Update of CH4 retrieval from AIRS(v6), IASI and CrIS

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AIRS, IASI, CrIS

(A plan to derive CH4 and other GHG data of 20+ years)

AIRS on NASA/Aqua 1:30 pm orbit (May 4, 2002)

IASI on METOP-A (Oct. 19, 2006) METOP-B (Sept 27, 2012) 9:30 am orbit

CrIS on NPP 1:30 pm orbit (Oct. 28, 2011) and JPSS
Outline

Summary of AIRS-V6 CH4 as compared to V5;
Validation of IASI CH4 and its improvement;
Current status of CH4 retrieval from CrIS on Soumi NPP.

Some comparison of CH4
1. Among CrIS, IASI and AIRS-v6 (5/15/2012);
2. Seasonal cycle of CH4 over South Asia and Siberia from AIRS-v5 (10 yrs) and IASI (5 yrs);
3. AIRS-v6 vs GOSAT TIR CH4;

One major effort to derive a better CH4 product in the polar region

Summary
More Retrieval Layers

CH4 Retrieval Functions

V5

V6
Backup of aircraft measurement for tuning and Validation

HIPPO-1

HIPPO-2

HIPPO-3

HIPPO -1 (Jan 2009) ; HIPPO -2 (Oct/11, 2009); HIPPO-3 (March/ April,2010) (HIAPER Pole-to-Pole Observations of Carbon Cycle Greenhouse Gases study)
Optimization of CH4 retrieval in V6

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<tr>
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<th>V5 (Research Product)</th>
<th>V6 (Standard product)</th>
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<td>Retrieval layers</td>
<td>7</td>
<td>10</td>
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<tr>
<td>Channels</td>
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<td>First guess</td>
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<td>Quality Flag</td>
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<td>tuning</td>
<td>empirical</td>
<td>Using more aircraft data</td>
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• V6-CH4 has improved QC;

• V6-CH4 has larger DOF than V5;

• V6-CH4 has a better sensitivity lower troposphere;

• Small bias and RMS error
V5

V6
Smaller bias
Scatter plot of AIRS vs In-situ

the bias is within 0.5% and standard deviation less than 1%.
• New Quality control is recommended

• Recent Validation

• Improvements by adopting the improvement in AIRS-v6

→ a paper is submitted to Atmos. Meas. Tech.
Scatter plot of IASI vs In-situ CH4

the bias is –1.7%
Error of IASI CH4

IASI CH4 have been generated on NOAA CLASS system;
CH4 retrieval from CrIS on Soumi NPP

on NOAA Unique CrIS ATMS Processing System (NUCAPS)

(more detail see Antonia’s talk tomorrow)

Comparison of CH4 from AIRS, IASI and CrIS using data on 5/15/2012
Comparison of DOF in different latitude
5/25/2012
Comparison of Averaging Kernels
5/15/2012
Comparison of CH4 at 400 hPa from CrIS, AIRS, IASI (5/15/2012)
Mean Profiles in different latitude
A very good agreement in observing the CH4 enhancement over the south Asia

In Siberia, a much larger seasonal cycle from IASI than from AIRS-V5
Comparison of CH4 retrieved from GOSAT TANSOTIR, AIRS and Aircraft Measurements

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GOSAT-PI meeting
Histogram of GOSAT minus AIRS (300-500 hPa)
To generate a long-term record for monitoring the polar CH4 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.
CH4 release from wetland and thawing permafrost are very sensitive to global warming. Its trigger will be a disaster.
Example: Optimization for the Polar CH4 retrieval (2009/01/13)

Better sensitivity to lower troposphere
1. Significant improvements in AIRS-V6 retrievals and setting of quality flag has been made, and the bias is within 0.5% and standard deviation less than 1%. More validation will be done as soon as all V6 data are available.

2. Validation to NOAA CLASS IASI CH4 product shows IASI is lower biased by ~1.7%. Recent improvement in AIRS-V6 will be incorporated in IASI CH4 retrieval.

3. CrIS has lower sensitivity and smaller DOF than AIRS and IASI. It is expected that better CH4 product can be derived from the full spectral resolution CrIS data.
• AIRS and IASI CH4 shows a good agreement in observing the seasonal cycle over the south-Asia, however, IASI observed a much larger summer increase in the polar region which will be further analyzed using data from AIRS-V6.

• Comparison among AIRS, IASI and CrIS CH4 products indicated that more works need to be done to generate a consistent, long-term CH4 product for climate change study, and one effort we are focusing now is to derive a better product in the polar regions. This can become part of AIRS-v7.
Attention GOES Users:
GOES-13 has returned to operations as GOES-East on Thursday, October 18 at 1041 UTC. All operations are nominal. GOES-14 is now turned off. This leaves a gap of GOES-13 data between September 23 and October 18 in our database. When searching on GOES-East data in CLASS be sure to search on GOES-13 and GOES-14 to retrieve a complete inventory of files.

Suomi NPP data access status:
VIIRS RDR and SDR products along with CrIS SDR and RDR products are the latest products to be released to the public and can be ordered through CLASS. Please go to the Suomi NPP FAQ page to view the list of all products and dates ranges that are available. The remaining NPP products will be released to the user community over a time frame of several months.

Please note that all newly released products are at ‘Beta’ maturity level as defined in the Product Maturity Level page. Details of high priority issues related to the data quality are contained in the Readme files provided by the NPP Project Scientist. All users are encouraged to read these before ordering and using the data. The following Readme files are provided:
All these improvements in V6 are based on extensive validation

Aircraft measurements used include

1. Aircrafts measurements from NOAA/ESRL/GMD (the only one used for V5 optimization)
3. START08(2008)
4. ARCTAS(2008)
5. HIPPO-1, -2(2009), -3(2010)

HIPPO-4, -5 data have not been released to public
CH4 over Siberia
A paper about the setting of QC and validation is in preparation.
Both infrared and microwave retrievals of water vapor and temperature are successful; Residual (observation minus RTA computation) relative to the estimated errors (including error in instrument, cloud-clearing, forward model) is less than 3 (Chi2 < 3); Total FOR Cloud fraction, solving for two layers of clouds, is less than 1.5; DOF is greater than 0.3
Comparison of AIRS vs GOSAT @ three layers
Comparison of Averaging Kernels (6/21/2008, 12/20/2009)

IASI

AIRS
Area of Averaging Kernels in different latitude

100,300,500,650 hPa

850hpa

IASI (April, 2010)
Lower Bias in IASI, CrIS