National Aeronautics and
Space Administration

**Jet Propulsion Laboratory**
California Institute of Technology
Pasadena, California

*Atmospheric Infrared Sounder*

# Using AIRS to for the evaluation of AMSU

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**We see large trends in the AIRS L2 which are potentially very interesting for climate.**

**The radiometric trend in the AIRS IR is about 5 mK/yr.**

**AMSU channel are used in the L2 retrieval**

**The AMSU channels are empirically bias and scan angle corrected**

**Could AMSU trend artifacts contribute to the L2 trends?**

**We use AIRS /AMSU channel pairs with equivalent weighting functions to evaluate this.**

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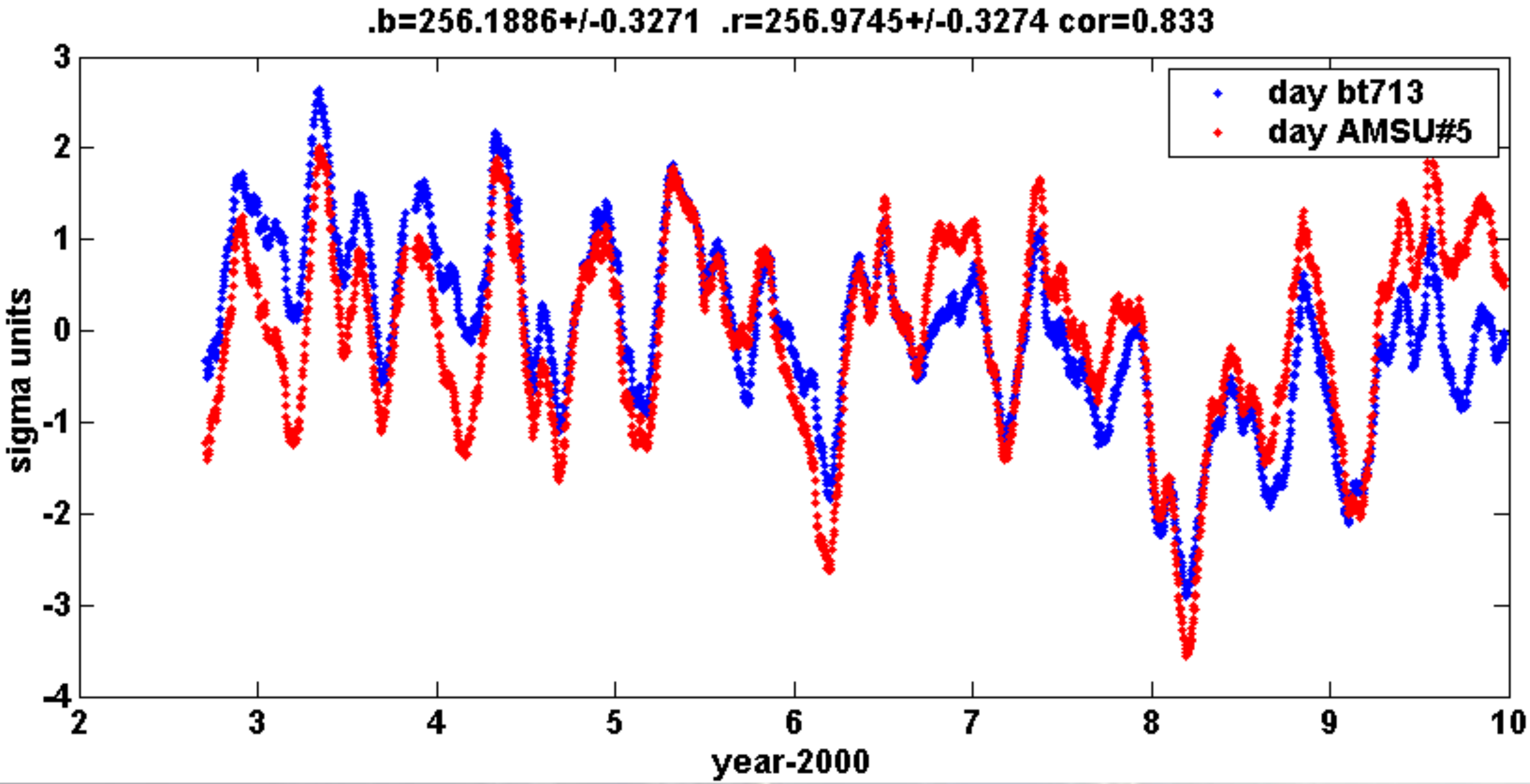
# AIRS bt712.74 and AMSU#5 have equivalent weighting functions with peak near 400 hPa




Daily mean of 10,000 AIRS clear tropoical ocean footprints from the ACDS

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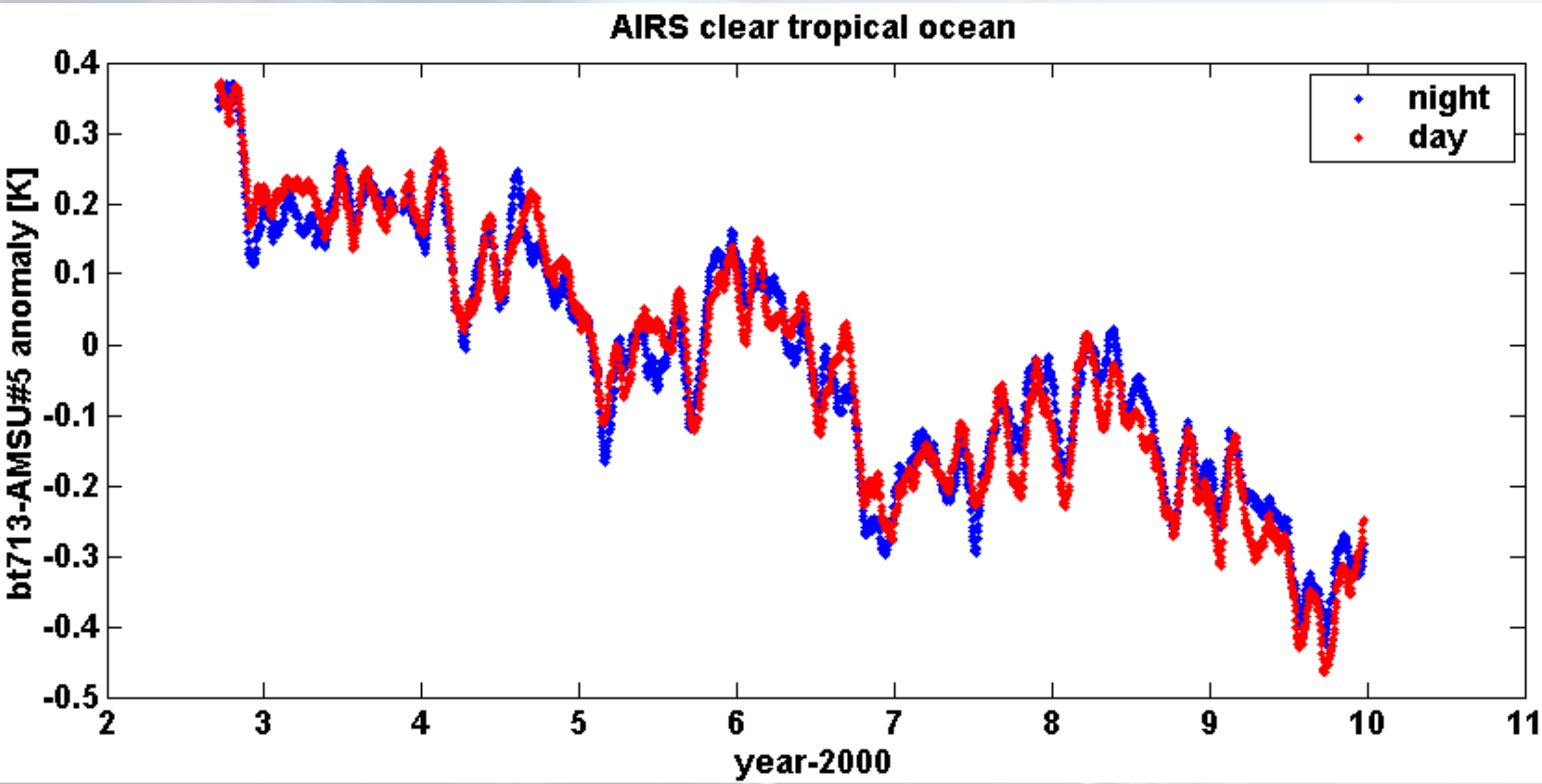


**The difference between AIRS and AMSU5 has a trend of -77±5 mK/yr**

# The -77 mK/yr trend in the difference between AIRS and AMSU5 can be explained

The SRF centroids of all AIRS channels are shifting by 0.1 um/yr in focal plane coordinates. The radiometric effect of this shift depends on the spectral gradient at the position of the SRF. For bt713 it causes a trend of -8 mK/yr.

The CO2 mixing ratio increases at the rate of 2.1±0.1 ppmv/yr.
As the CO2 increases in the troposphere, the weighting function of bt713 shifts higher, i.e. colder, since the lapse rate is about negative.
For a tropical atmosphere the bt713 sensitivity is -38.7 mK/ppmv.
We should expect a trend due to co2 of -81±3 mK/yr.
The trend in AIRS channels is of the order of +5±4 mK/yr
The expected trend corrected for the SRF shift is -81+8-5 =-78±5 mK/yr.

The trend in the difference between AIRS and AMSU#5
is explained within 5 mK/yr

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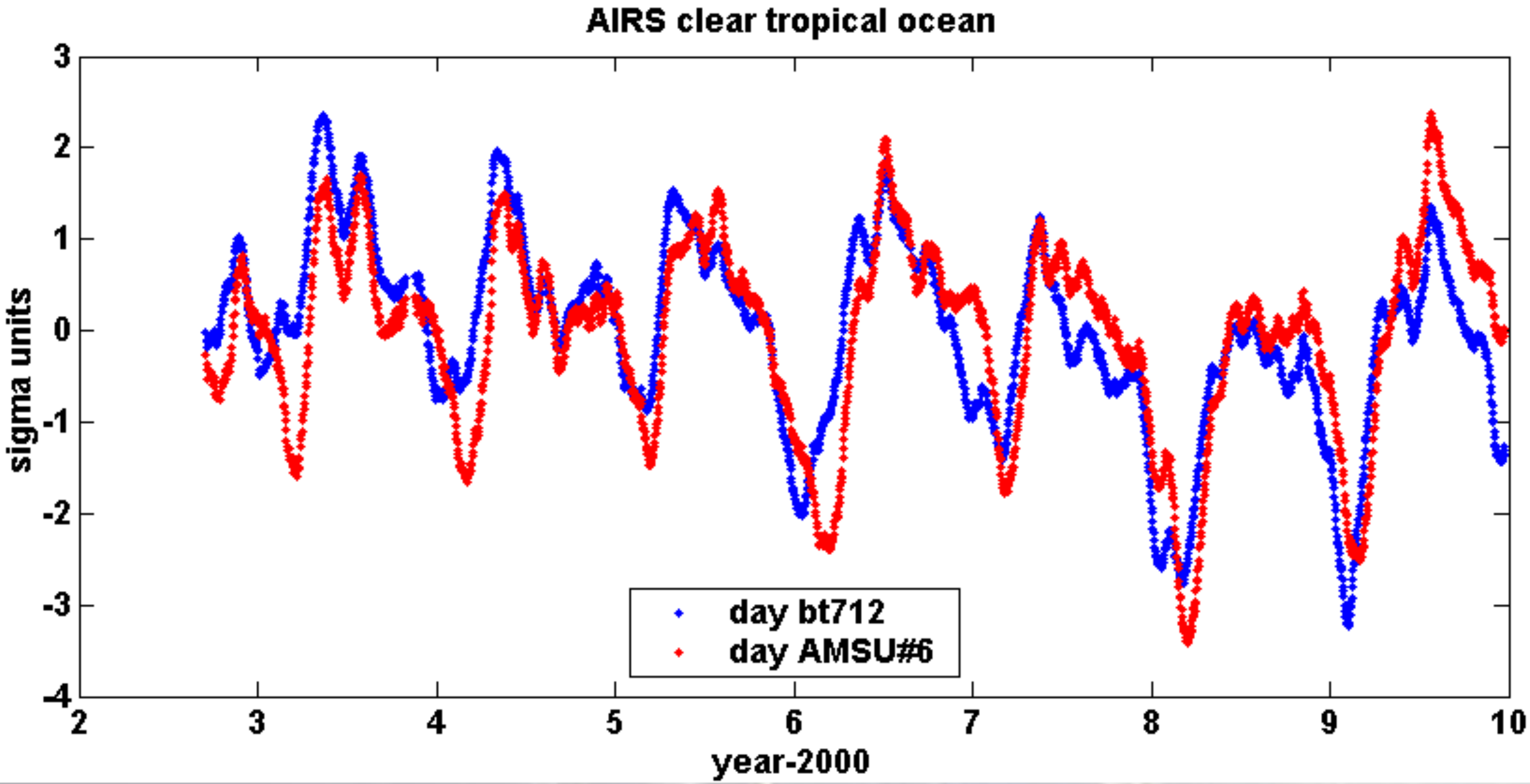
# AIRS 712.0 and AMSU#6 have equivalent weighting functions with peak near 300 hPa




**The difference between AIRS and AMSU6 has a trend of -52±4 mK/yr**

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## The difference between AIRS and AMSU6 has a trend of -52±4 mK/yr

The SRF centroids of all AIRS channels are shifting by 0.1 um/yr in focal plane coordinates. The radiometric effect of this shift depends on the spectral gradient at the position of the SRF. For bt712 it causes a trend of +8 mK/yr.

The CO2 mixing ratio increases at the rate of 2.1±0.1 ppmv/yr.
As the CO2 increases in the troposphere, the weighting function of bt712 shifts higher, i.e. colder, since the lapse rate is about negative.
For a tropical atmosphere the bt712 sensitivity is -33.4 mK/ppmv
We should expect a trend due to co2 of -70±3 mK/yr.
The trend in AIRS channels is of the order of +5±4 mK/yr

The expected trend is -70+8 +5 ±5 = -57±5 mK/yr.

The trend in the difference between AIRS and AMSU#6
Is explained within 5 mK/yr

Note that AMSU#5 and AMSU#6 use different receivers.

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# Summary

The AIRS radiometric and spectral stability can be measured directly

The AMSU radiometric and spectral stability have to be inferred indirectly

We use AIRS to evaluate the stability of AMSU#5 and AMSU#6

An AIRS trend of +5 mK/yr, the SRF shift at the rate of 0.1um/yr, and the effect of the increase in co2 explain the trend in the difference between AMSU and AIRS within 5 mK/yr.

For climate applications a trend of 10 mK/yr or less is required.
Use of L2 and/or AMSU for climate have to include the uncertainty in the AIRS and AMSU instrumental trends.