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# Validation of AIRS-V6 CH<sub>4</sub> Product and Some New Results

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AIRS Spring Meeting  
May 21, 2013



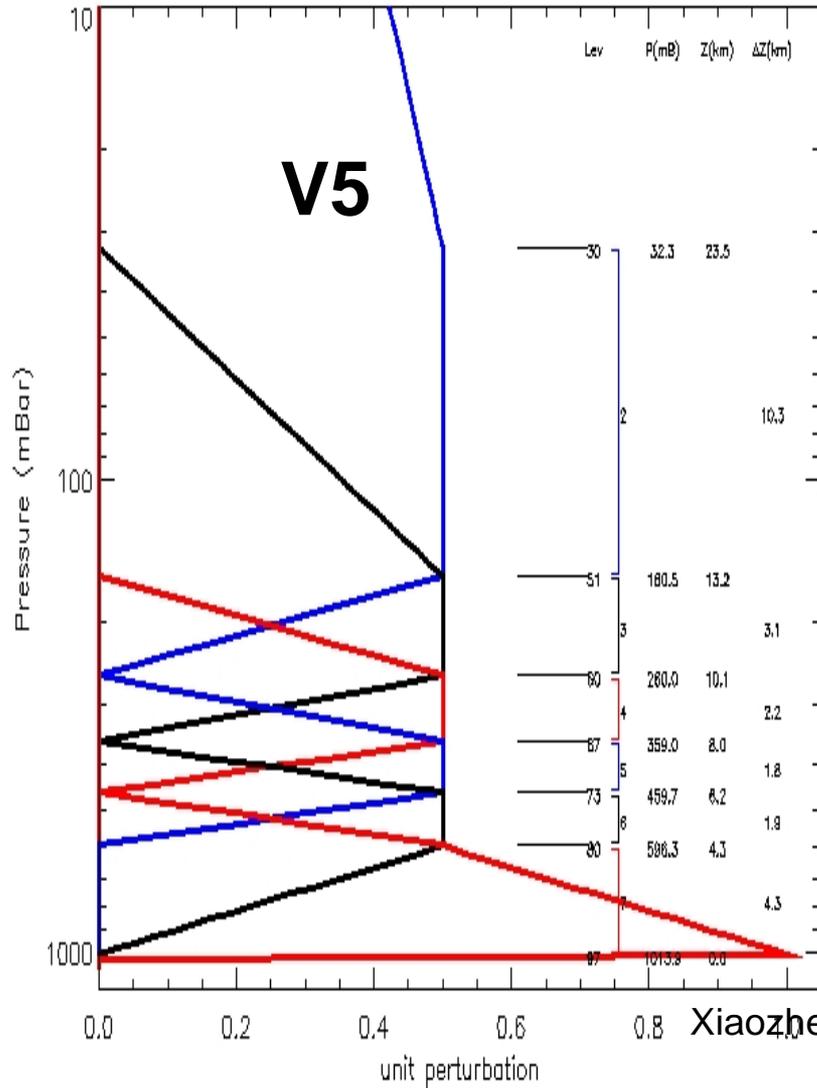
# Outline

- **Validation of AIRS-V6 CH<sub>4</sub> using HIPPO Aircraft measurement; More validation need to be done late**
- **More improvement after new tuning and better N<sub>2</sub>O first guess is possible;**
- **Arctic CH<sub>4</sub> is very important. We can catch CH<sub>4</sub> depletion during stratospheric intrusion event (GRL paper)**
- **Optimization to current algorithm and better quality control need to be done for generating a product from AIRS (plus IASI/CrIS) for climate change study. A proposal was just submitted.**
- **Summary**

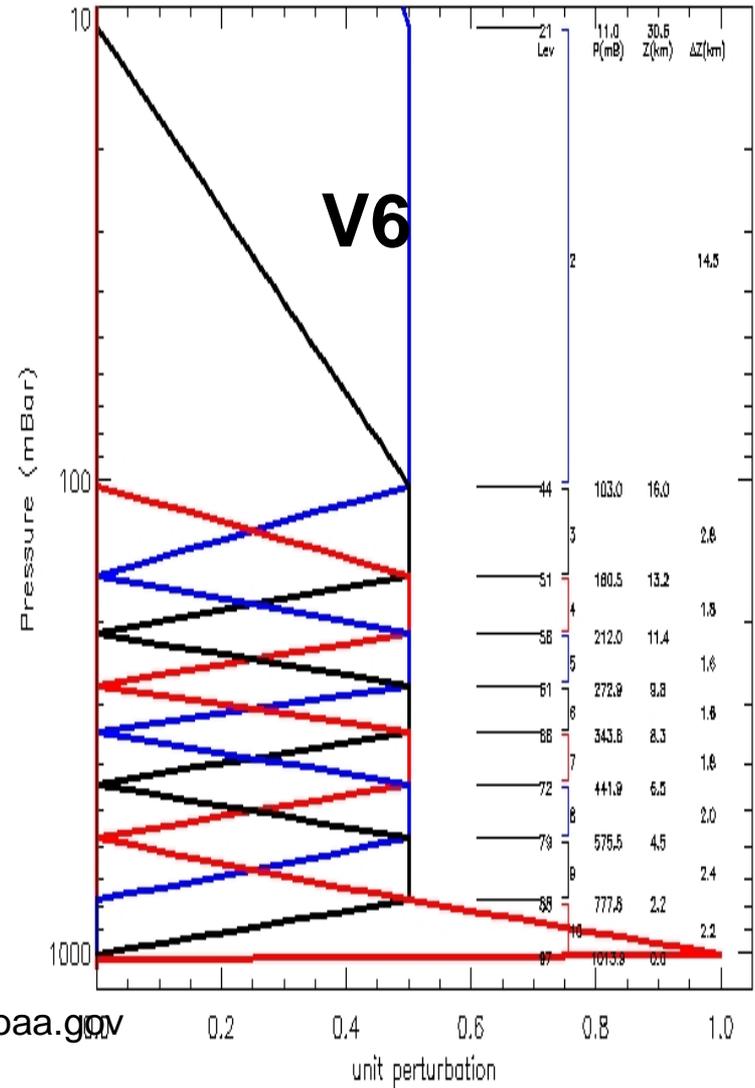


# More Retrieval Layers in V6

CH4 Retrieval Functions



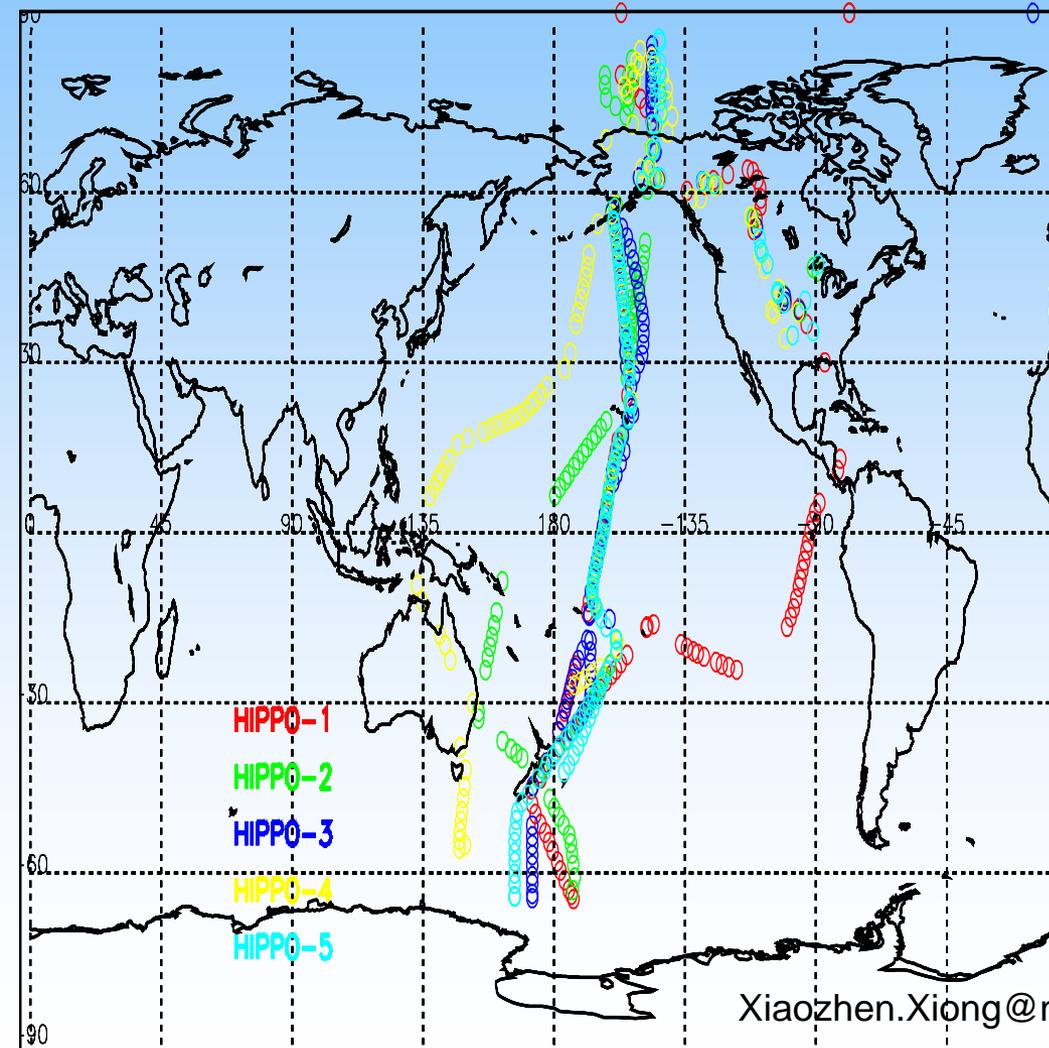
CH4 Retrieval Functions



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# Validation to AIRS-V6

HIPPO-1, -2, -3, -4, -5

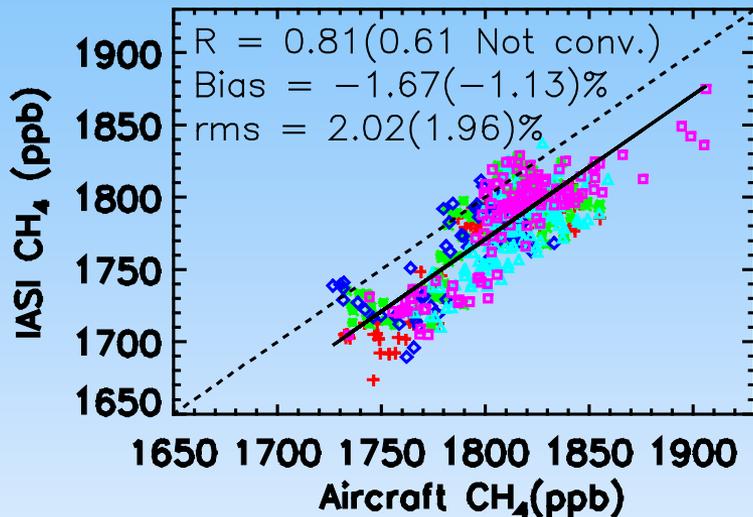


1. Within 200 km
2. Same day
3. ACTM model data are used to extrapolate the Aircraft measurement
4. Averaging Kernels are applied

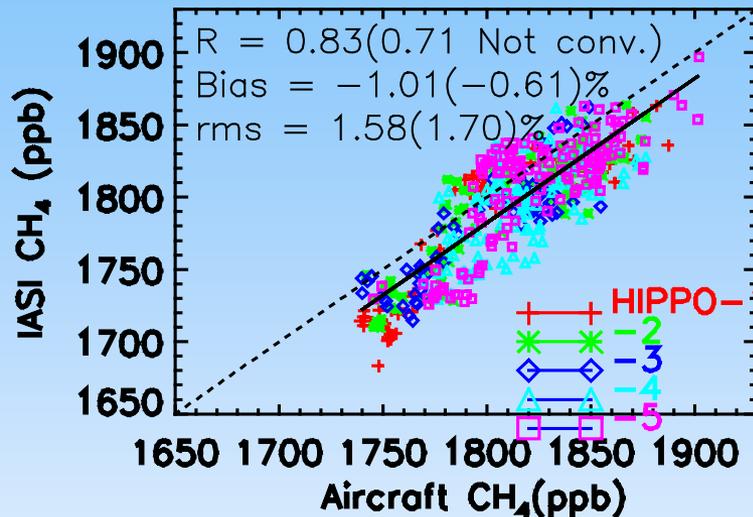


# AIRS-V6 CH<sub>4</sub> vs Aircraft Measurement

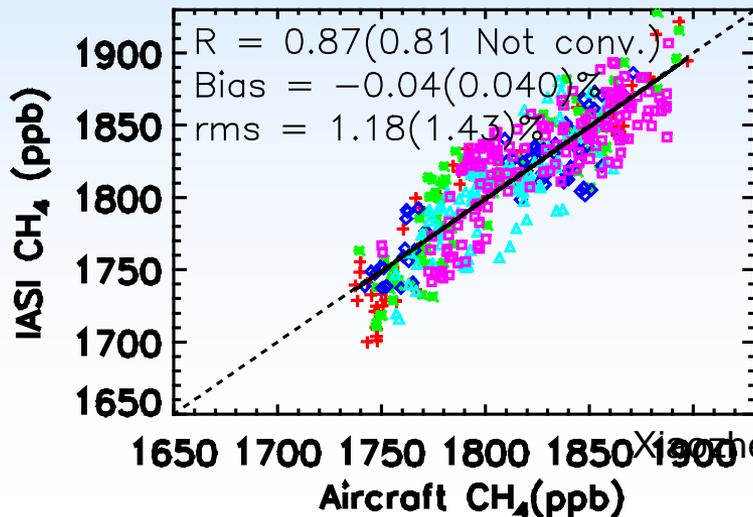
300–374 hPa



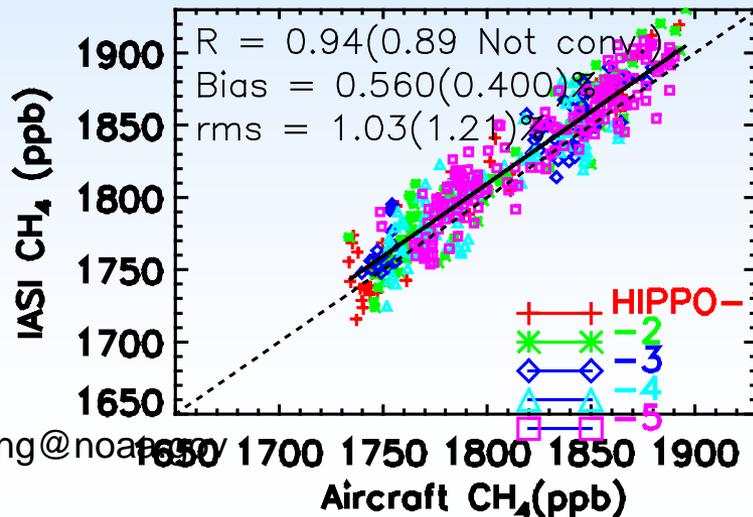
374–477 hPa



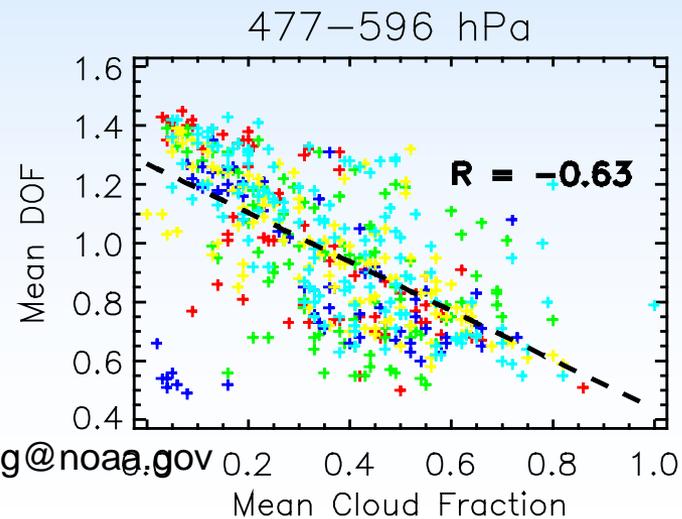
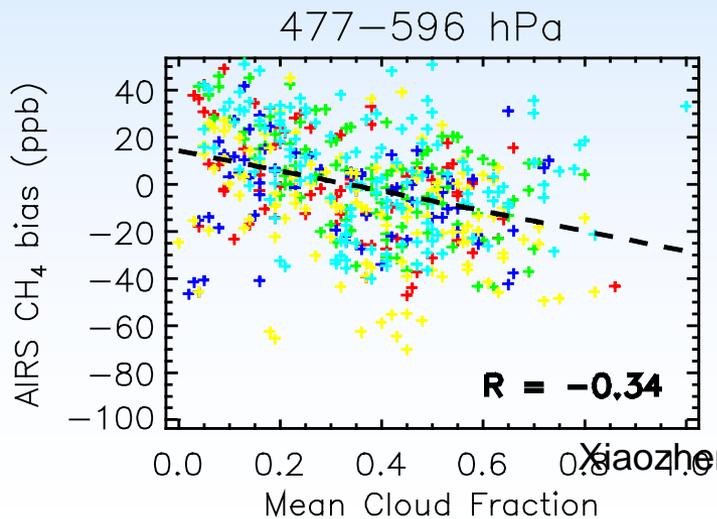
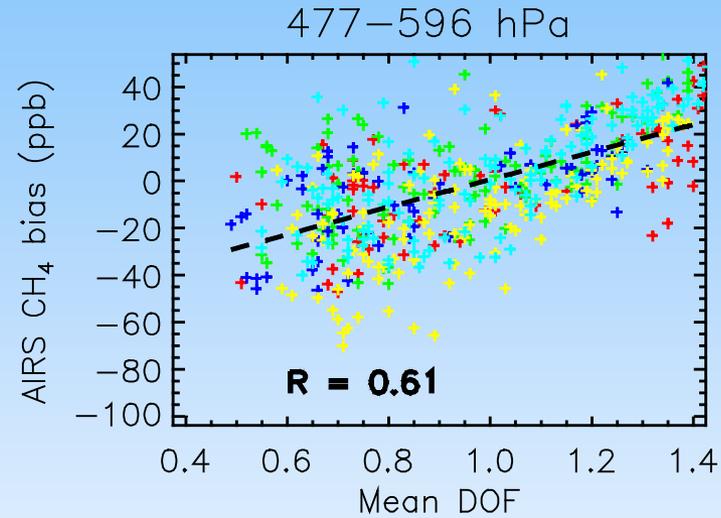
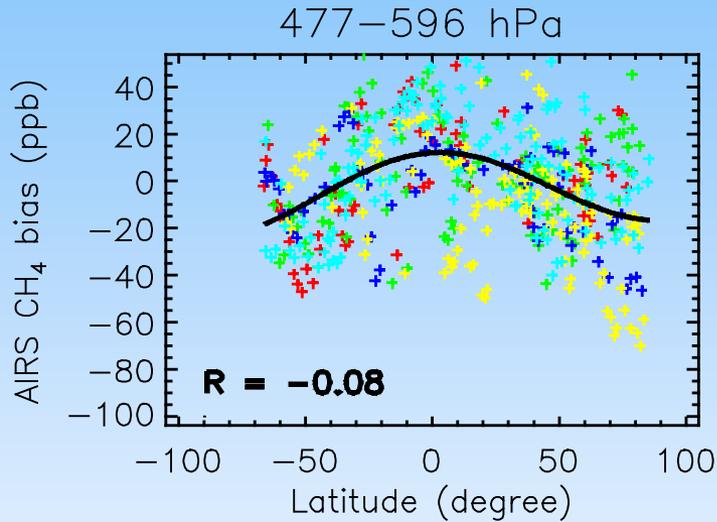
477–596 hPa



596–753 hPa



# Error at 477-596 hPa vs latitude, Cloud Fraction and DOF





# More validation will be done in the future

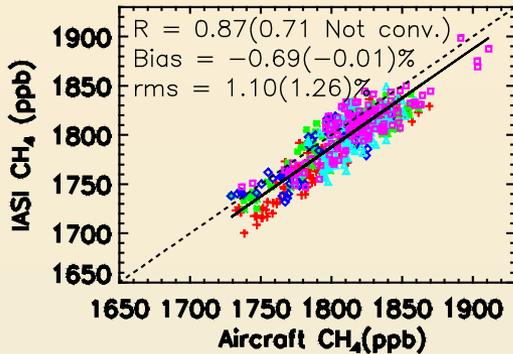
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Aircraft measurements used include

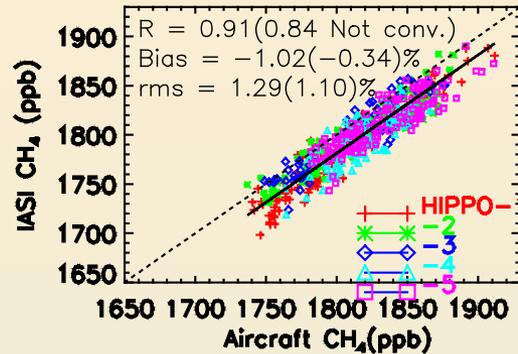
1. Aircrafts measurements from NOAA/ESRL/GMD
2. Intex-A (2004), -B(2006)
3. START08(2008)
4. ARCTAS(2008)
5. Any other campaign data

# Recent Improvements (in V5.9)

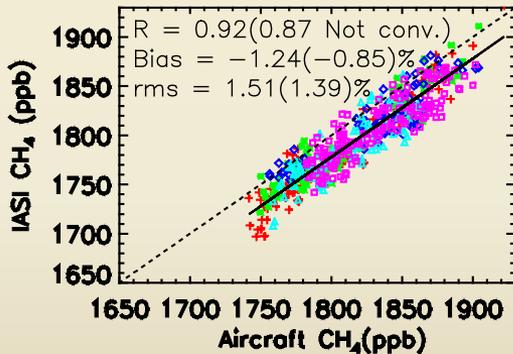
300–374 hPa



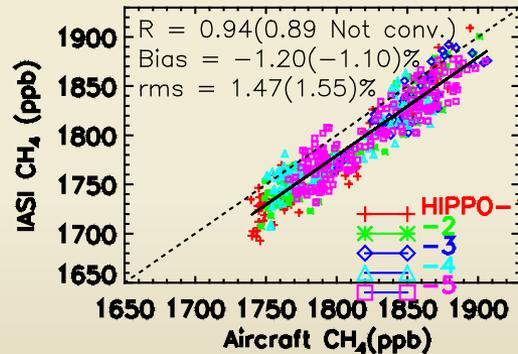
374–477 hPa



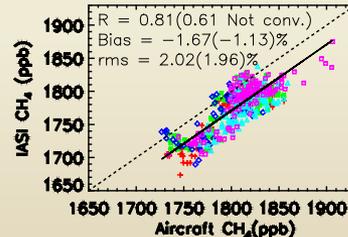
477–596 hPa



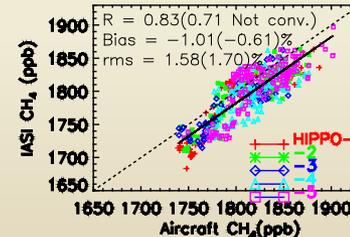
596–753 hPa



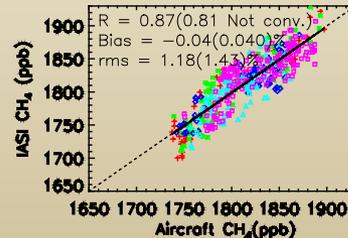
300–374 hPa



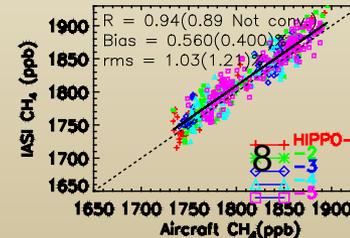
374–477 hPa



477–596 hPa

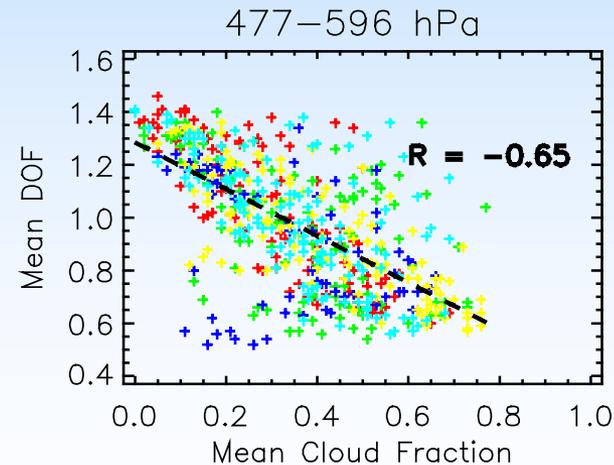
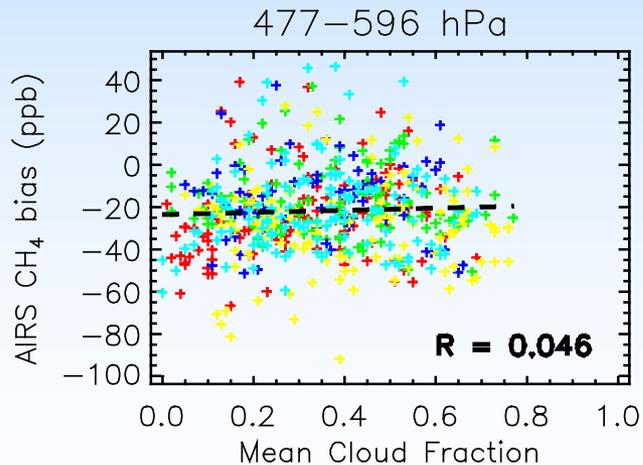
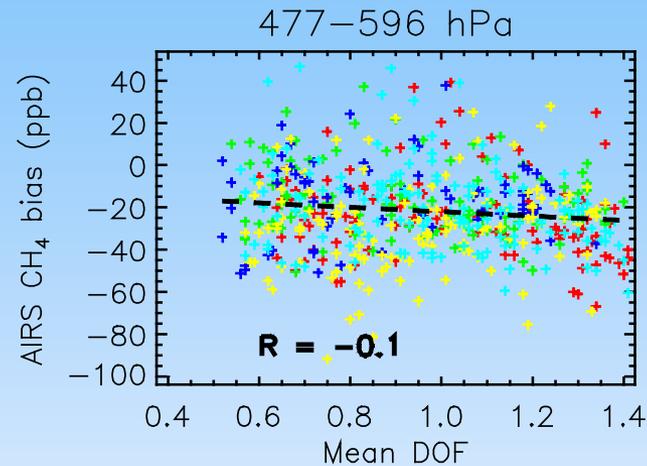
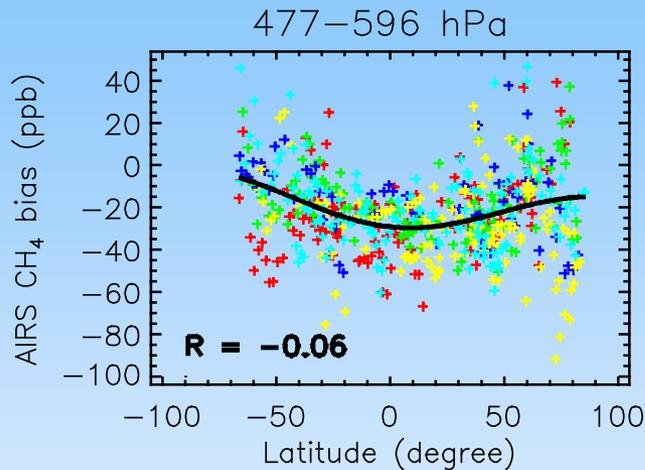


596–753 hPa





# Error after more improvement

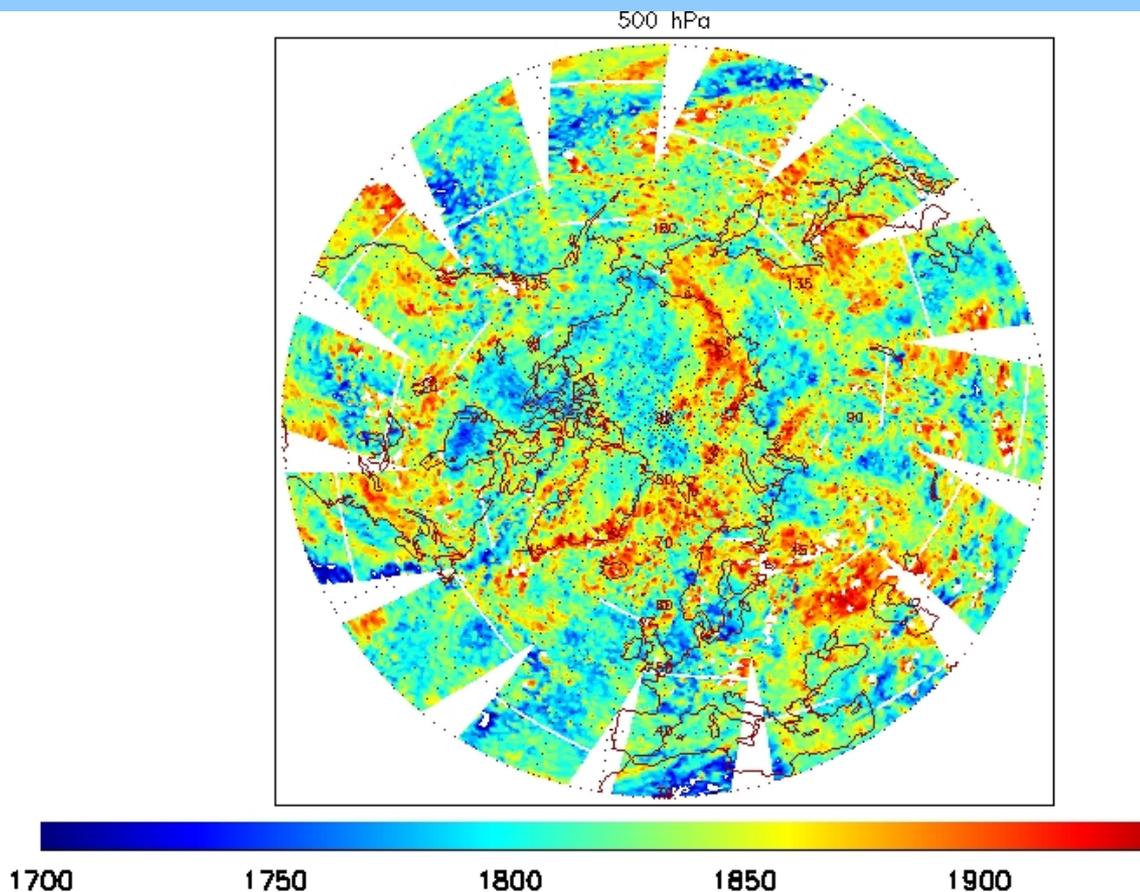




# CH<sub>4</sub> leakage in the Arctic



# To generate a long-term record for monitoring the polar CH<sub>4</sub> emission under the impact of global warming

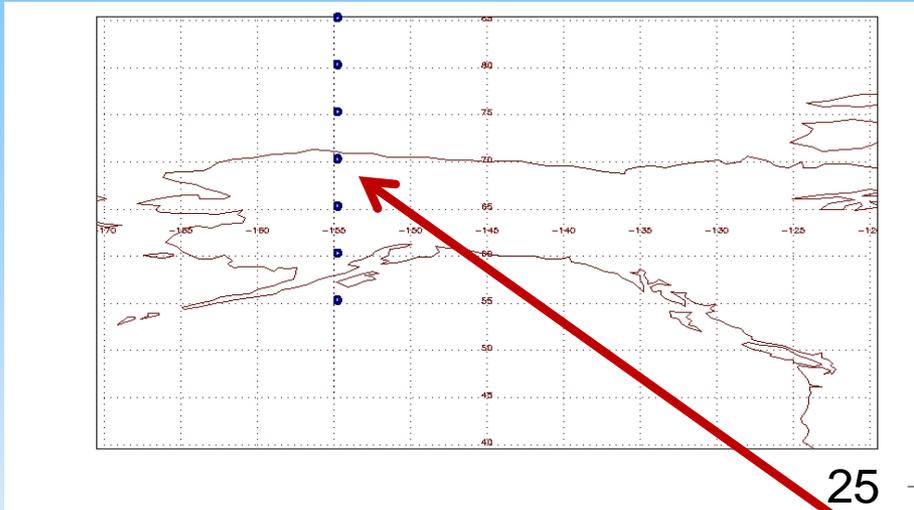


- Current algorithm is not optimized in the polar;
- Information of multiple observations per day has not been well used in L3 product;
- We are investigating to better characterize the retrieval in the polar and use better first guess

**Multiple observations from AIRS per day over the polar regions**

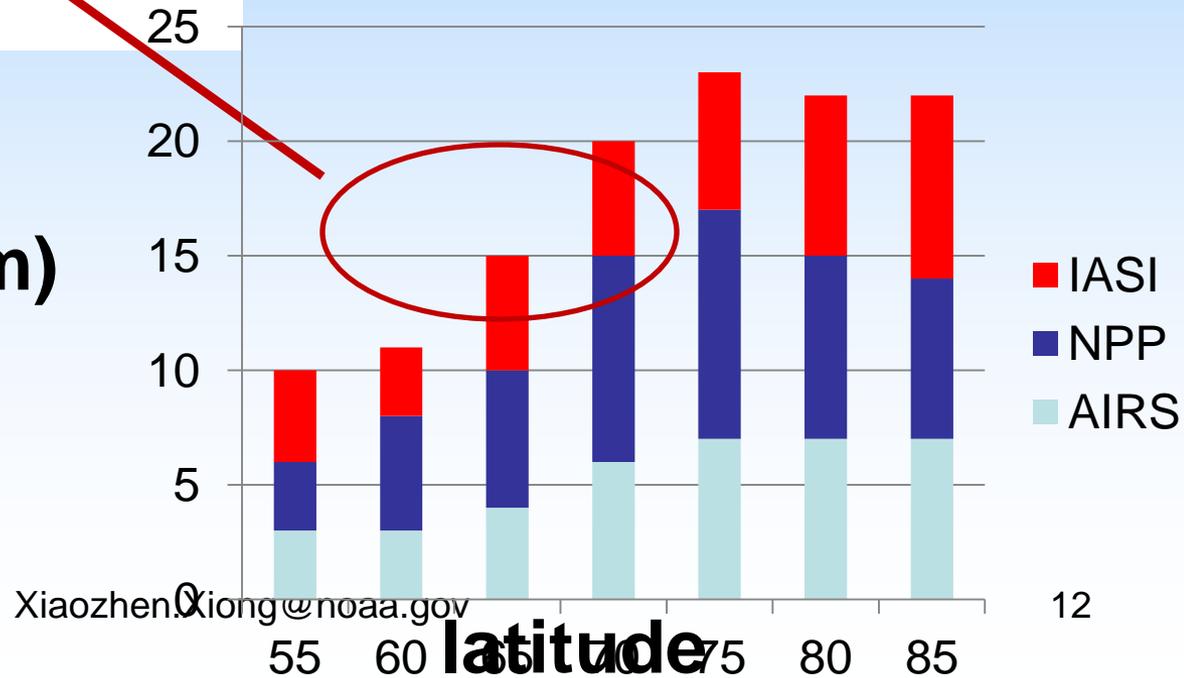
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# CH4 Observations over Alaska



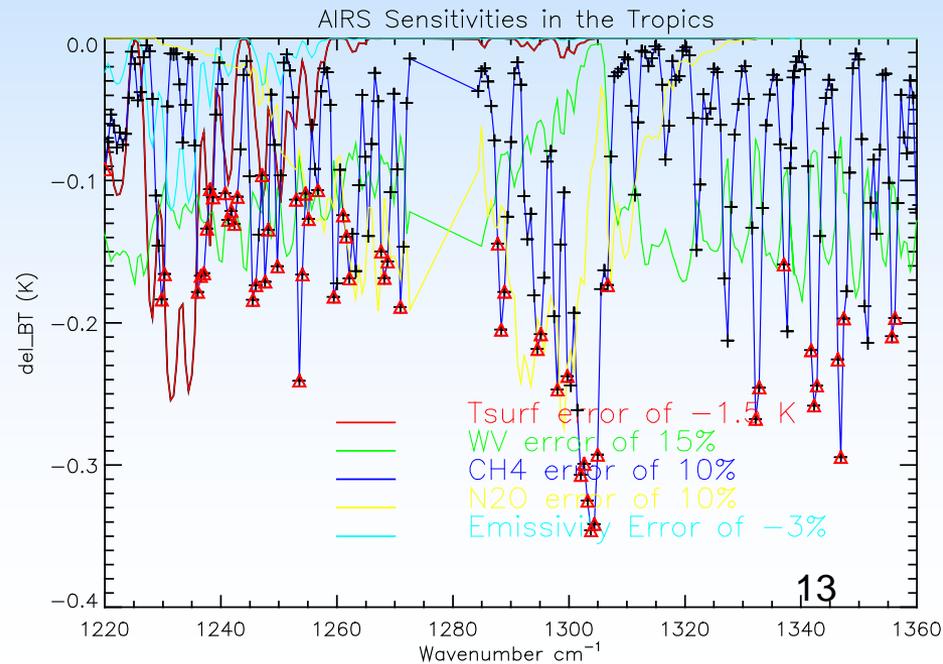
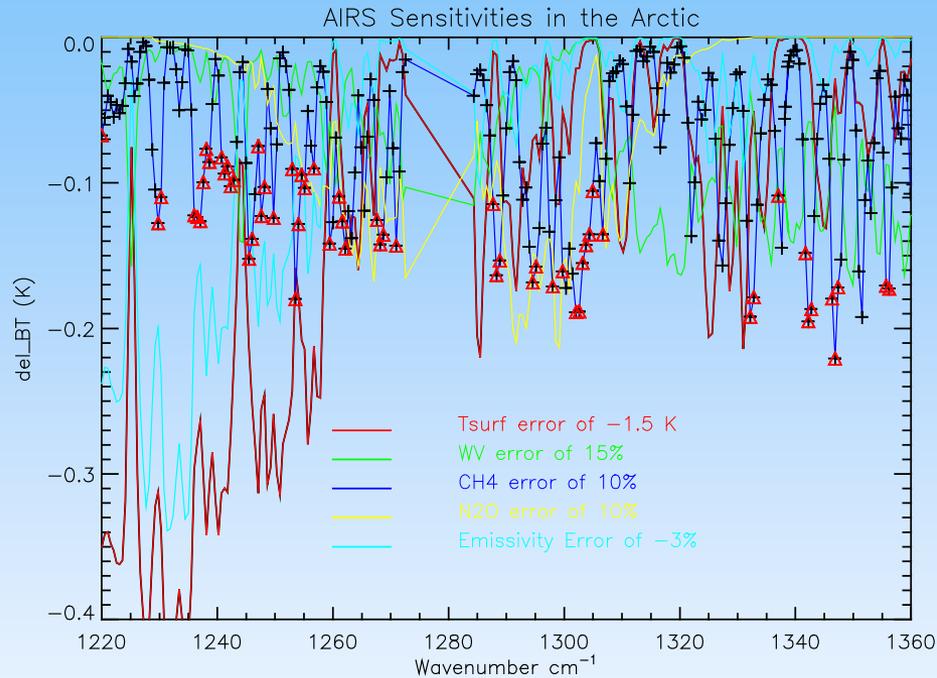
**CH4 release from wetland and thawing permafrost are very sensitive to global warming. Its trigger will be a disaster.**

**Times (within 100km)**

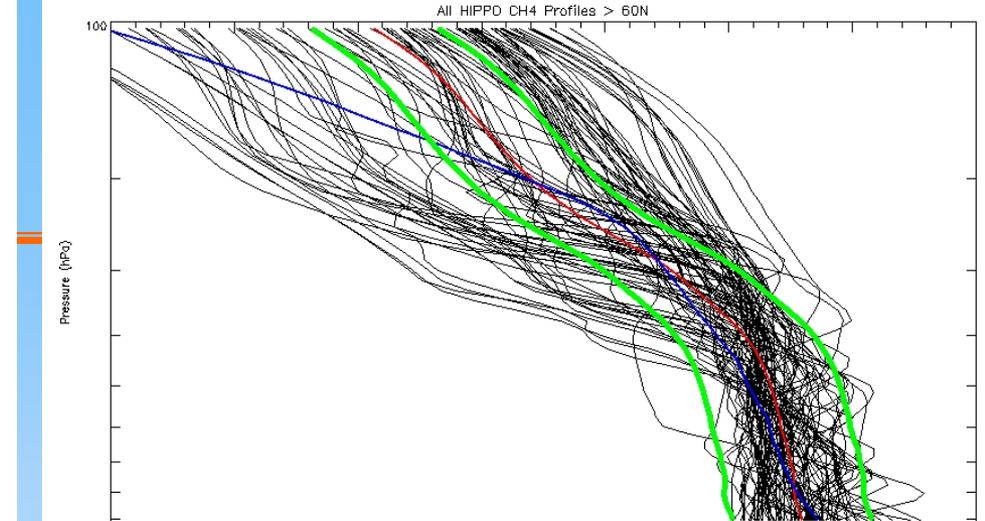
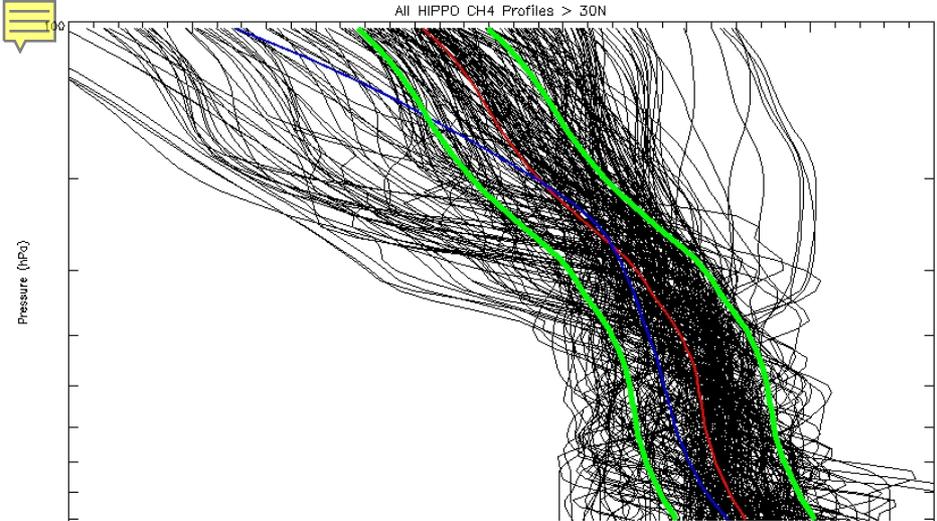


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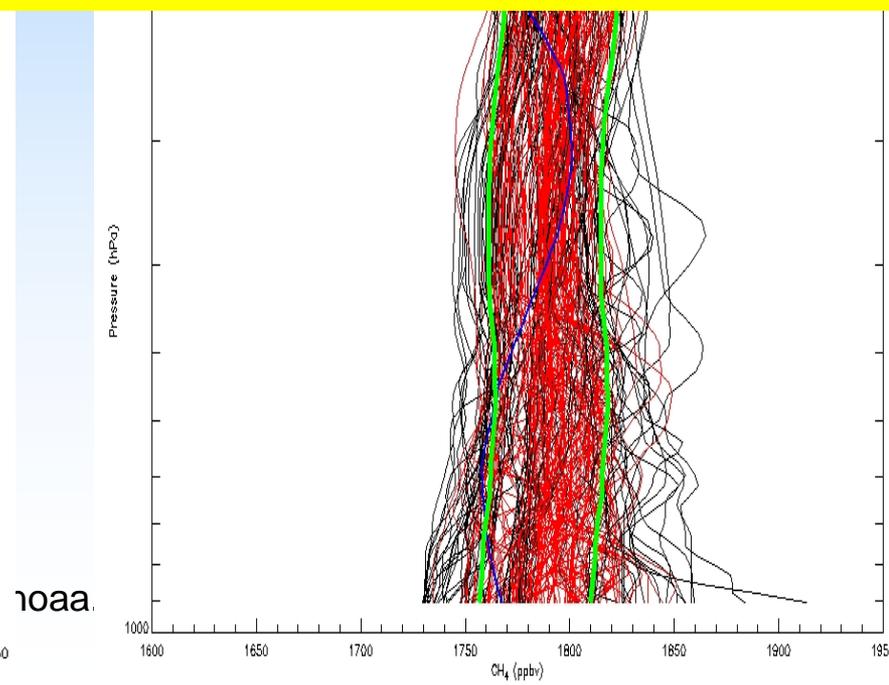
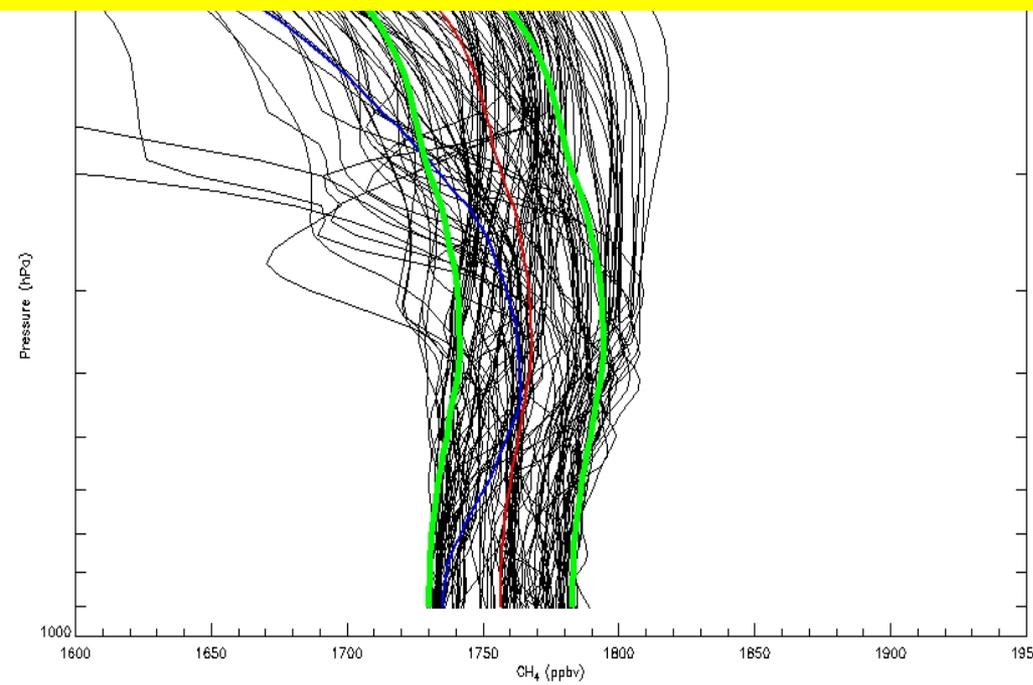
# Arctic is unique with low wv



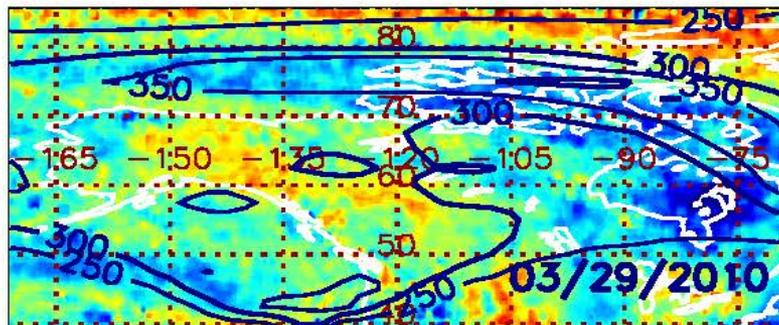
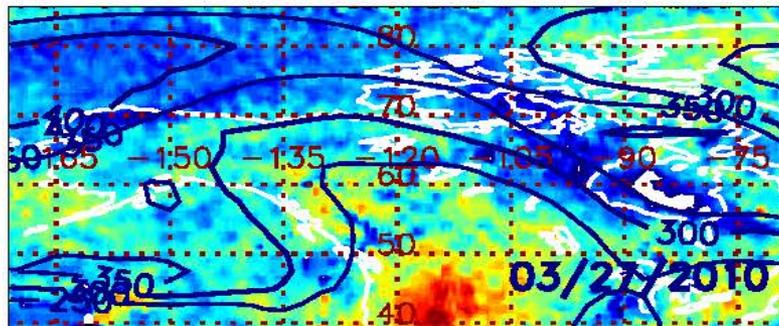
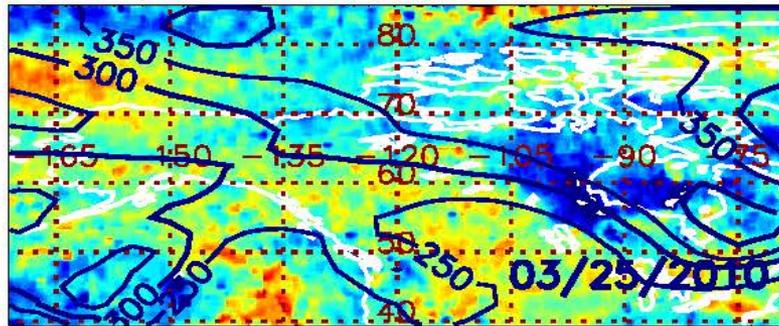
**Channels easily  
contaminated by surface**



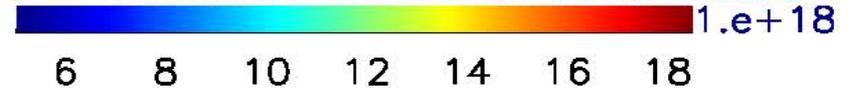
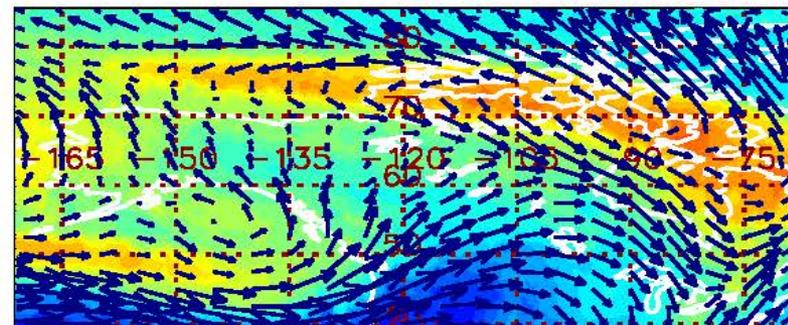
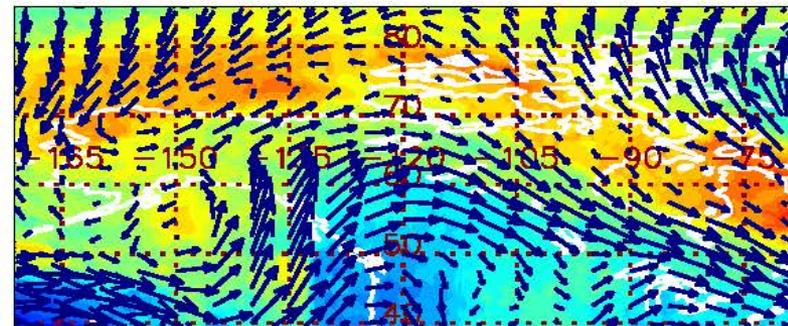
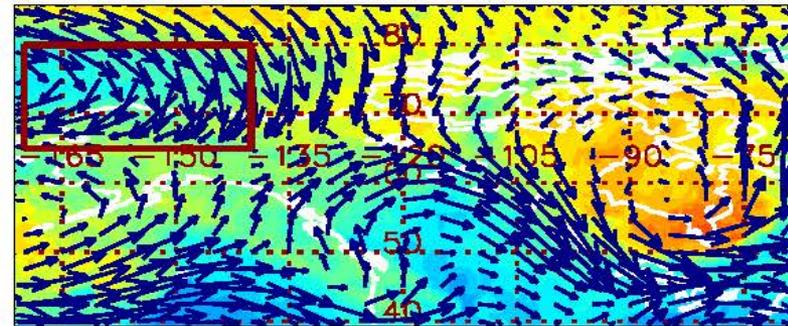
**Much larger variation of CH4 in the Arctic makes it more difficult in observation and validation**

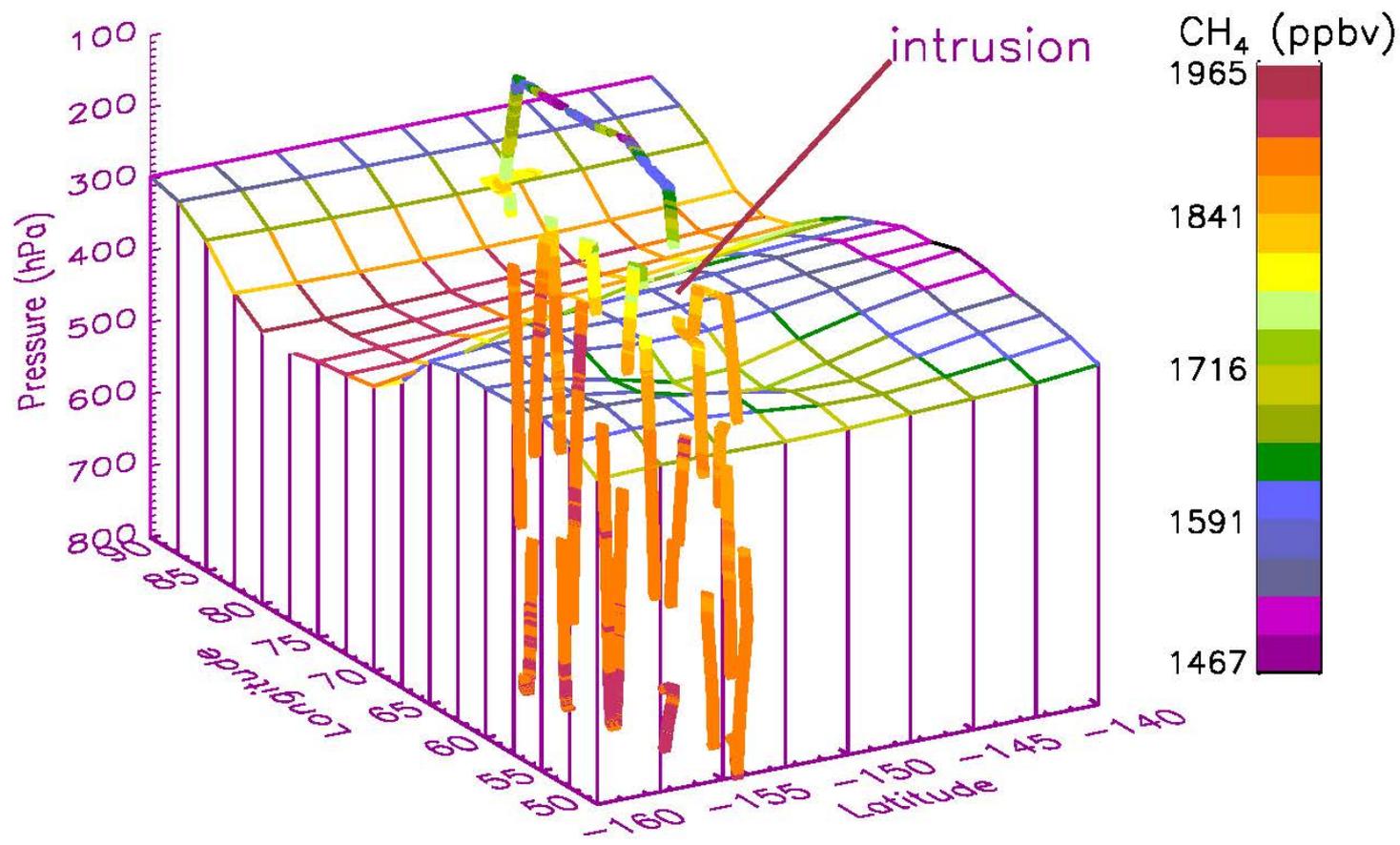


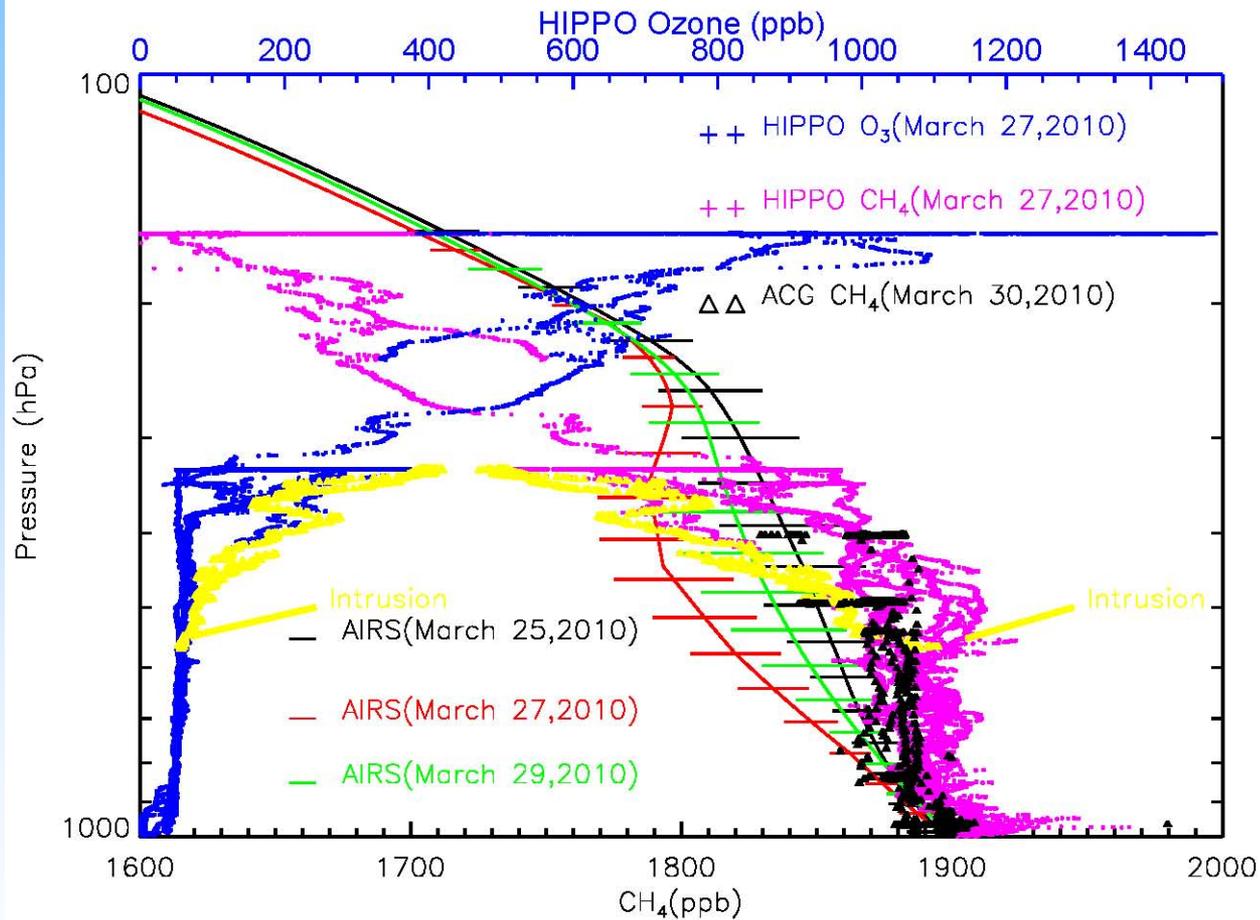
CH<sub>4</sub> at 407 hPa



Total Ozone









# Summary

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- 1. Validation to AIRS-V6 using HIPPO aircraft data has been done, and more validation is needed and will be done later.**
- 2. Results is as expected but have a larger bias, which call for more study on CH<sub>4</sub> spectroscopy; More improvement is encouraging.**
- 3. We can and should try to generate a dataset to monitor CH<sub>4</sub> variation under the impact of global warming. A proposal was just submitted to ROSE A28 Science of Terra and Aqua:**

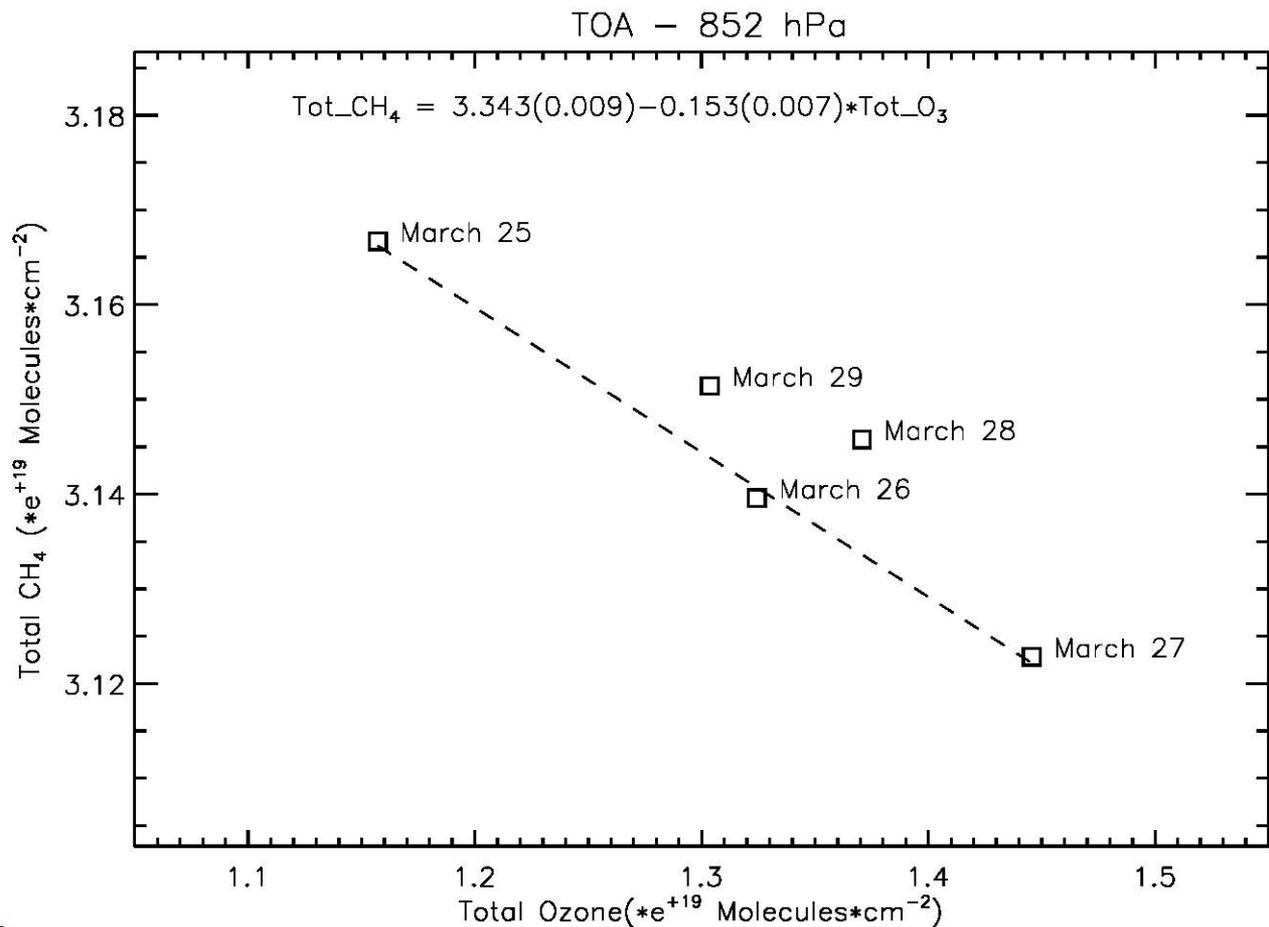
**Developing a Long-Term Mid-tropospheric CH<sub>4</sub> and N<sub>2</sub>O Concentration Dataset over the Circum-Arctic for Monitoring the Release of These Gases from Permafrost and Other Sources**



# Thank You

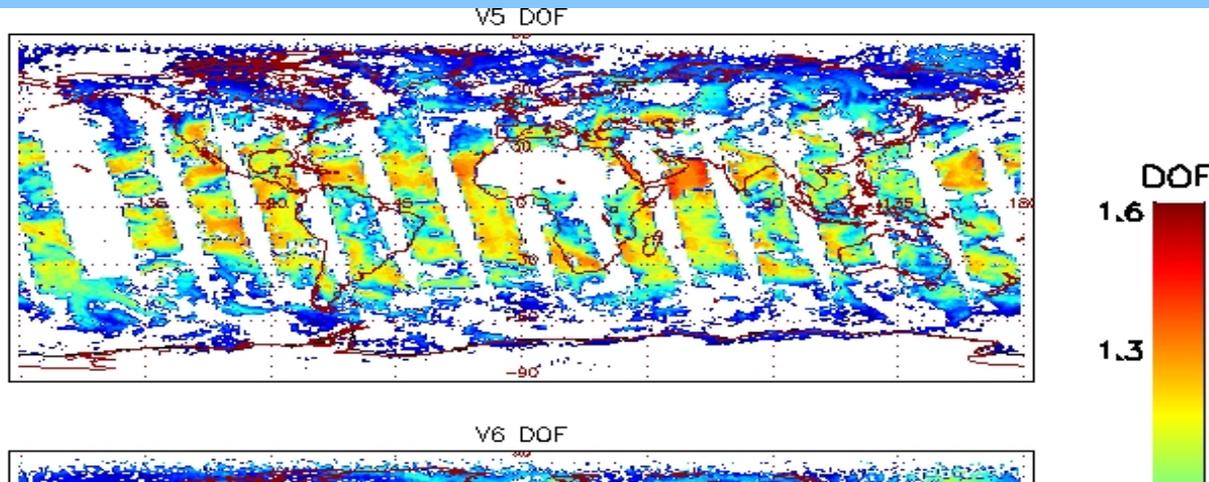
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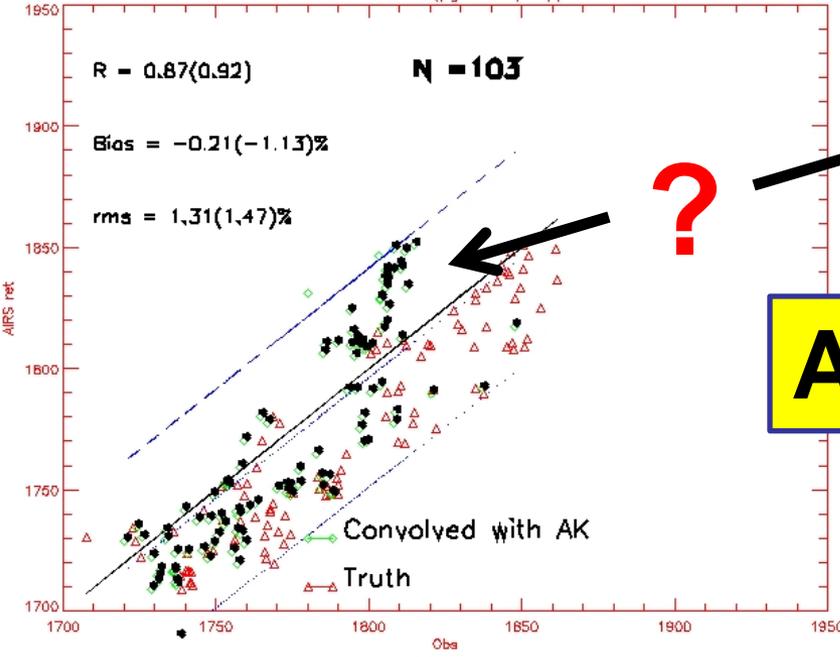


# AIRS V5 vs V6 (March 27, 2010)

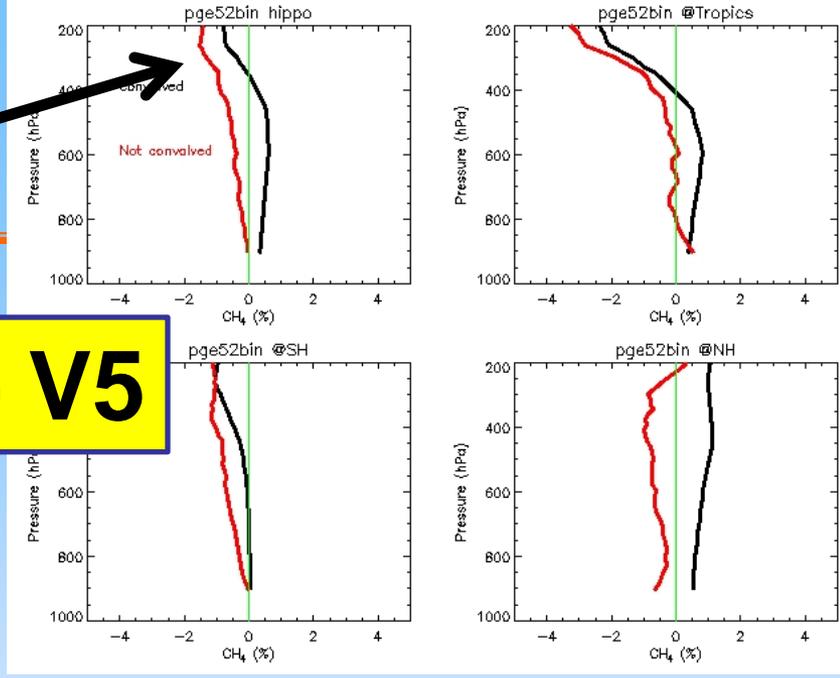


- V6-CH4 has improved QC;
- V6-CH4 has larger DOF than V5;
- V6-CH4 has a better sensitivity lower troposphere;
- Smaller bias and RMS error

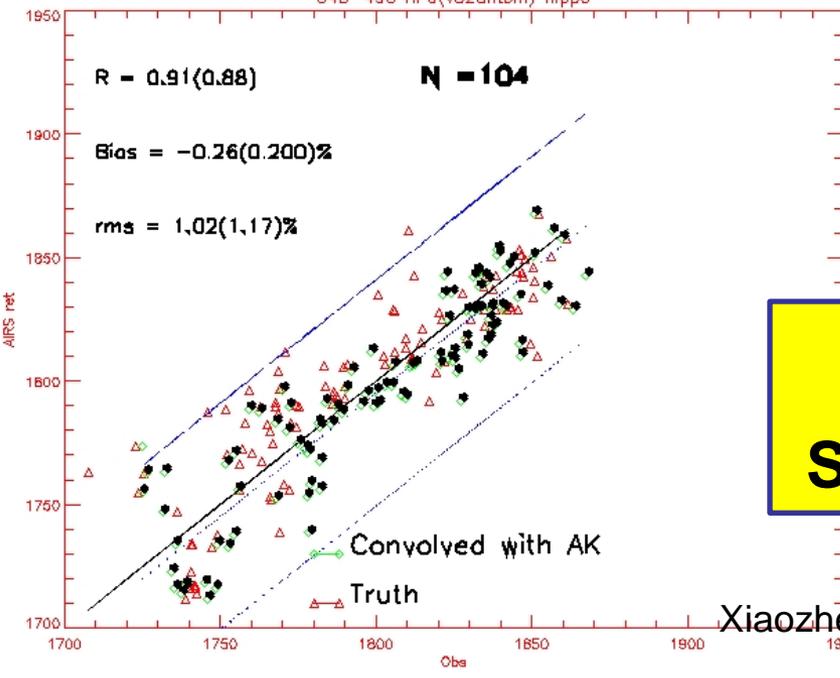
343-496 hPa(pge52bin) hippo



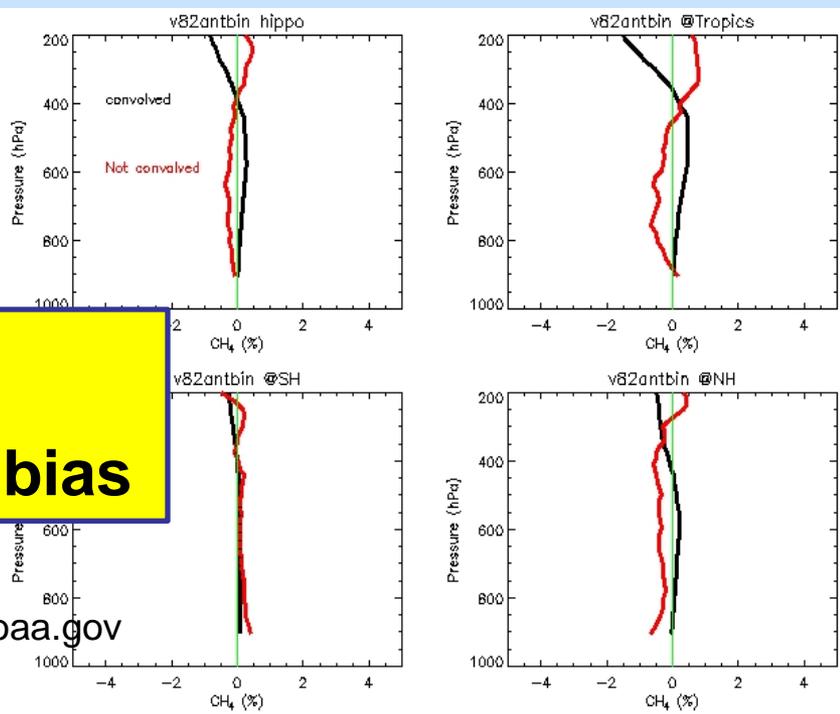
# AIRS- V5



343-496 hPa(v82antbin) hippo



# V6 Smaller bias



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