Monitoring and Assimilation of IASI Radiances at ECMWF

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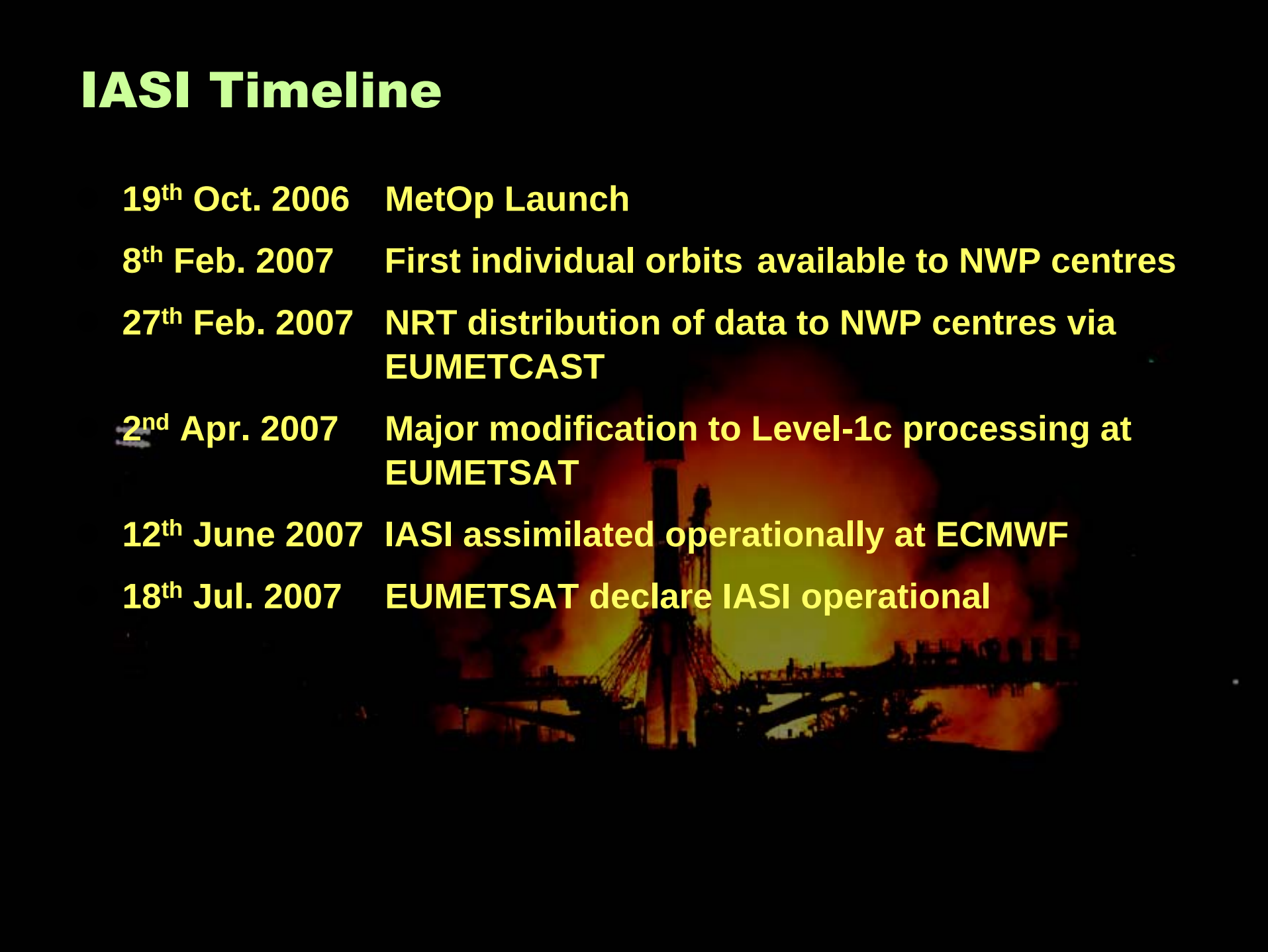
Overview

- Introduction
- Assimilation Configuration
- IASI First Guess Departures
- IASI Forecast Impacts
- The Future
- Conclusions

Introduction

IASI Timeline

19th Oct. 2006	MetOp Launch
8th Feb. 2007	First individual orbits available to NWP centres
27th Feb. 2007	NRT distribution of data to NWP centres via EUMETCAST
2nd Apr. 2007	Major modification to Level-1c processing at EUMETSAT
12th June 2007	IASI assimilated operationally at ECMWF
18th Jul. 2007	EUMETSAT declare IASI operational



Assimilation Configuration

Current Operational Configurations

AIRS

- Operational at ECMWF since October 2003
- 324 Channels Received in NRT
- One FOV in Nine
- Up to 155 channels may be assimilated (CO_2 and H_2O bands)

IASI

- Operational at ECMWF since 12th June 2007
- 8461 Channels Received in NRT
- All FOVS received; Only 1-in-4 used (FOV 1)
- 366 Channels Routinely Monitored
- Up to 168 channels may be assimilated (CO_2 band only)

Assimilation Configuration: Channel Selection

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Why Select Channels?

- **The volume of IASI data available is such that we do not have the computational resources to simulate and assimilate all these data in an operational timeframe**
- **Not all channels are of equal use when assimilated into an NWP system**

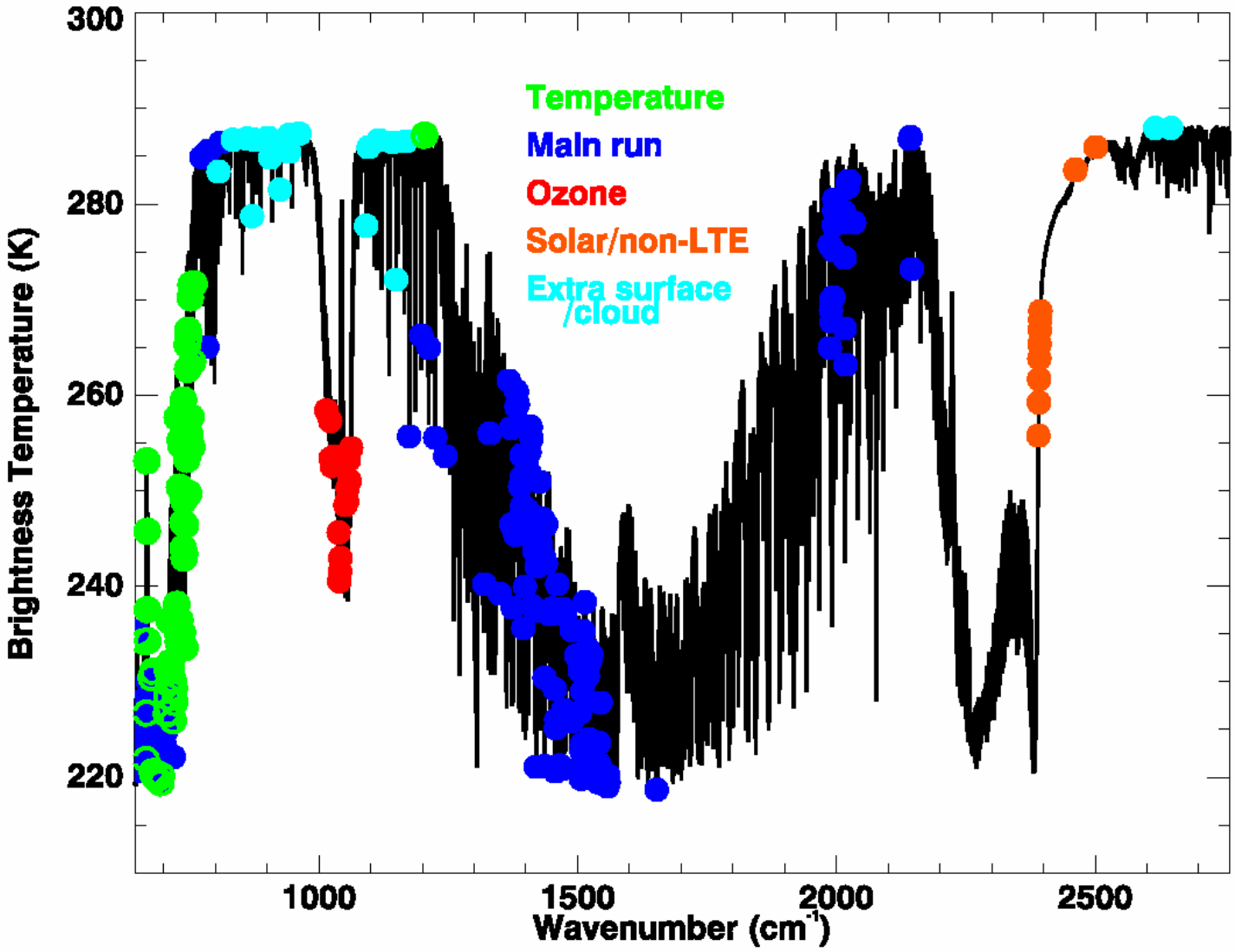
- **We choose channels that we wish to monitor (often with a view to future use)**
- **We choose a subset of these channels which we actively assimilate**

IASI Channel Selection

- **All IASI channels are distributed to European Users via EUMETCAST. Distribution of IASI radiances via GTS is for 300 channels chosen according to Collard (2007).**
- **At ECMWF, for IASI we use the 300 channels above plus a further 66 channels.**
- **These are the channels that are routinely monitored – not all are actively assimilated .**

Collard (2007) ECMWF Technical Memorandum 532

Selected Channels (2)



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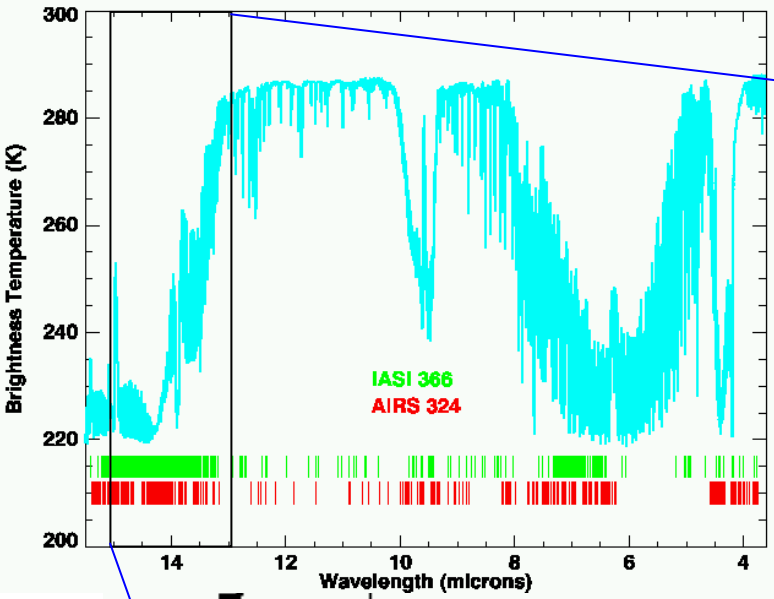
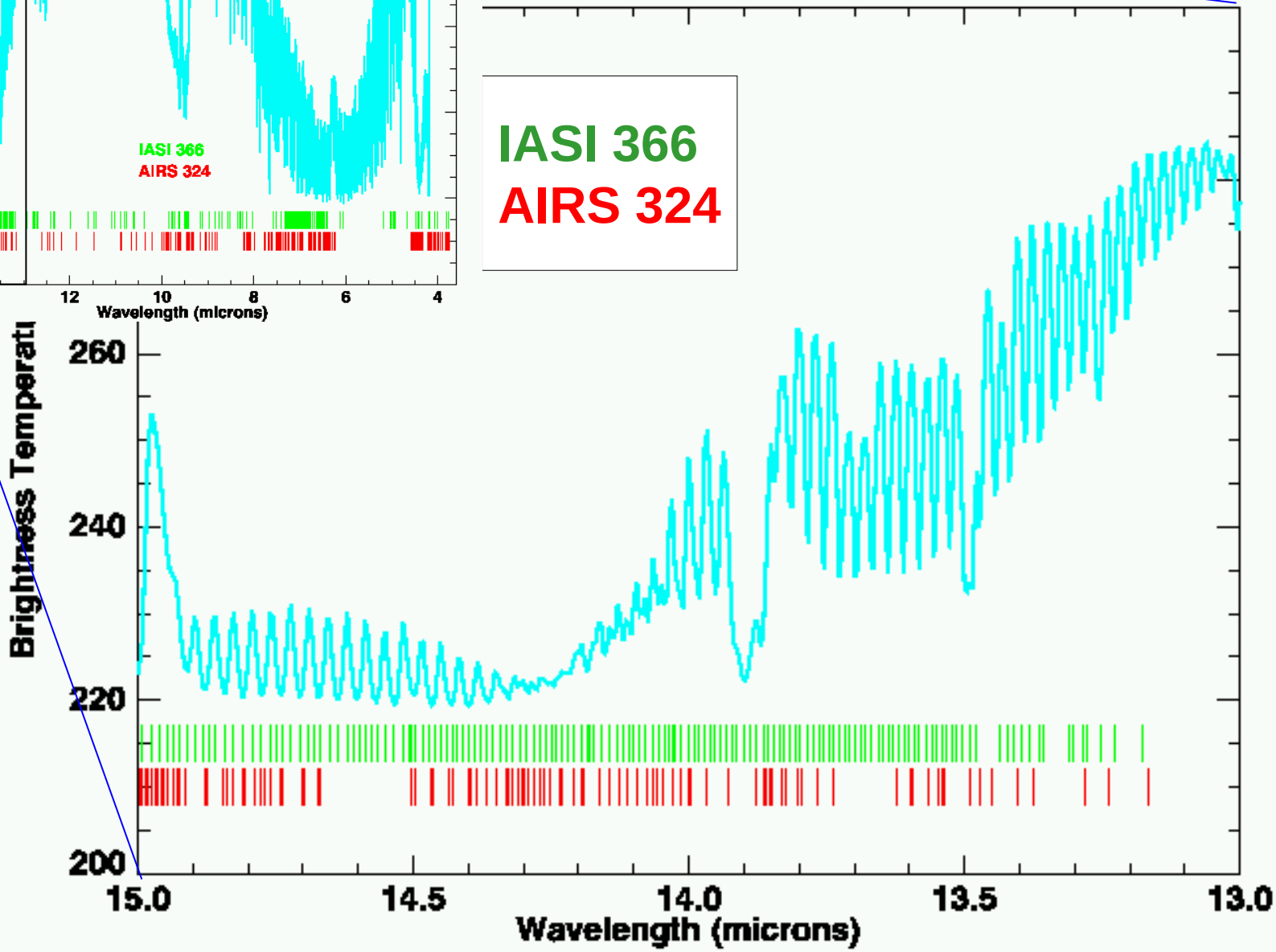
AIRS 324 vs IASI 366

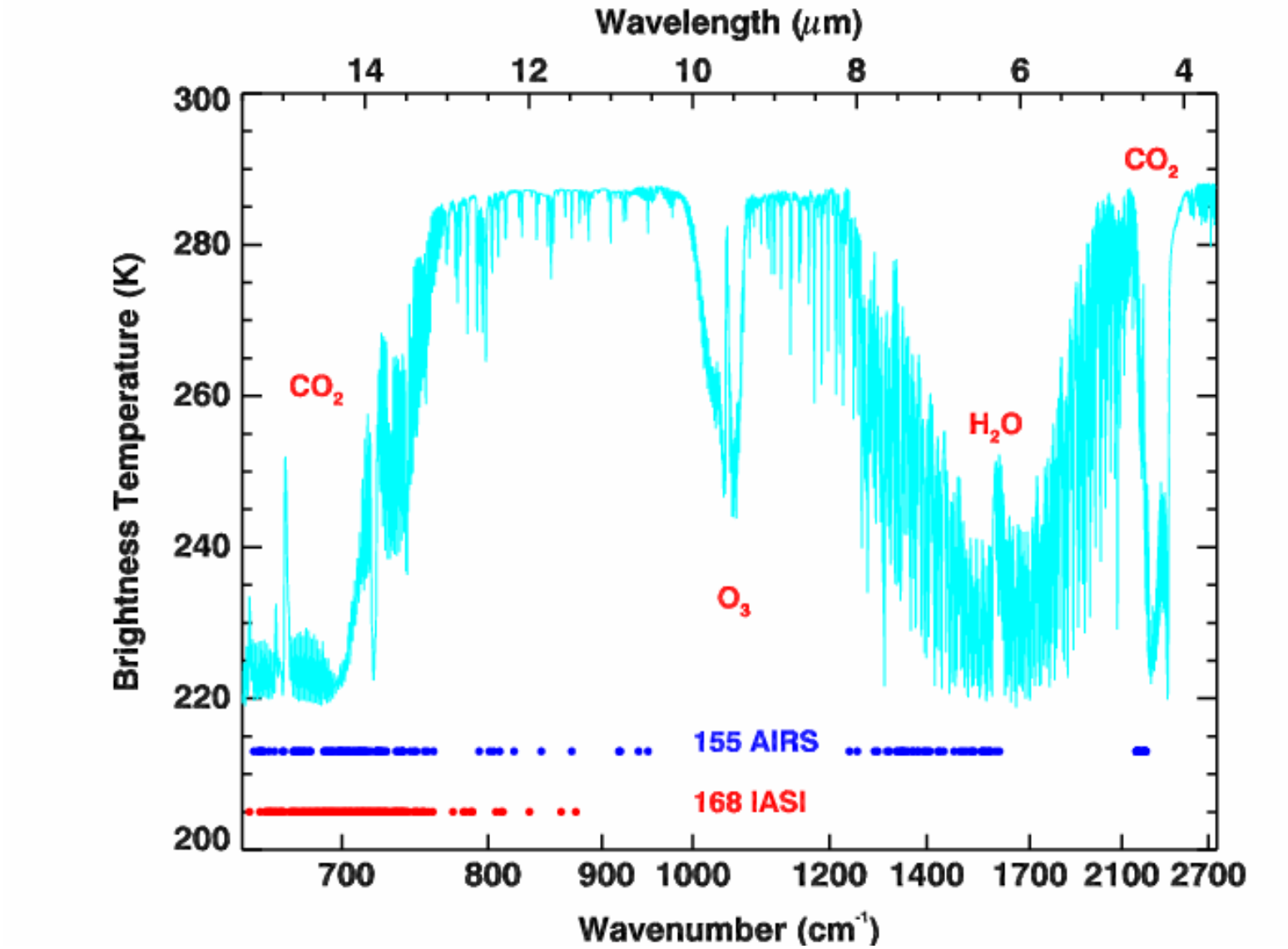


IASI 366

AIRS 324



Comparison of Actively Assimilated Channels (1)



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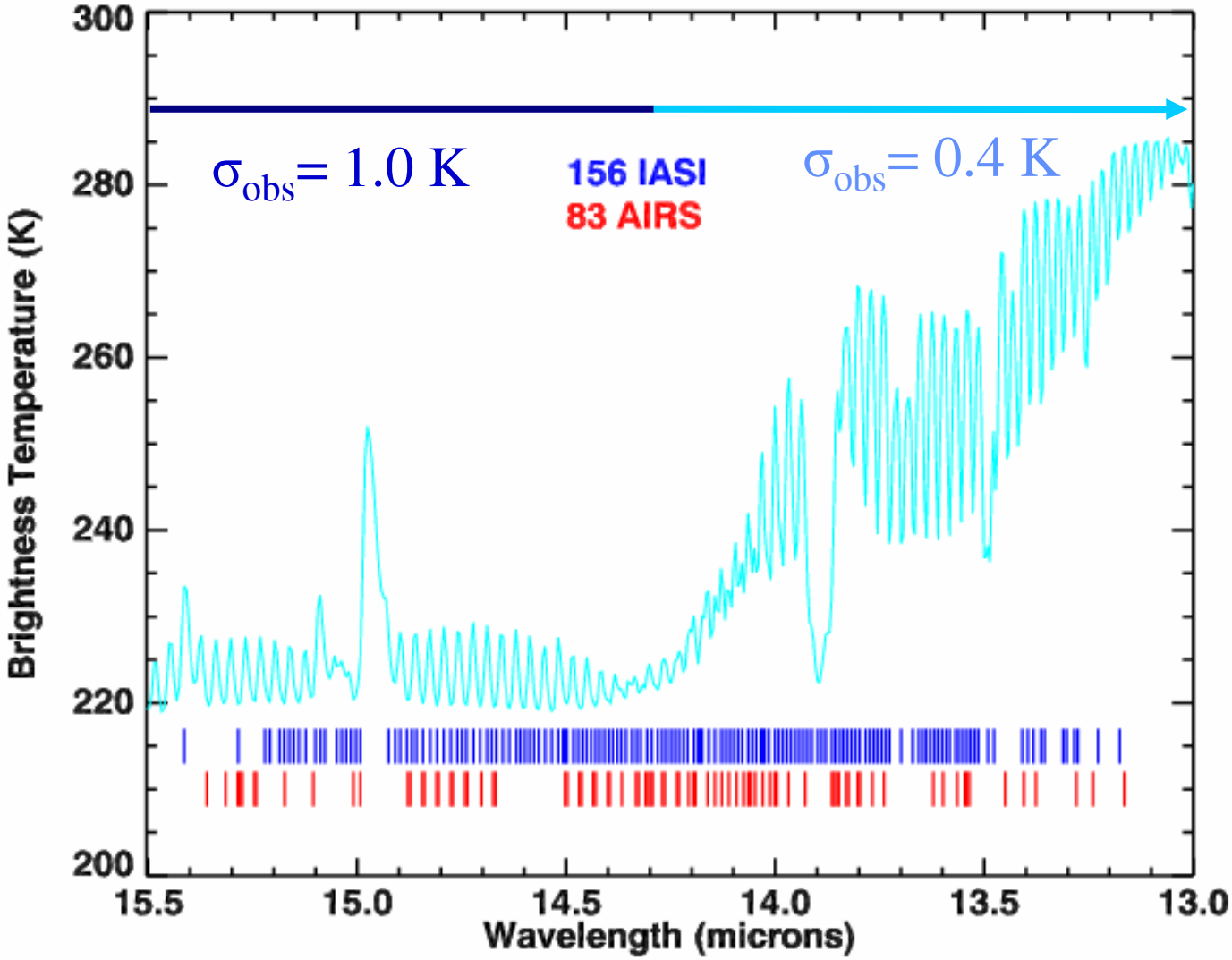
Comparison of Actively Assimilated Channels (2)



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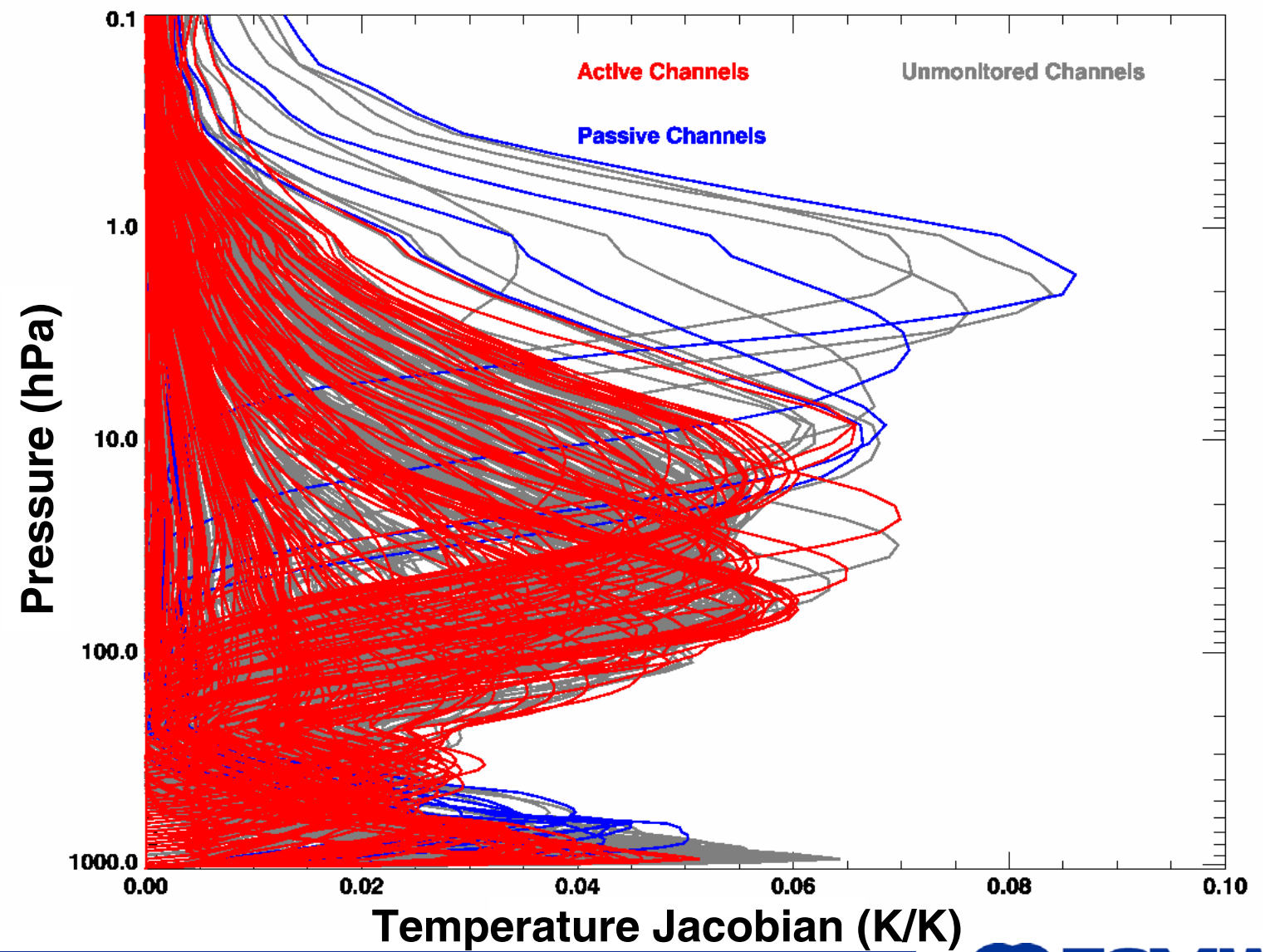
Jacobians of 15μm CO_2 Band



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Assimilation Configuration: Cloud Detection

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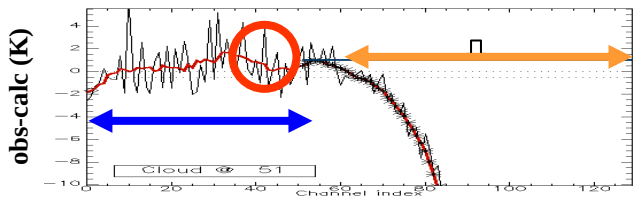
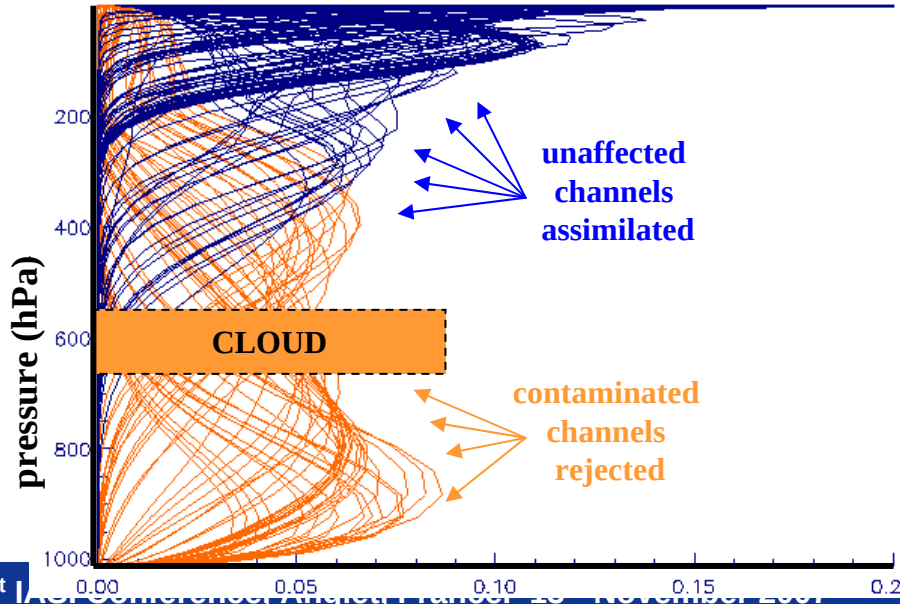
Cloud detection scheme for Advanced Sounders

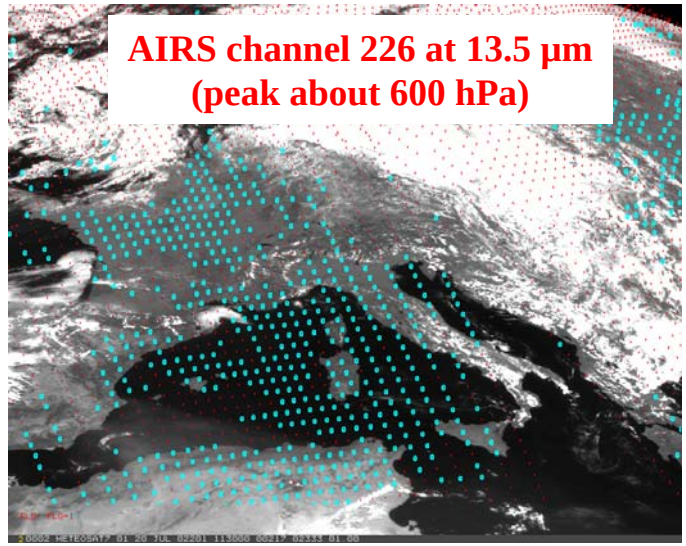
A non-linear pattern recognition algorithm is applied to departures of the observed radiance spectra from a computed clear-sky background spectra.

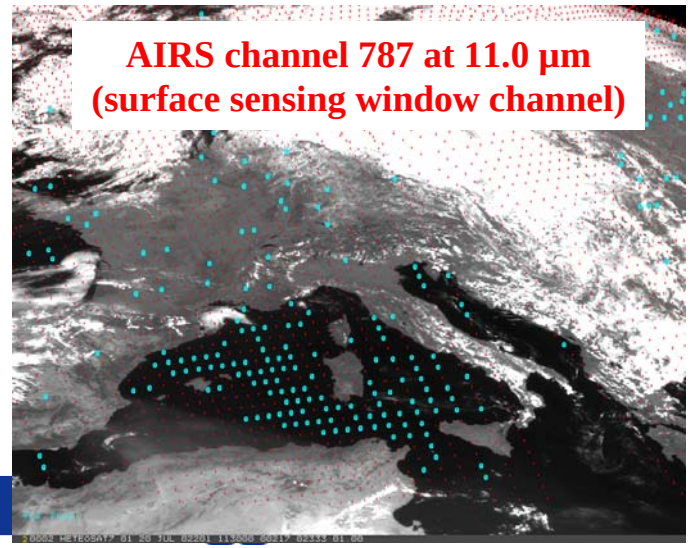


Vertically ranked channel index

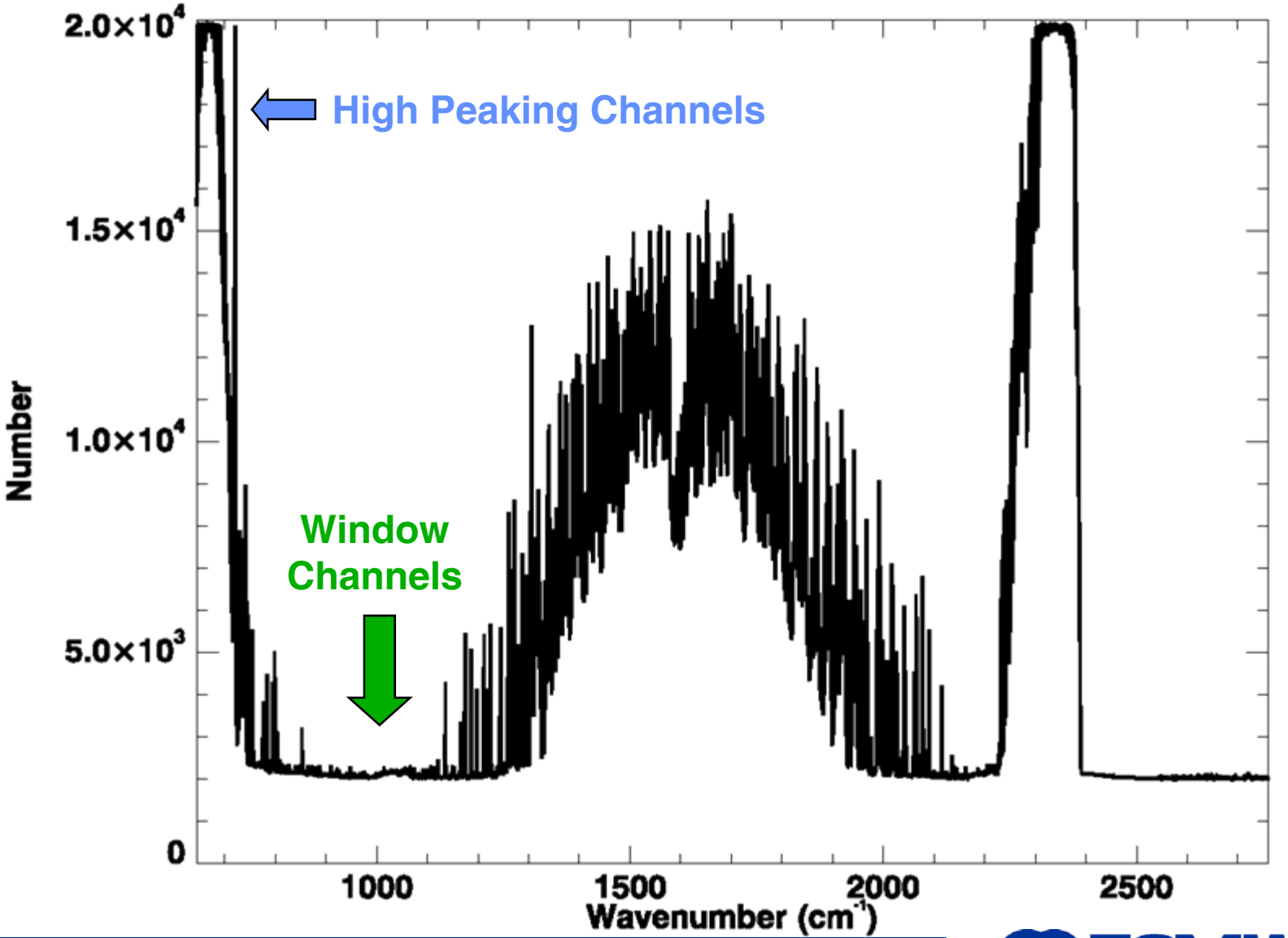
This identifies the characteristic signal of cloud in the data and allows contaminated channels to be rejected







Number of Clear Channels



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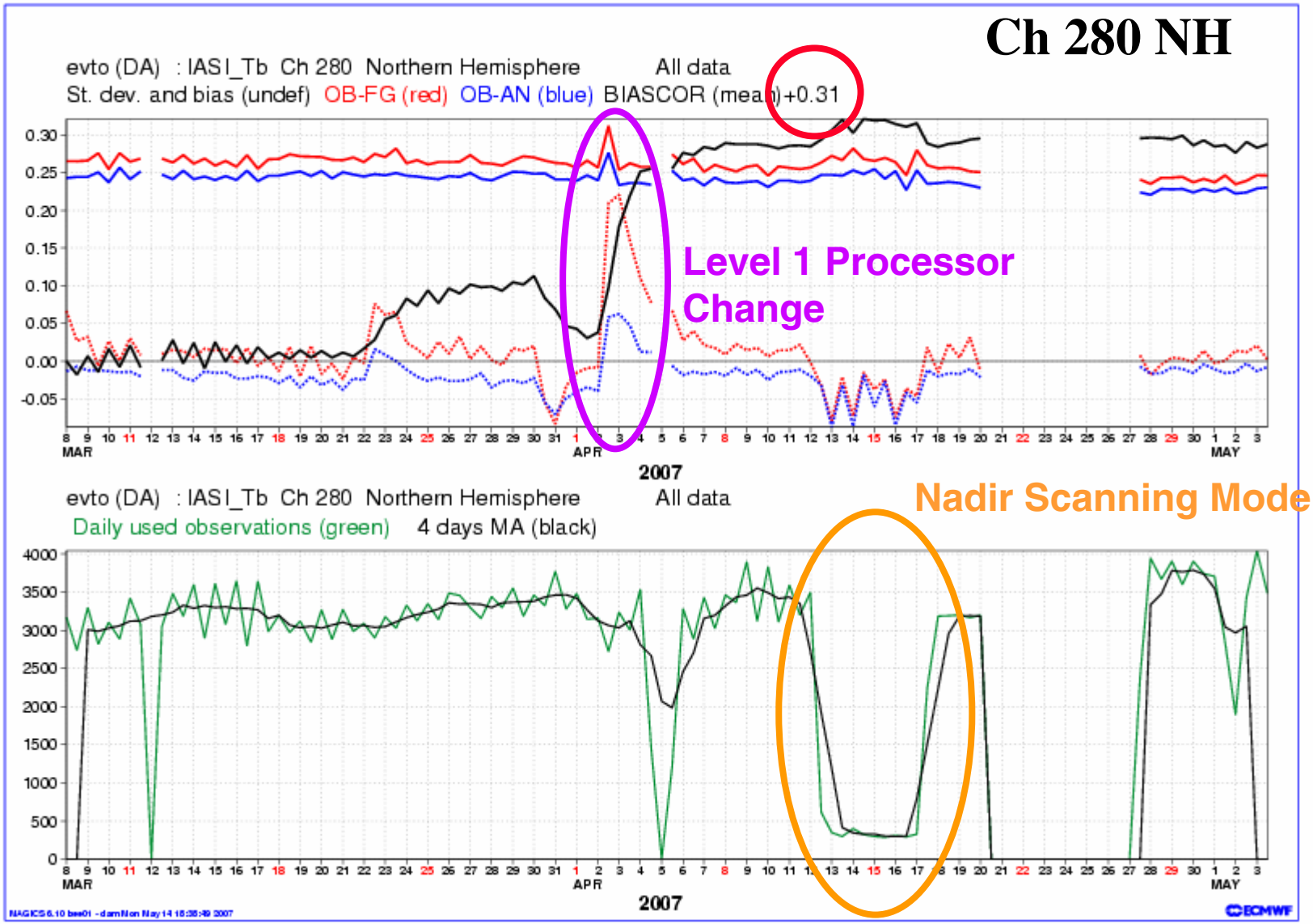
Cloud Detection Software is Available

- **Cloud detection has been re-written to allow greater portability and to allow cloud detection of IASI**
- ***It is available for all to use from the NWPSAF***
- **http://www.metoffice.gov.uk/research/interproj/nwpsaf/**

Evolution of Bias Correction



IASI First Guess Departures

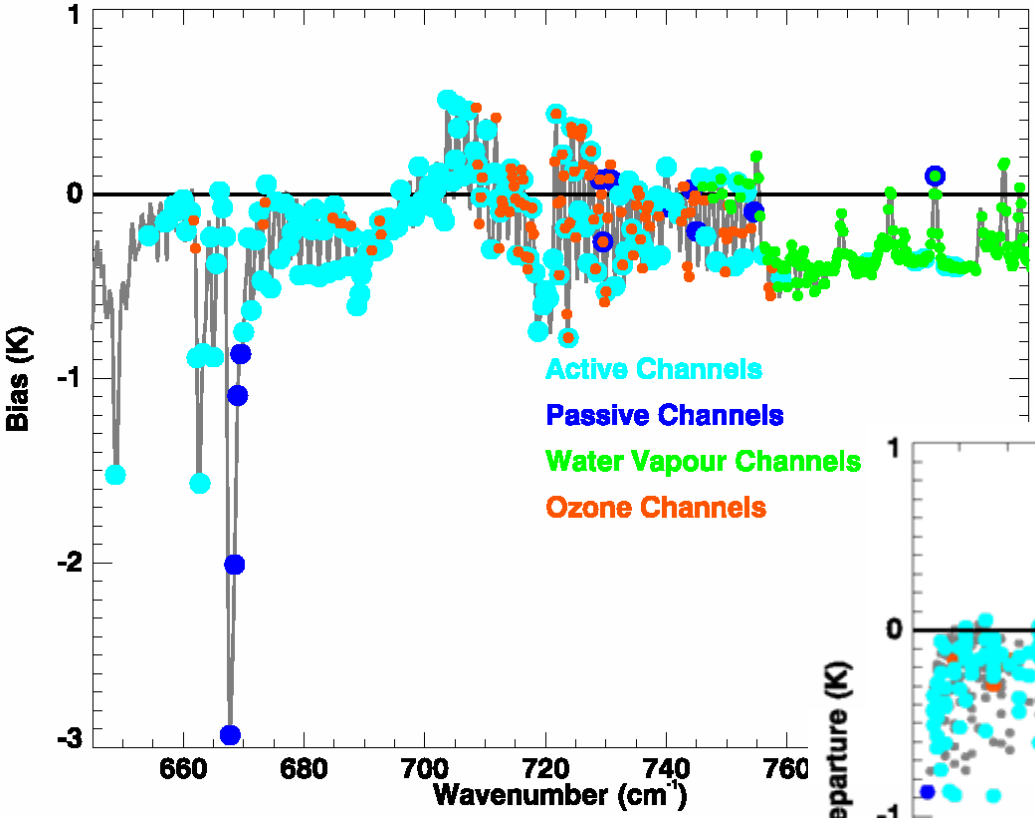
Looking at First Guess Departures

- Observed Radiances minus Radiances Predicted from Short Range Forecast from Previous Cycle
- First Guess Departures drive the increments

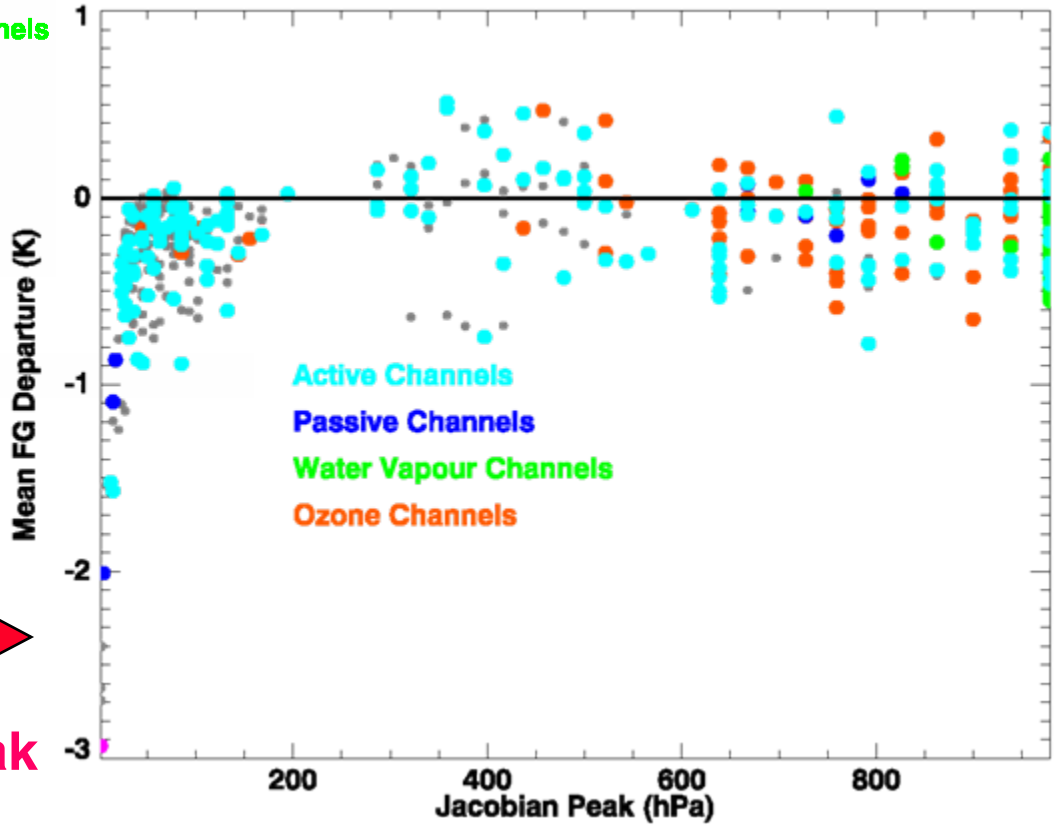
In the following slides:

- Clear-sky first guess departures
- The cloud detection uses the operational bias-correction
- The first-guess departures are NOT bias-corrected

First Guess Departure Biases in 15 μm CO_2 Band



Ordered by Wavenumber



Ordered by Jacobian Peak Pressure

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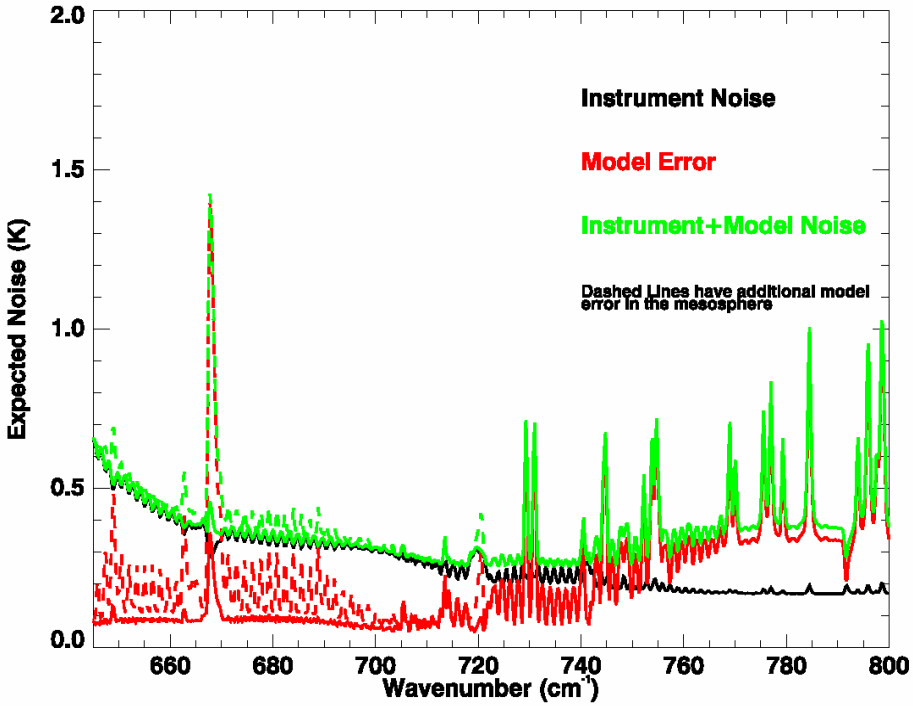
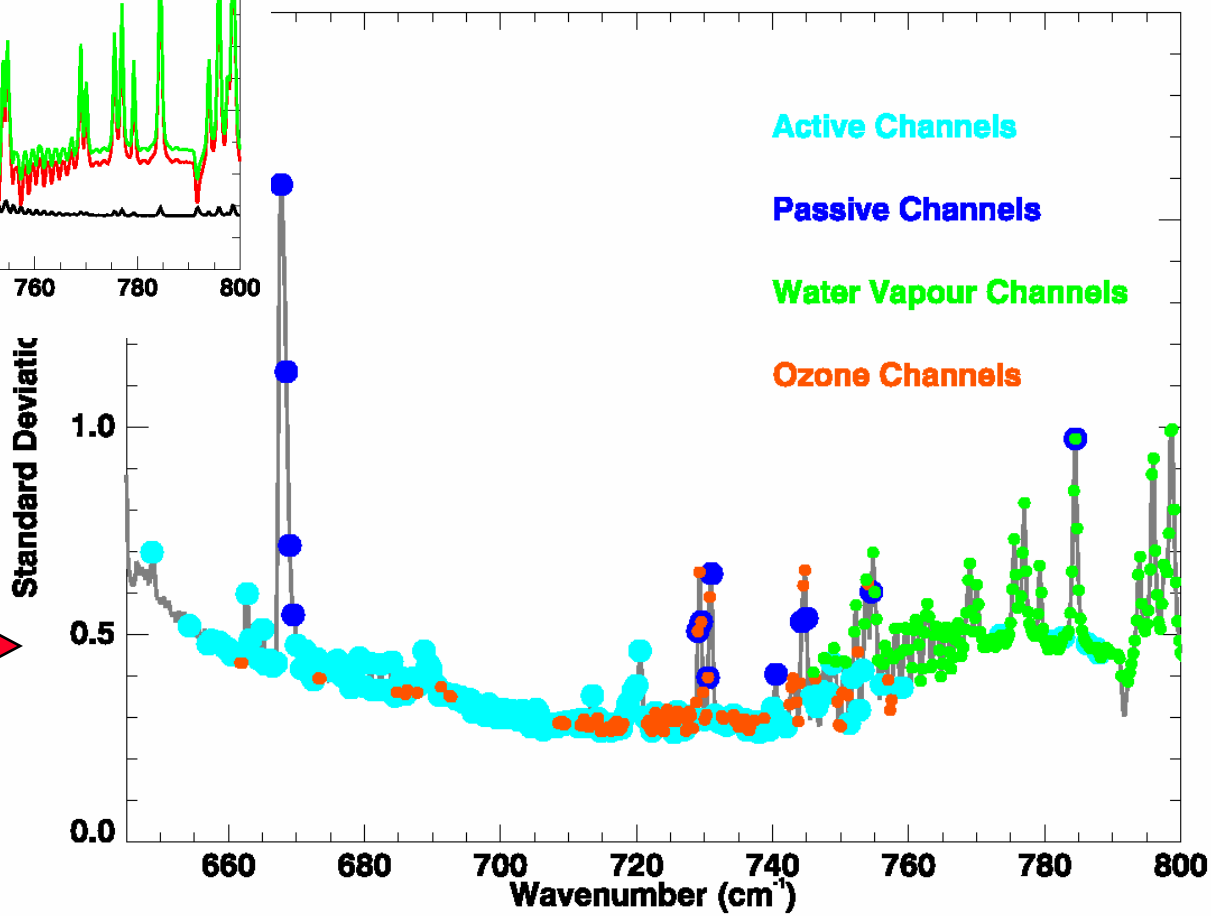
First –Guess Departure Standard Deviations in 15 μm CO_2 Band



Calculated Std. Dev.

Observed Std. Dev.



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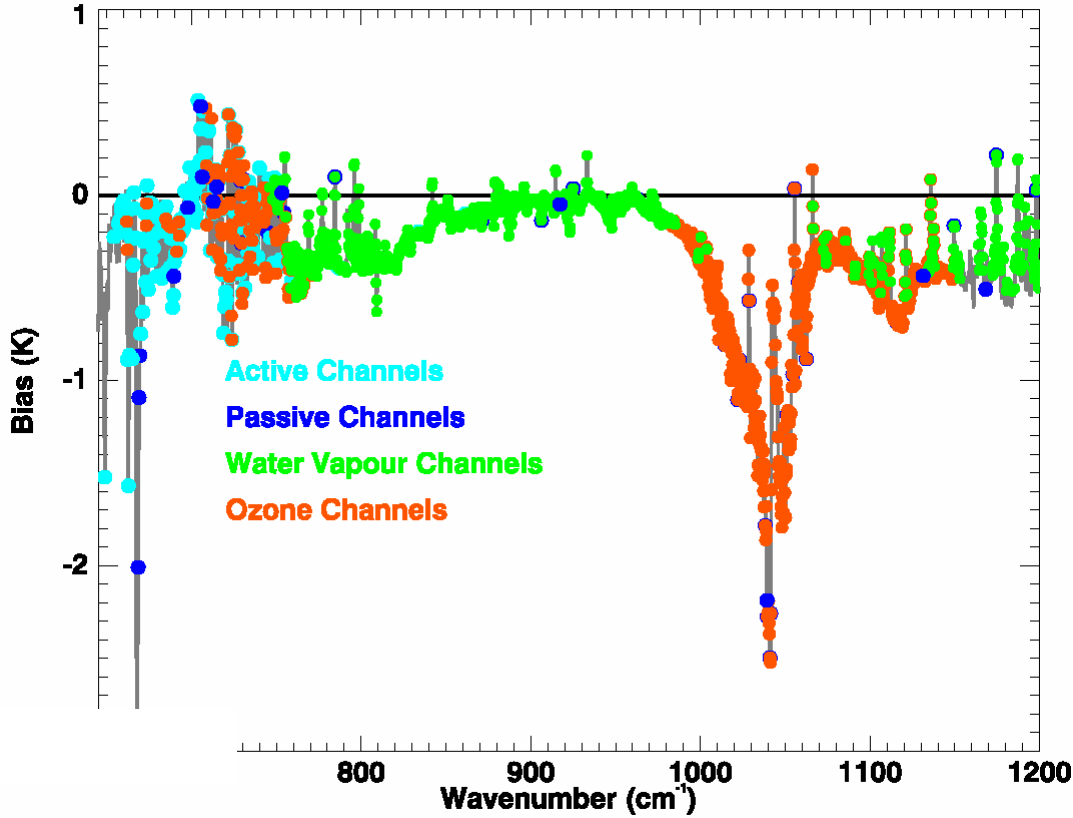
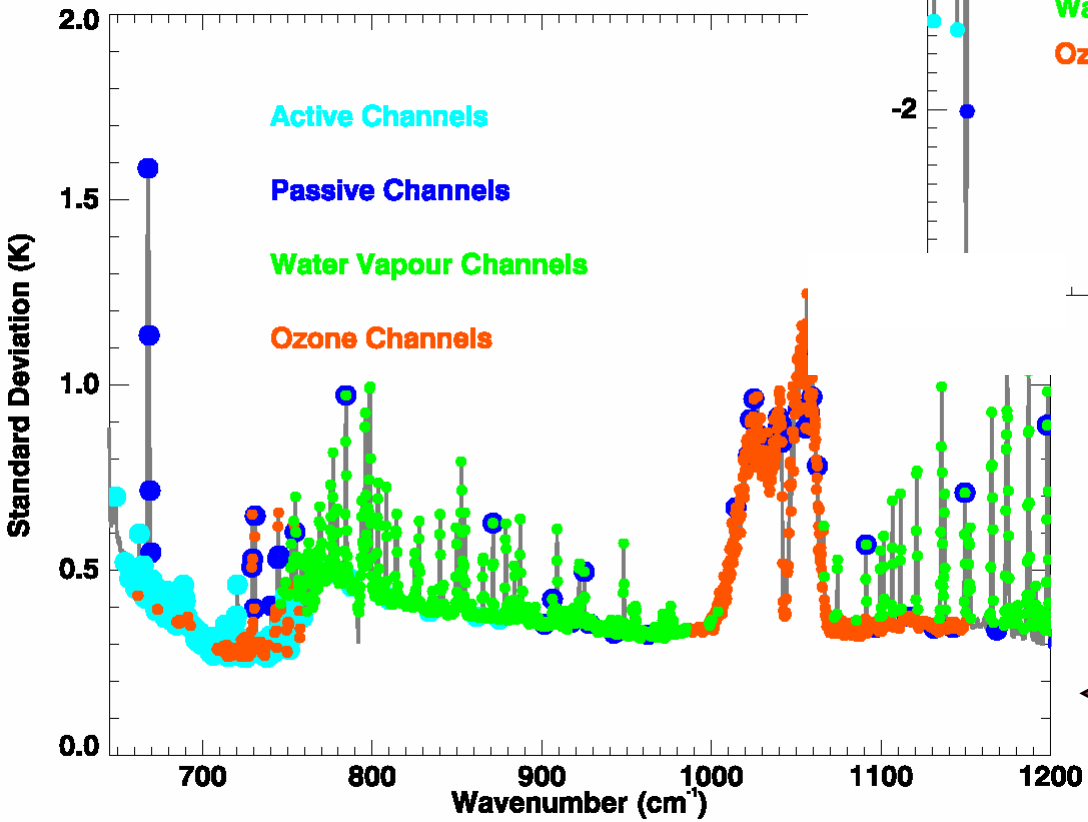
First Guess Departure Standard Deviations and Biases in the Longwave Window





Bias

Standard Deviation

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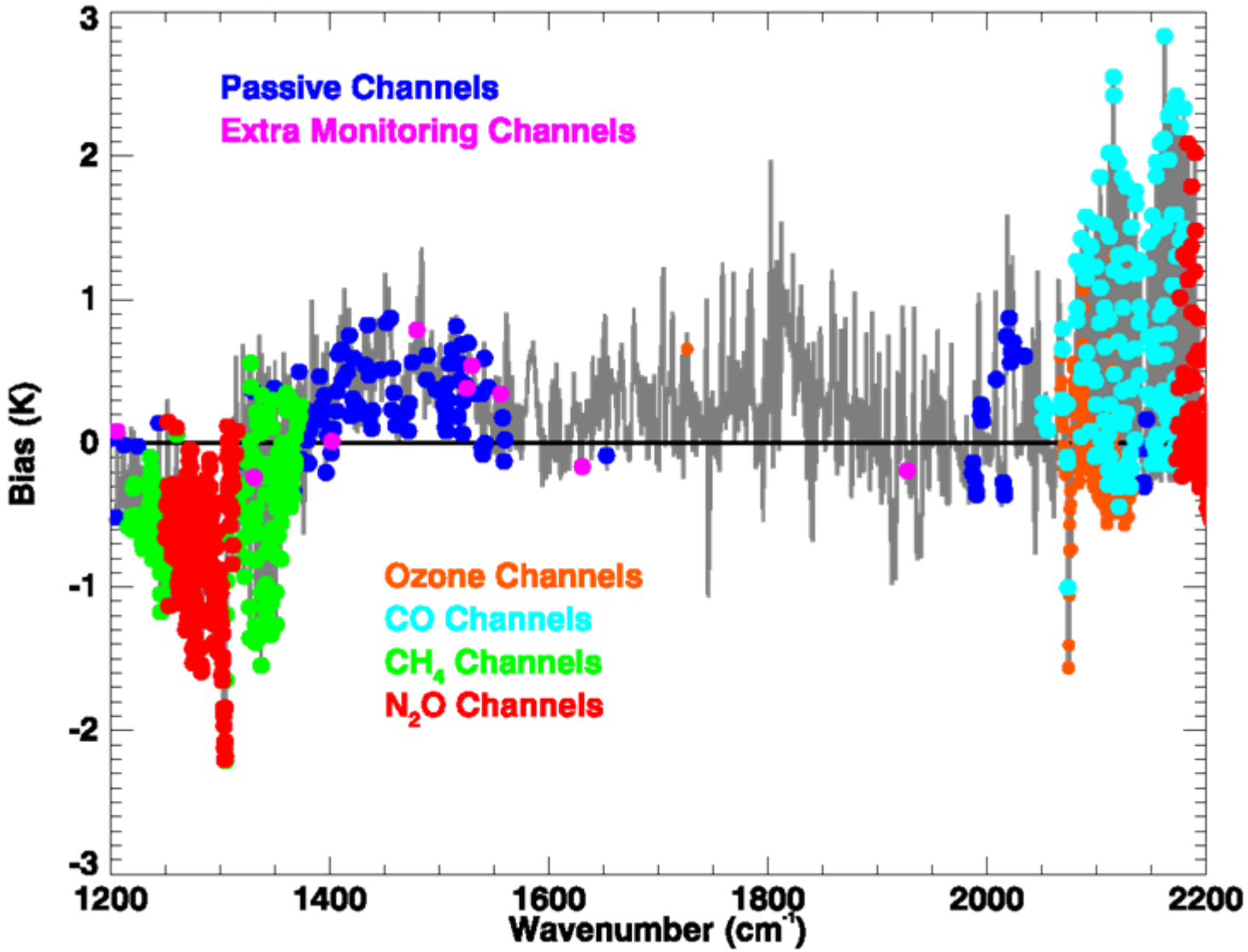
First-Guess Departure Biases in Water Band



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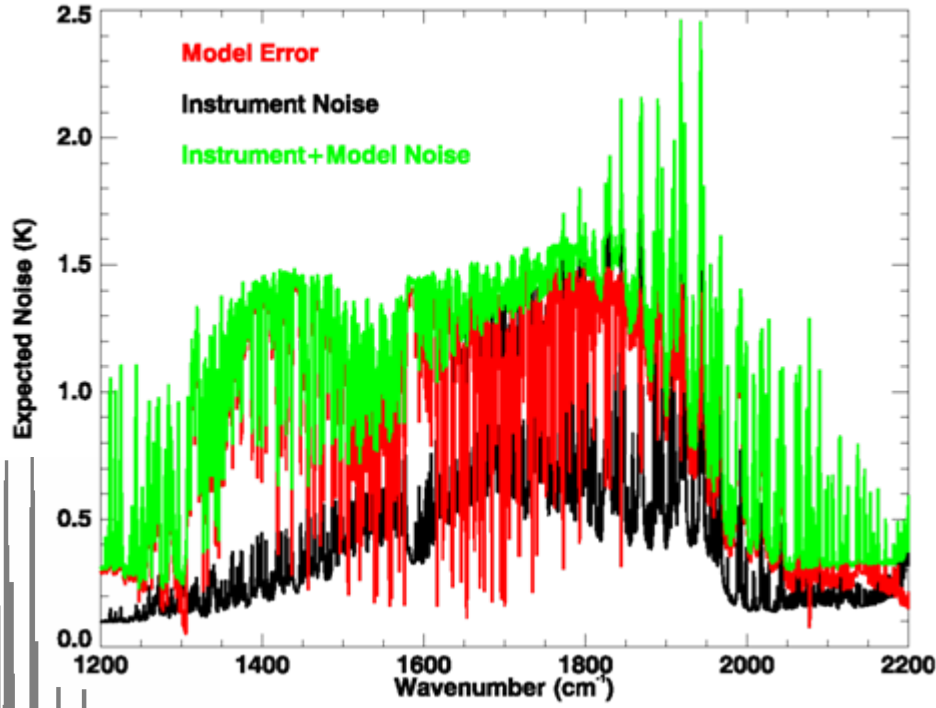
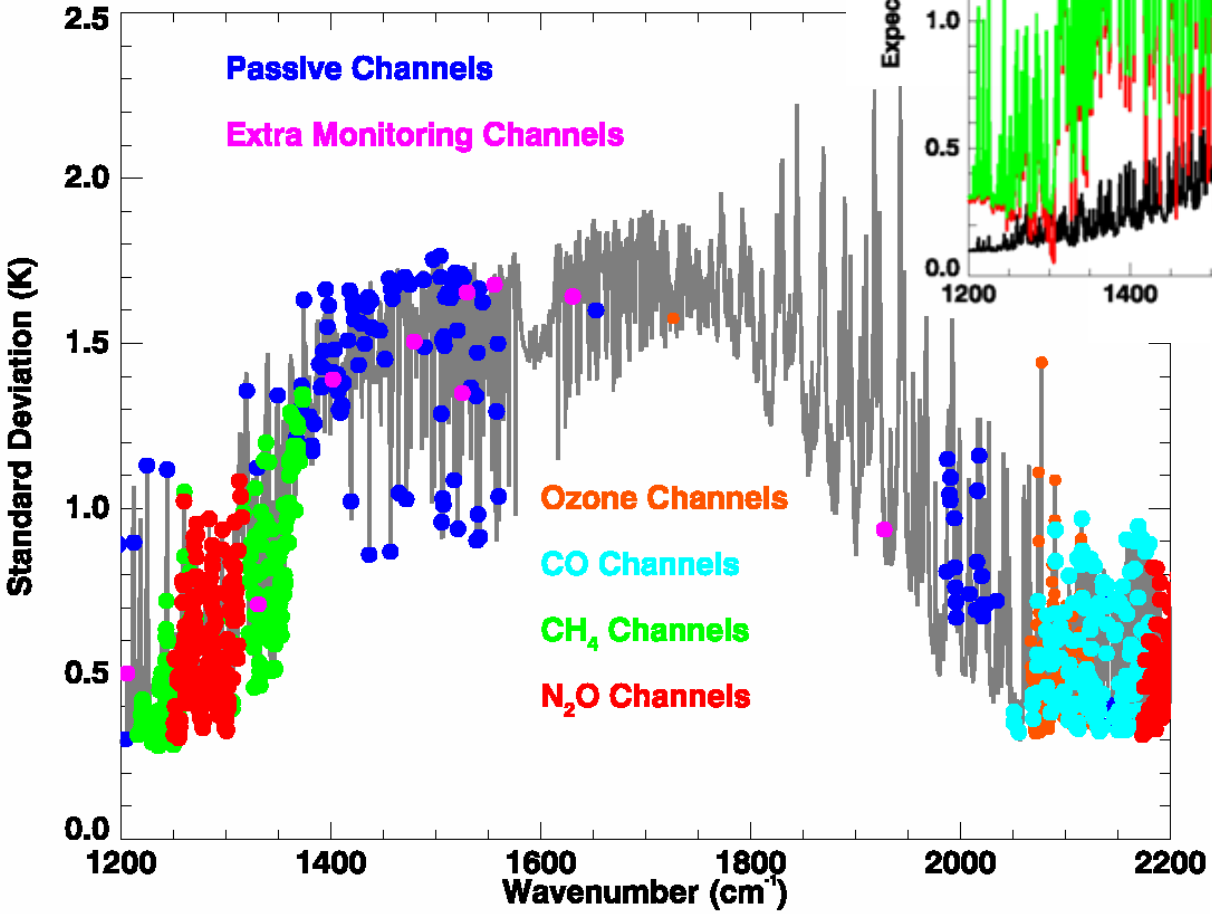
First–Guess Departure Standard Deviations in Water Band





Calculated Std. Dev.

Observed Std. Dev.

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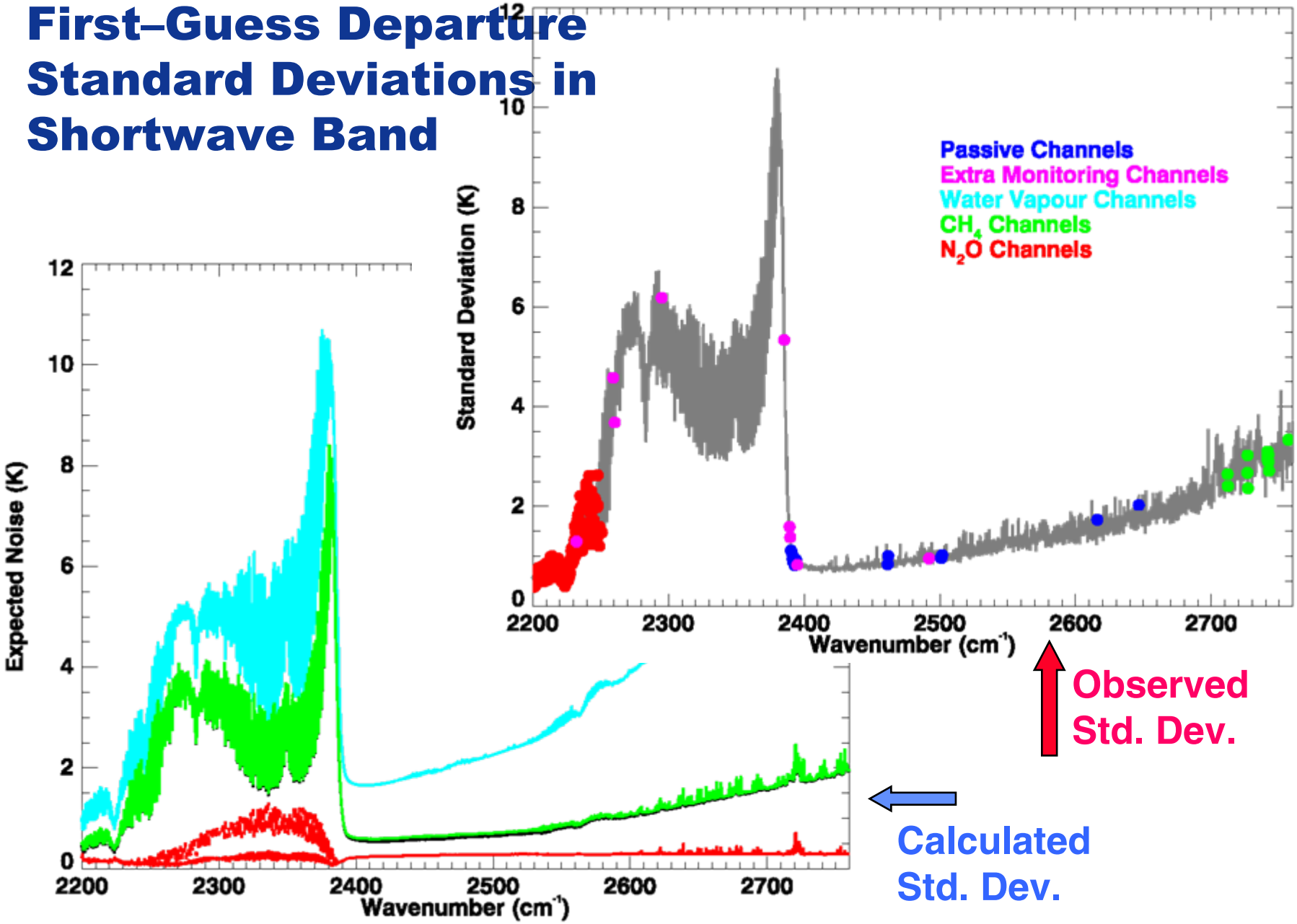
First–Guess Departure Standard Deviations in Shortwave Band



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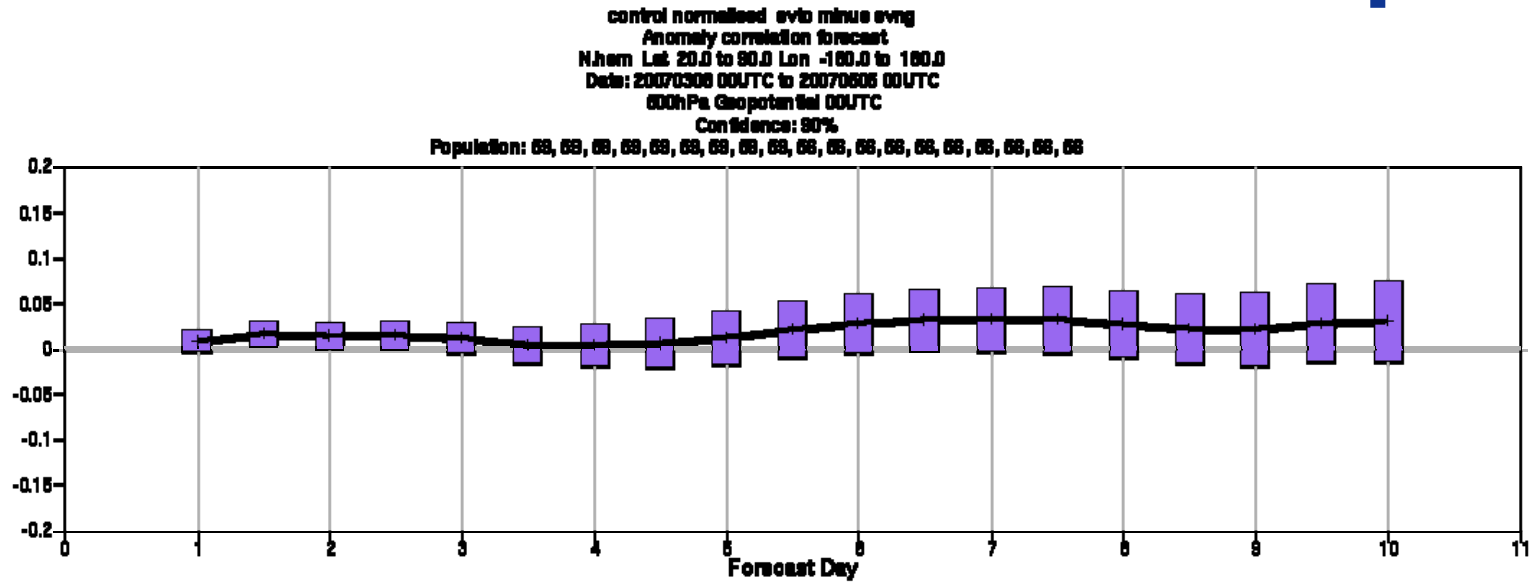
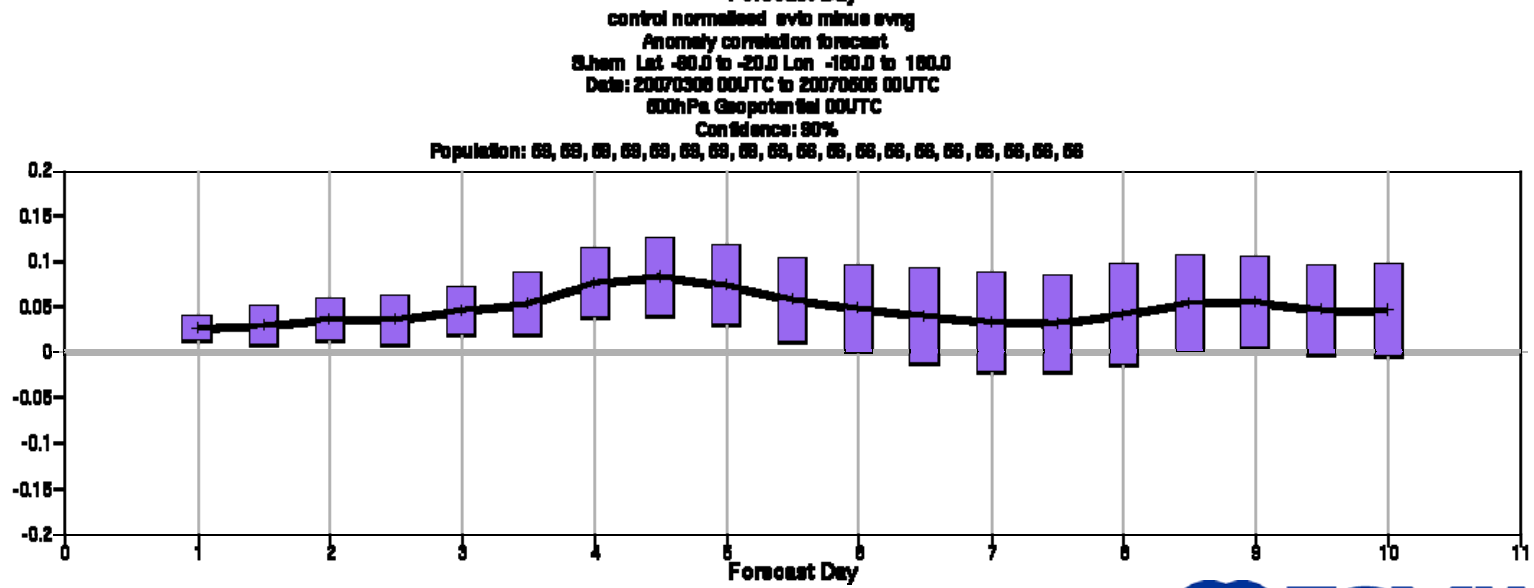
IASI Forecast Impacts

IASI Forecast Scores: 500 hPa Geopot. AC



NH

IASI Better



SH

IASI Worse

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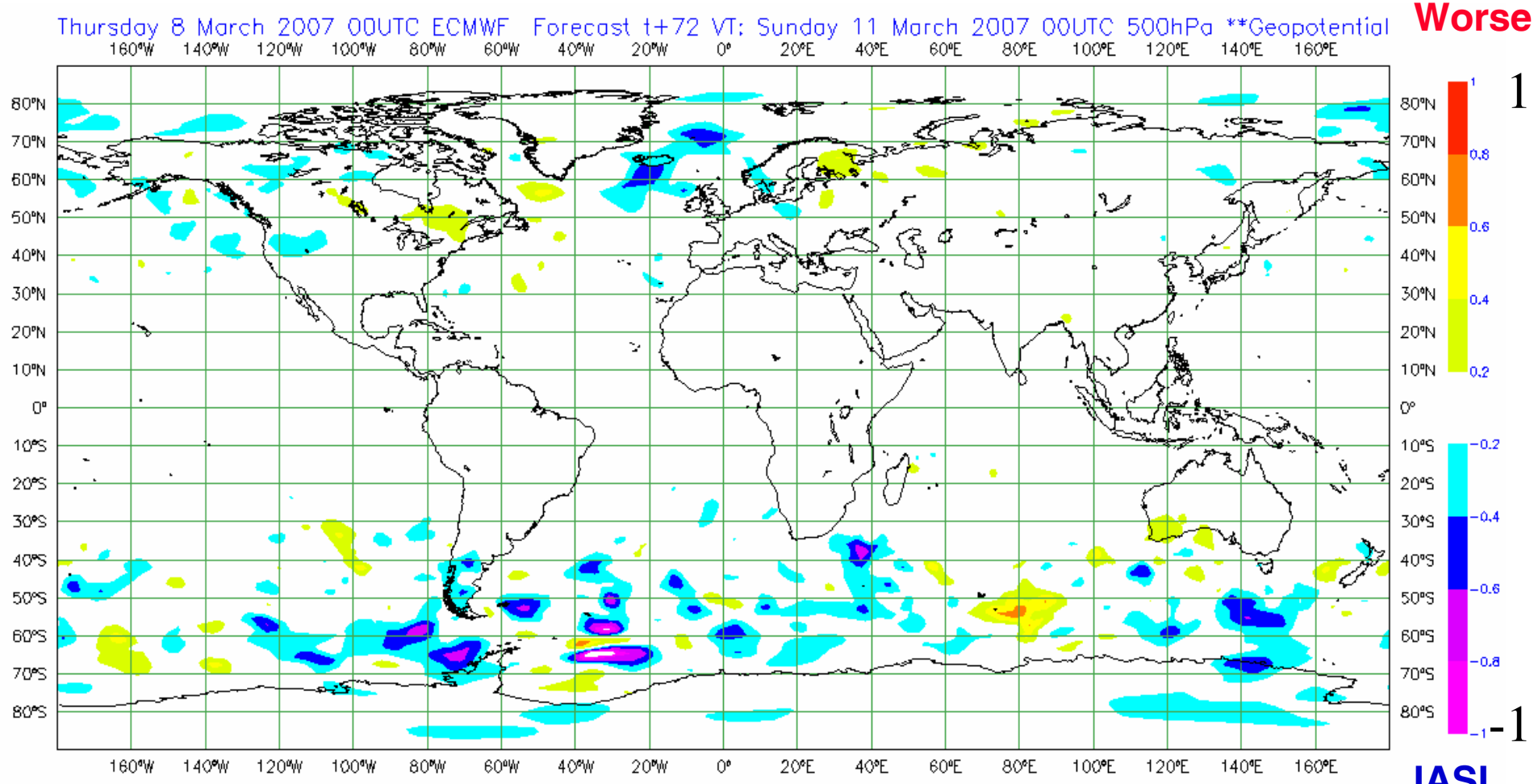
Map of RMS Forecast Error Differences

3-Day 500 hPa Geopotential Height (m)



IASI Worse

IASI Better

3rd March-16th May 2007

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Next Steps and Conclusions

Next Steps

- Use the water vapour band
- Use over land
- Review assumed observation errors
- Cloud affected radiances
- Use of compressed data

Conclusions

- IASI is performing as expected
- The initial ECMWF implementation has focussed on the areas most likely to give positive impact (based on AIRS experience)
- IASI is providing positive impact on forecast scores – even using a system where AIRS is already used

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