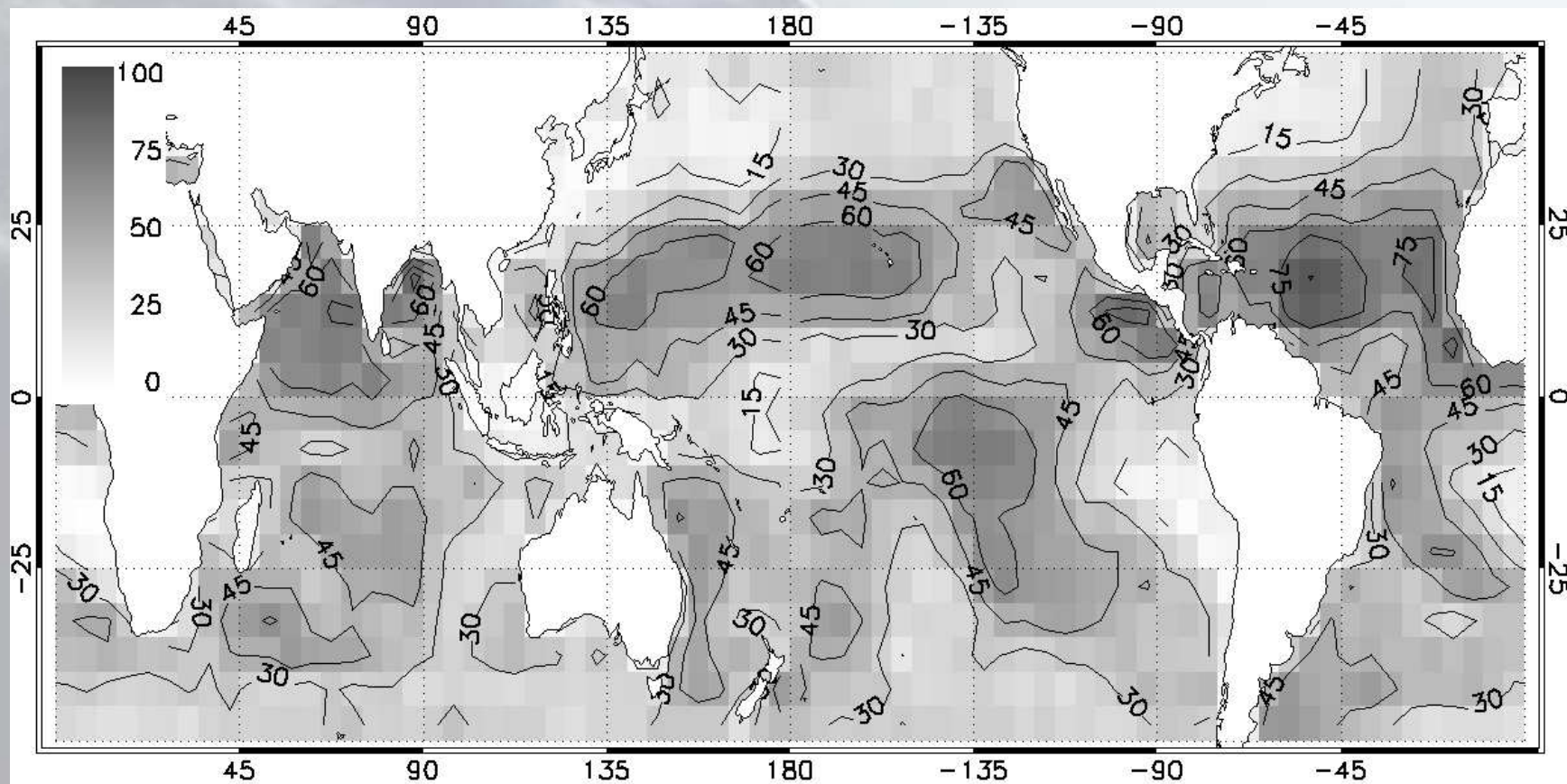




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AIRS retrieval yield varies with location



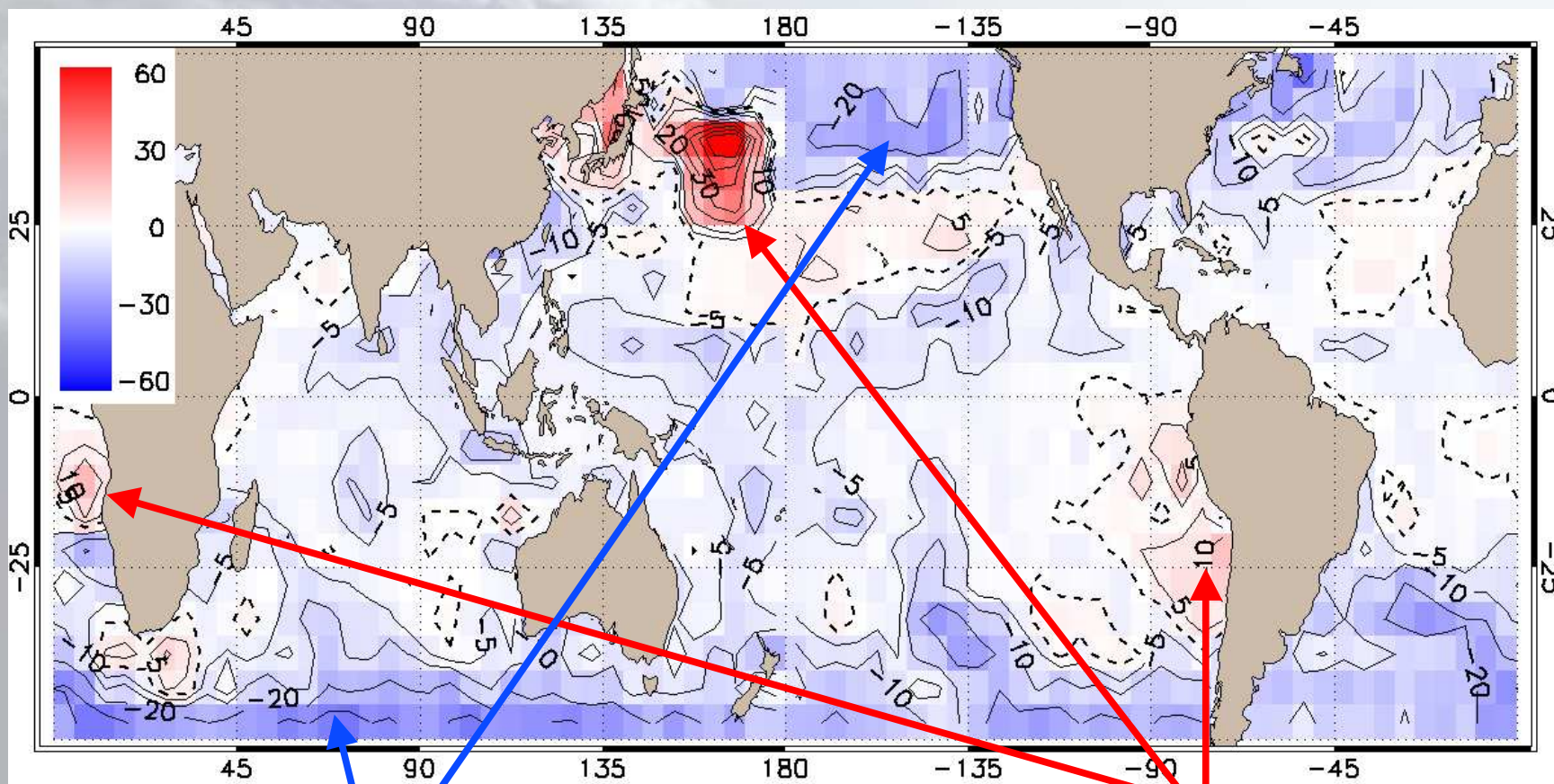


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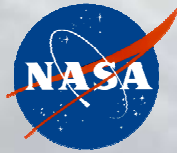
Full AIRS & AMSR-E climatologies

AIRS can be drier OR wetter because of cloud-induced sampling effects



**AIRS climatology is
drier than AMSR-E at high latitudes**

**AIRS climatology is
wetter than AMSR-E in stratus regions**



Possible AIRS sampling biases in water vapor using AMSR-E as a diagnostic

<u>Climate Regime</u>	<u>AIRS-AMSR-E total bias (%)</u>	<u>AIRS Full Retrieval yields (%)</u>
Mid-latitude storm belts	-10 to -30	15 to 30
Cold air outbreaks	+30 to +70	<15
Subtropical stratus	-5 to -15	<15
Trade wind cumulus	-5 to +5	50 to 90
Tropical deep convection	-5 to +5	15 to 50

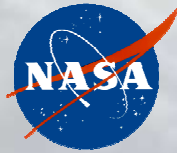
Lesson 1: AIRS biases are small in most of the tropics.

Lesson 2: AIRS biases can be positive or negative.

- Positive in midlatitude storms where clouds mean more total water
- Negative in stratus where clouds mean less total water.

Lesson 3: Poor AIRS retrieval yield does not necessarily mean a sampling bias.

- Warm Pool yields are ~50%, but AMSR-E-AIRS biases are small.



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AIRS - AMSR-E Comparison: *Summary and Conclusions*

- Biases in their climatologies for two reasons:
 1. Slight *moist* bias in AIRS due to loss of HSB
 2. *Cloud effects can lead to wet or dry sampling biases in AIRS*