Current status and future plans for the use of AIRS and IASI data at the Met Office

Fiona Hilton

Bill Bell, James Cameron, Stephen English, Stephan Havemann, Ed Pavelin, TR Sreerekha, Jon Taylor

ITSC15, October 2006

Talk Overview

- AIRS Status
- Developments in IR Sounding
  - Increasing AIRS data usage
  - Use of Principal Components
- IASI Plans
- Early IASI data monitoring
- IASI Routine data monitoring

AIRS Status

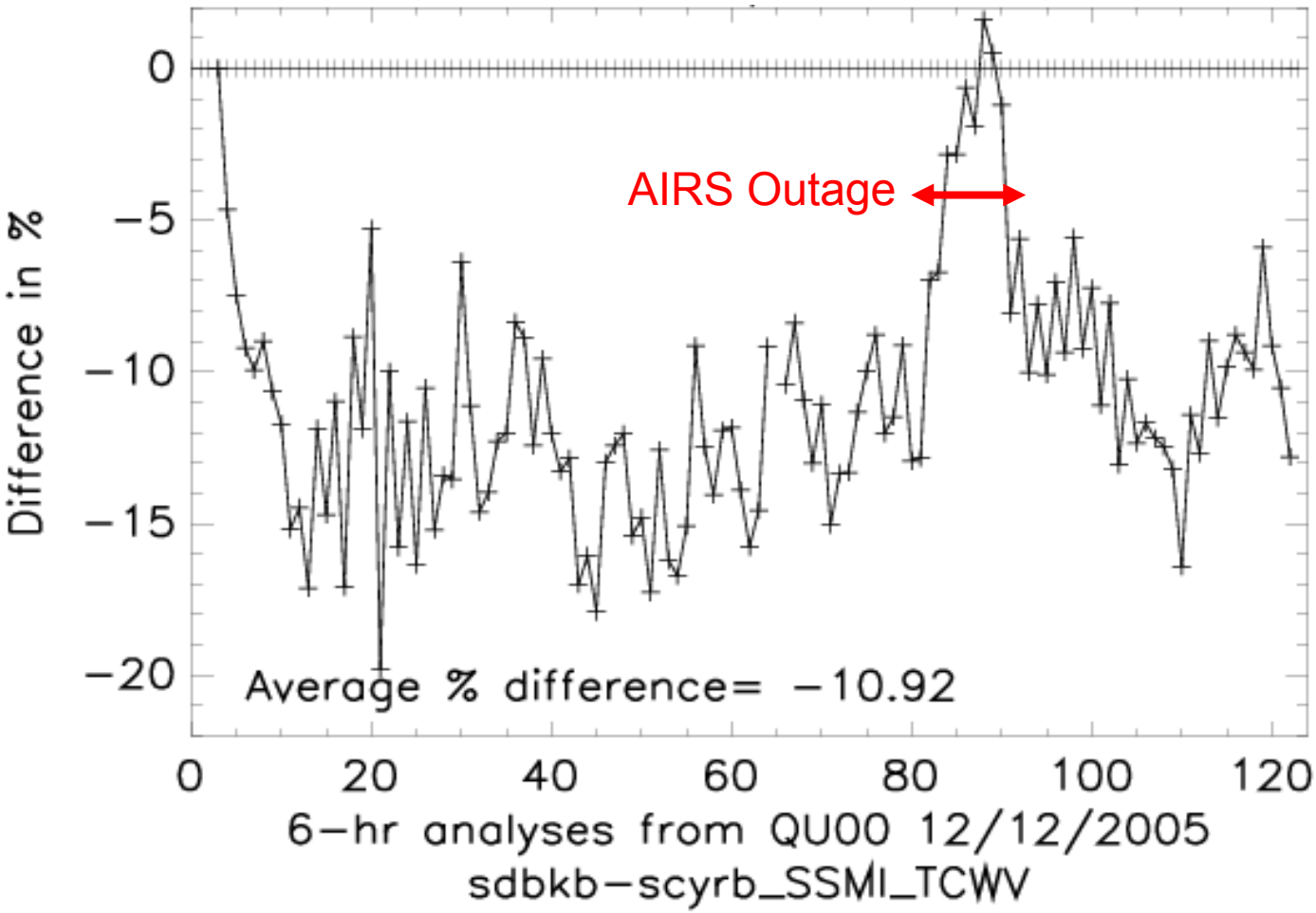
Current status of AIRS processing

- Fairly similar to initial implementation
- Using Warmest Field of View dataset since March 2006
  - Maximum 81,000 observations each cycle
- Use 45/57 out of 324 channels supplied (day/night)
- Only use observations over the sea, only in clear conditions
- Obs reduced to around 4-5% of original number for 4D-Var
  - Cloud detection and surface rejection
  - Post-1D-Var thinning removes the rest.
- WFOV similar impact to CFOV – Valuable observation type!

AIRS improves model fit to SSMI TCWV

(see similar improvement in fit with AMSU-B)

Percentage difference (No AIRS - AIRSWF)
of RMS Retrieved-Background SSMI TCWV



Developments in IR sounding

Increasing AIRS data usage

Future directions for IR data
Increasing data usage

- Using data in cloudy areas
  - Use channels where the observed radiance has little contribution from atmospheric layers at or below the cloud top
  - Ed Pavelin's poster
- Using observations over land and sea-ice
  - Cloud detection
  - Land surface emissivity

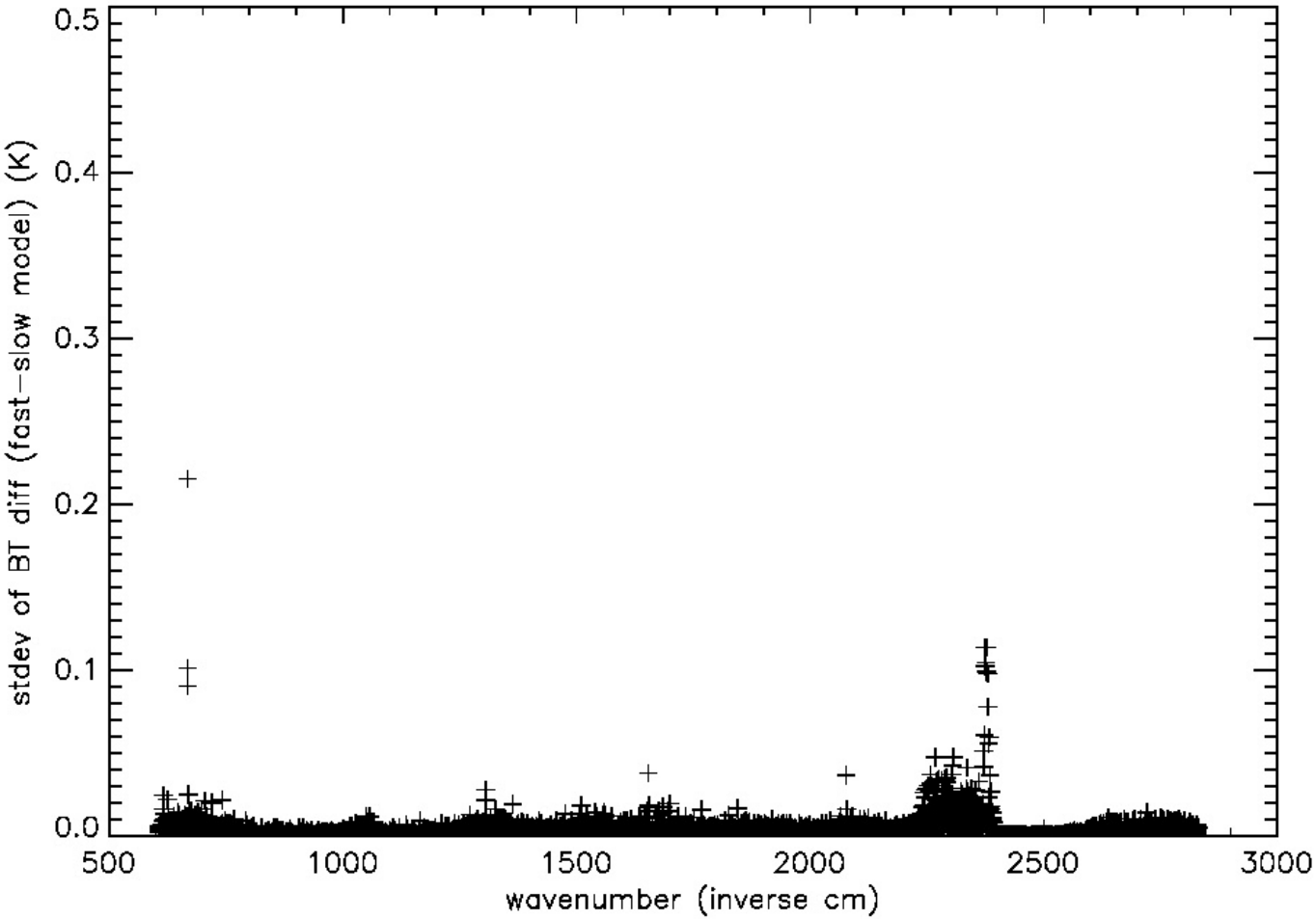
Developments in IR sounding

Use of PCs

Future directions for IR data
Principal Component RT Modelling

- HT-FRTC Model developed by Stephan Havemann
- Similar to Xu Liu's PCRTM
- Designed to calculate radiances
  - either at TOA
  - or for a range of viewing angles for airborne instruments
- Wavelength range: 3 - 16.5 μm
- Atmospheric absorption by water vapour and atmospheric gases included
- Spectral resolution: currently 0.5 cm-1, higher possible (down to 0.0025 cm-1)
- Accuracy: Better than 0.1 K in Tb.
- Speed: comparable to RTTOV

HT-FRTC Accuracy



Standard deviation of differences between fast and LBL model for simulations of 100 independent profiles.

Experimental 1D-Var Scheme working with Principal Components

- Uses the new Havemann Taylor Fast Radiative Transfer Code - working in EOF space
- A 1-D Var scheme with control vectors of T(p), q(p), T* and spectrally resolved surface emissivity
- Observations will be Principal Components
- 1st version for clear skies only will be tested early 2007
- Aim to add additional PCs that represent cloud properties in the future.

Plans for IASI

Plans for IASI processing

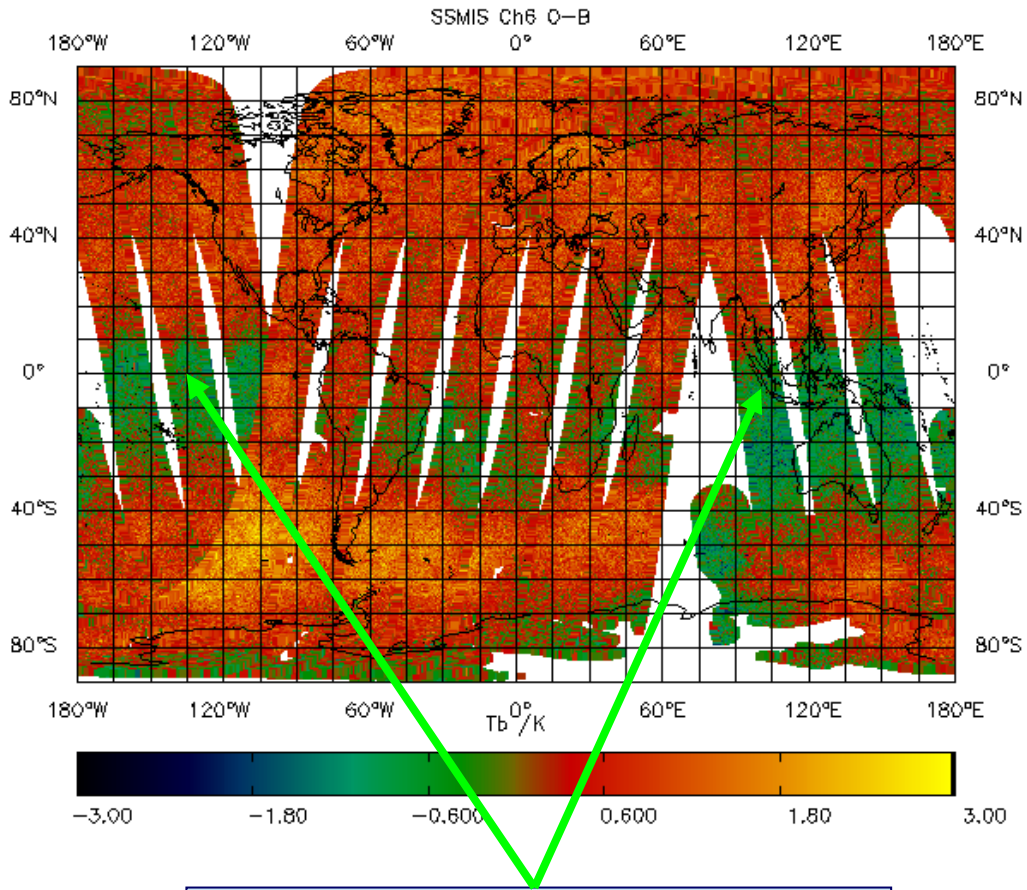
- We are planning a similar implementation as currently in place for AIRS
- Intend to use majority of 300 channel set as described in
  - "Selection of a subset of IASI Channels for Near Real Time Dissemination" by Collard and Matricardi (2005)
- Clear/Sea only to begin with

Early data quality monitoring – why do it?

SSMIS Reflector Emission – Early checks allowed

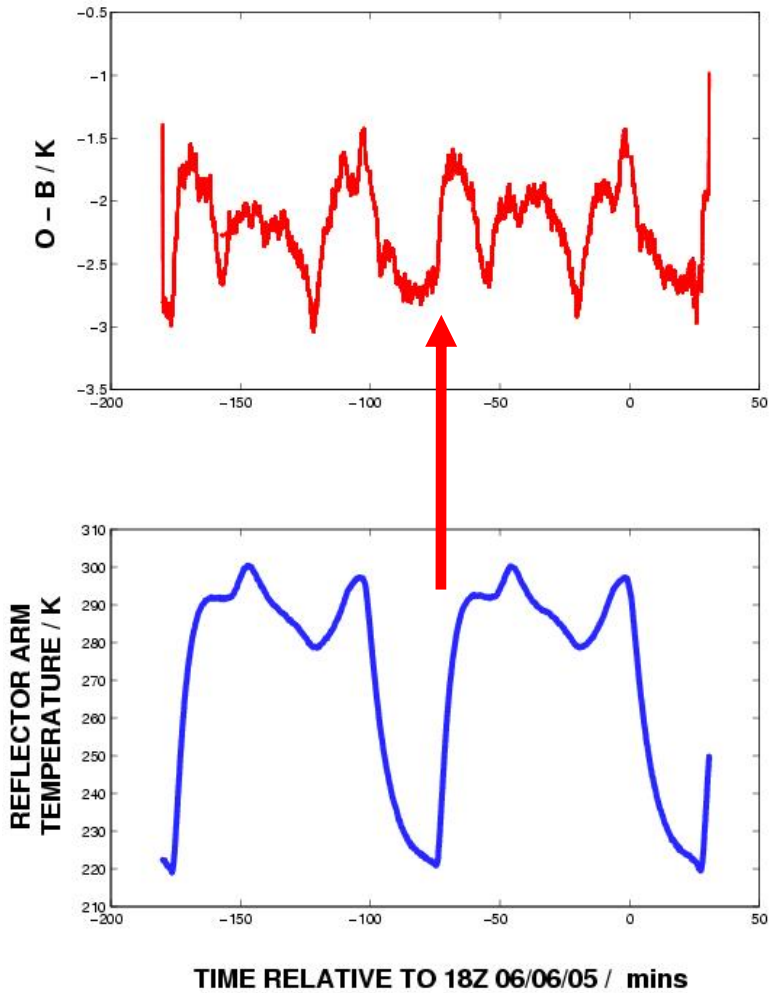
identification and resolution of data quality issues

Global maps of O-B



Problems in ascending node not evident in descending node

Smooth timeseries of ob-by-ob O-B

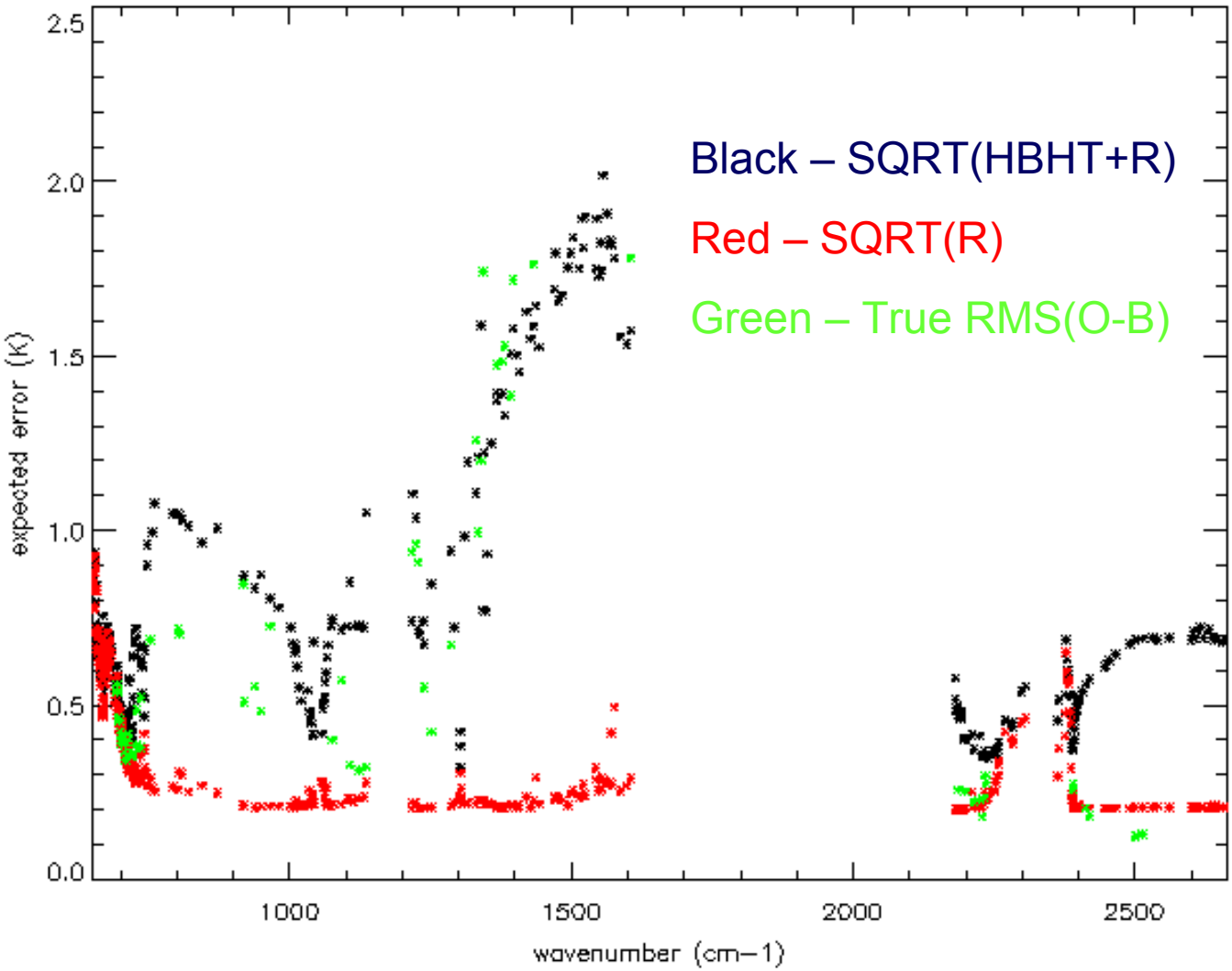


What do we expect of IASI?

- Take 1D-Var background error covariance matrix
- And an estimate of IASI instrument plus forward model error (assume channels uncorrelated)
- Calculate HBH^T+R
- Average across sea profiles from 13495 Chevallier profile dataset
- This should be roughly equivalent to what we expect for IASI Obs-Background values

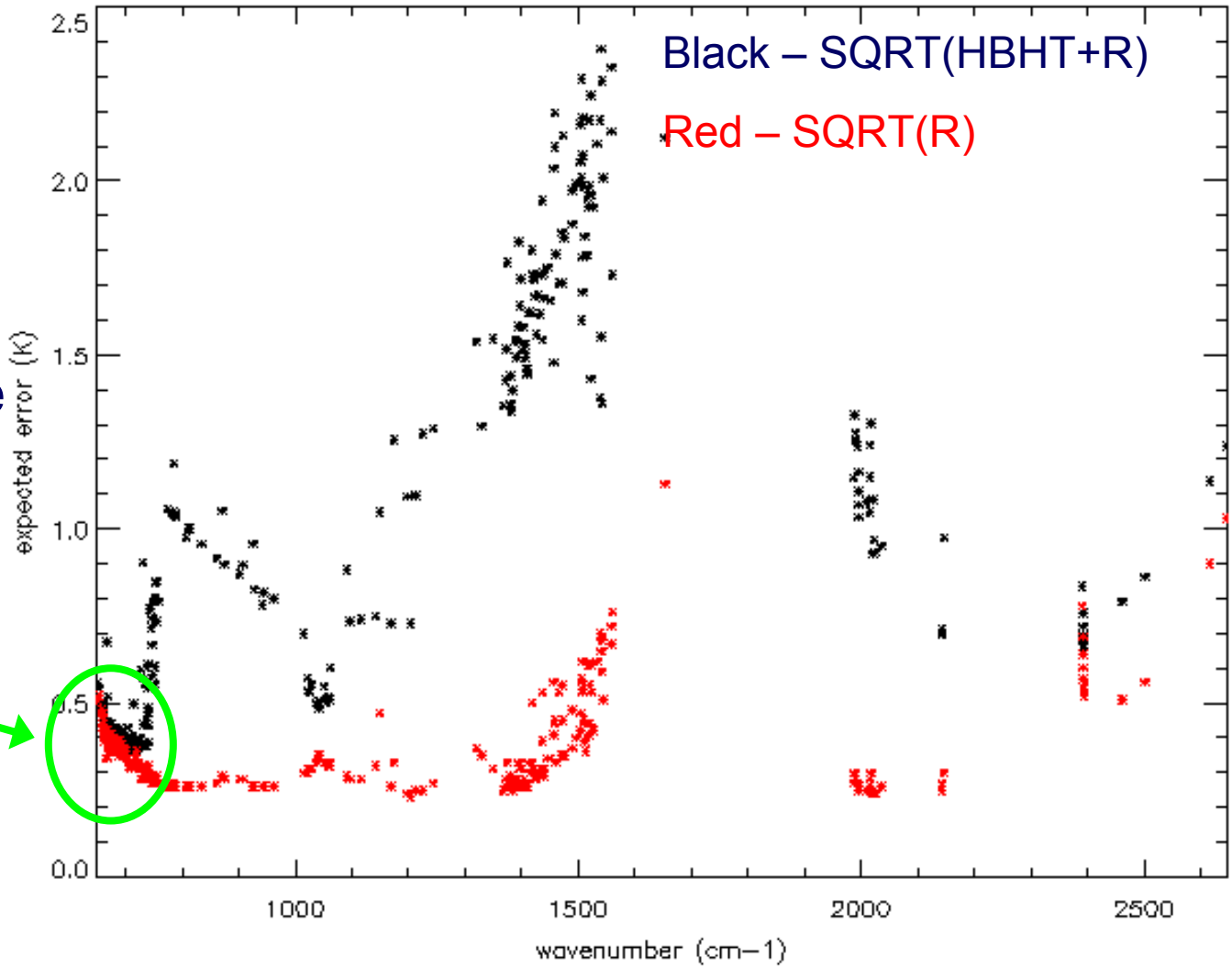
Let's look at AIRS first

- Real AIRS RMS (O-B) used to adjust B-matrix to give realistic calculation
- Short-wave calculated error is much larger than truth.



What do we expect of IASI? (2)

- Background error possibly overestimated
- However, gives indication of which parts of the spectrum we should be able to model most accurately
- And differences from AIRS



IASI Data Quality

Routine Monitoring

Routine Monitoring of IASI Data

- ITSC 14: Action from NWP Working Group to produce a Monitoring Strategy for IASI
- Aim is to encourage NWP centres to produce consistent monitoring output, making comparisons between centres easier
- Series of plots available on external web
- Provision of feedback to CNES/EUMETSAT in event of problem identification
- Currently ECMWF, Met Office, Météo-France have “signed up”

Routine Monitoring of IASI Data (2)

- For more detail on what is proposed, please see:

  Proposal of a monitoring strategy for IASI

  Thomas Auligné (ECMWF)

  Denis Blumstein / Thierry Phulpin (CNES)

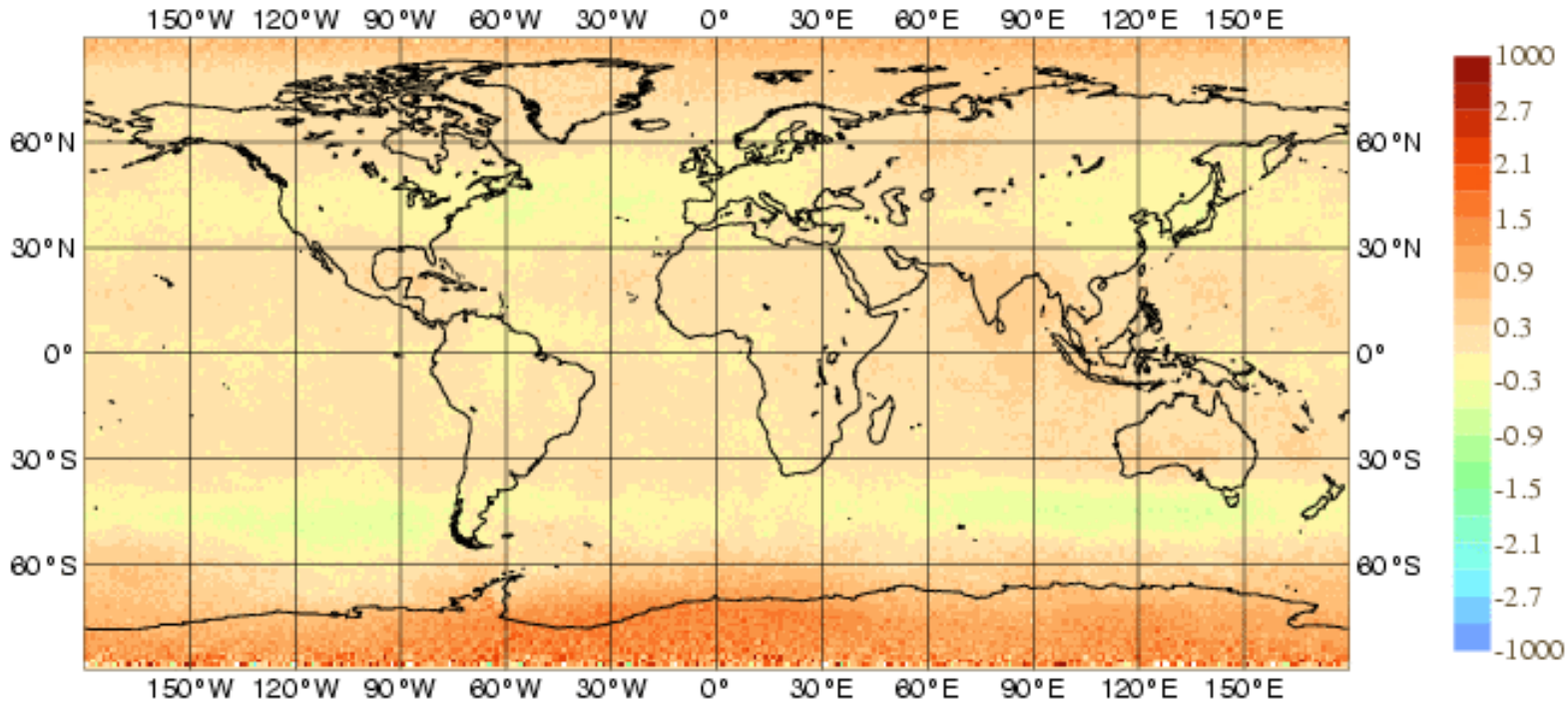
  Fiona Hilton (Met Office)

- Most of what is proposed is already produced by many NWP centres for other instruments, e.g. AIRS, ATOVS

Example monitoring plots
Global Map

Example from ECMWF AIRS monitoring of selected channel

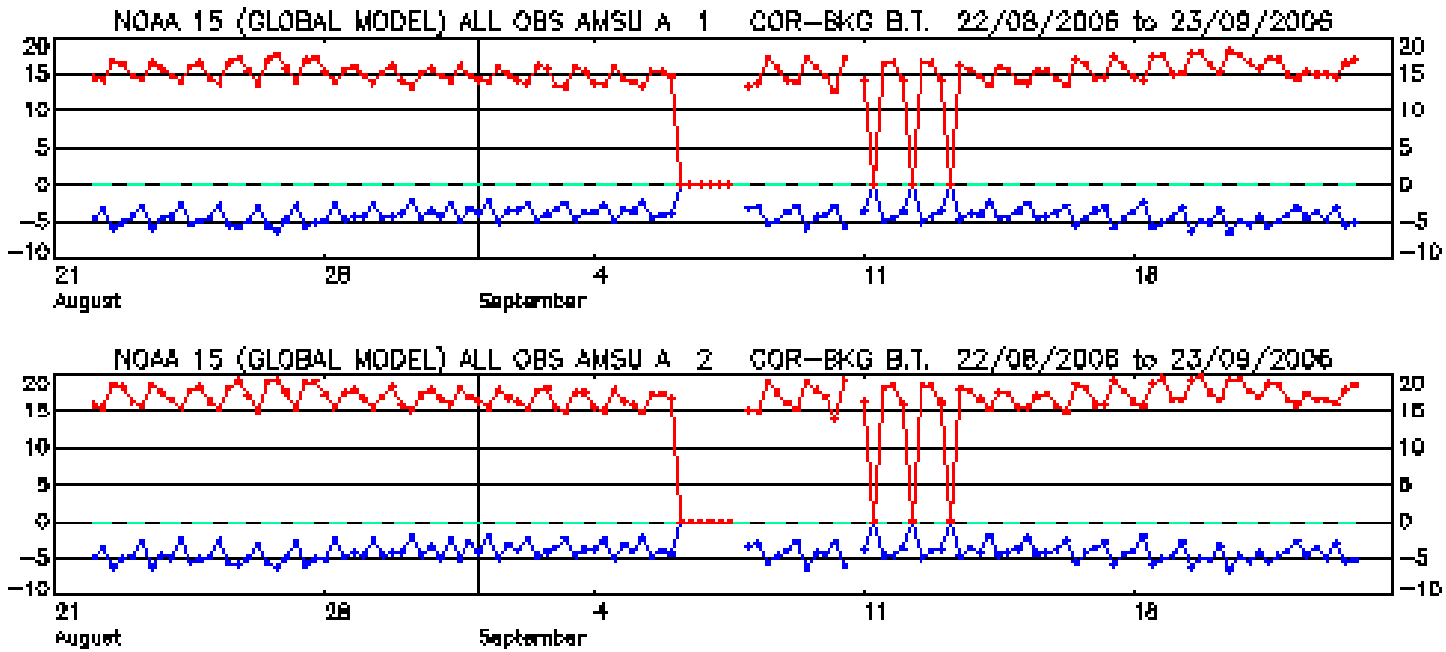
STATISTICS FOR RADIANCES FROM AQUA / AIRS - 75
MEAN ANALYSIS DEPARTURE (OBS-ANA) (BCORR.) (CLEAR)
DATA PERIOD = 2006090100 - 2006092306 , HOUR = ALL
EXP = 0001
Min: -2.1150 Max: 5.3492 Mean: 0.207929



Example monitoring plots
Time series plot

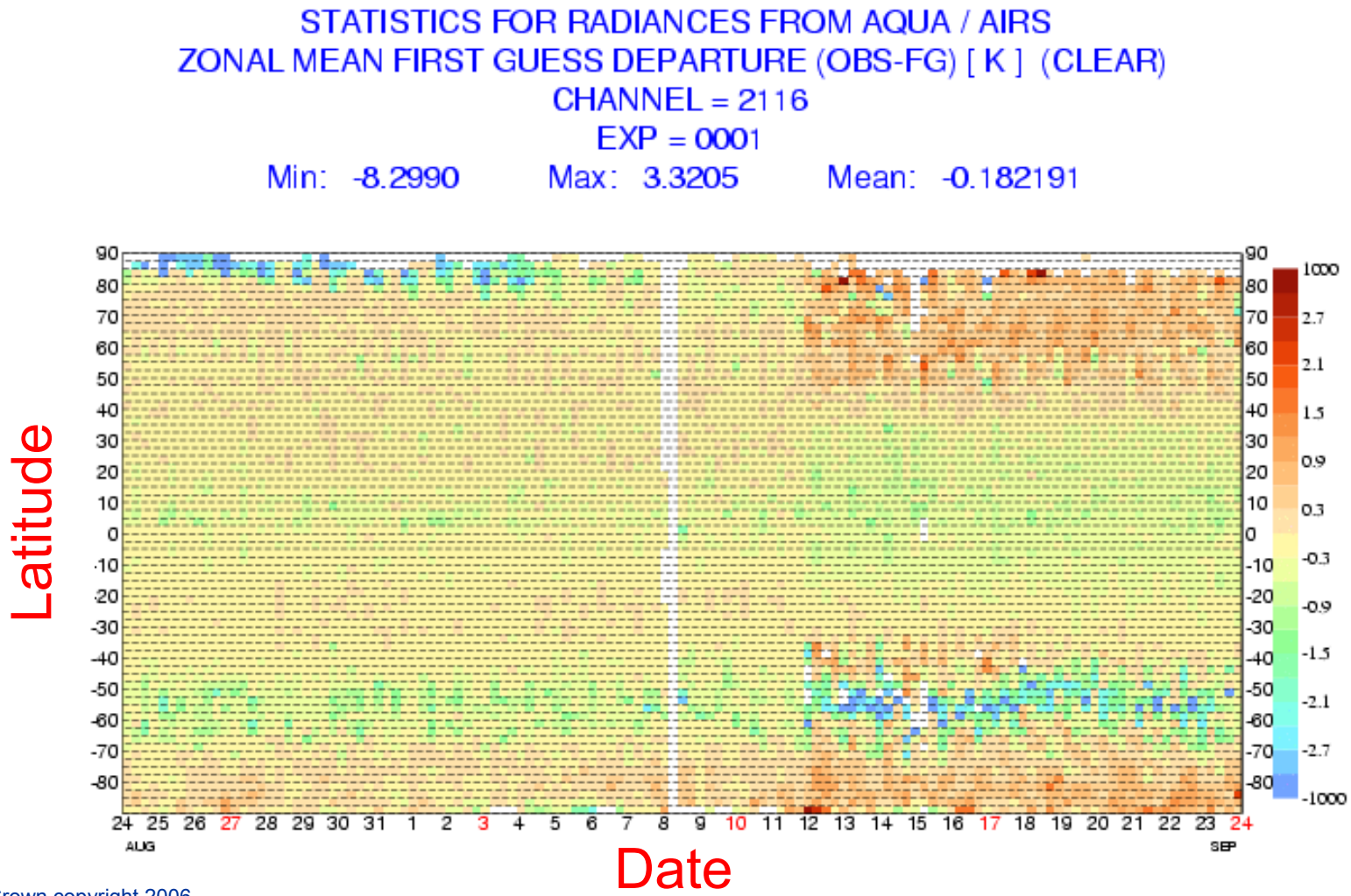
Example plot from Met Office ATOVS monitoring system

Mean (blue) and SD (red) of O-B values of selected channel



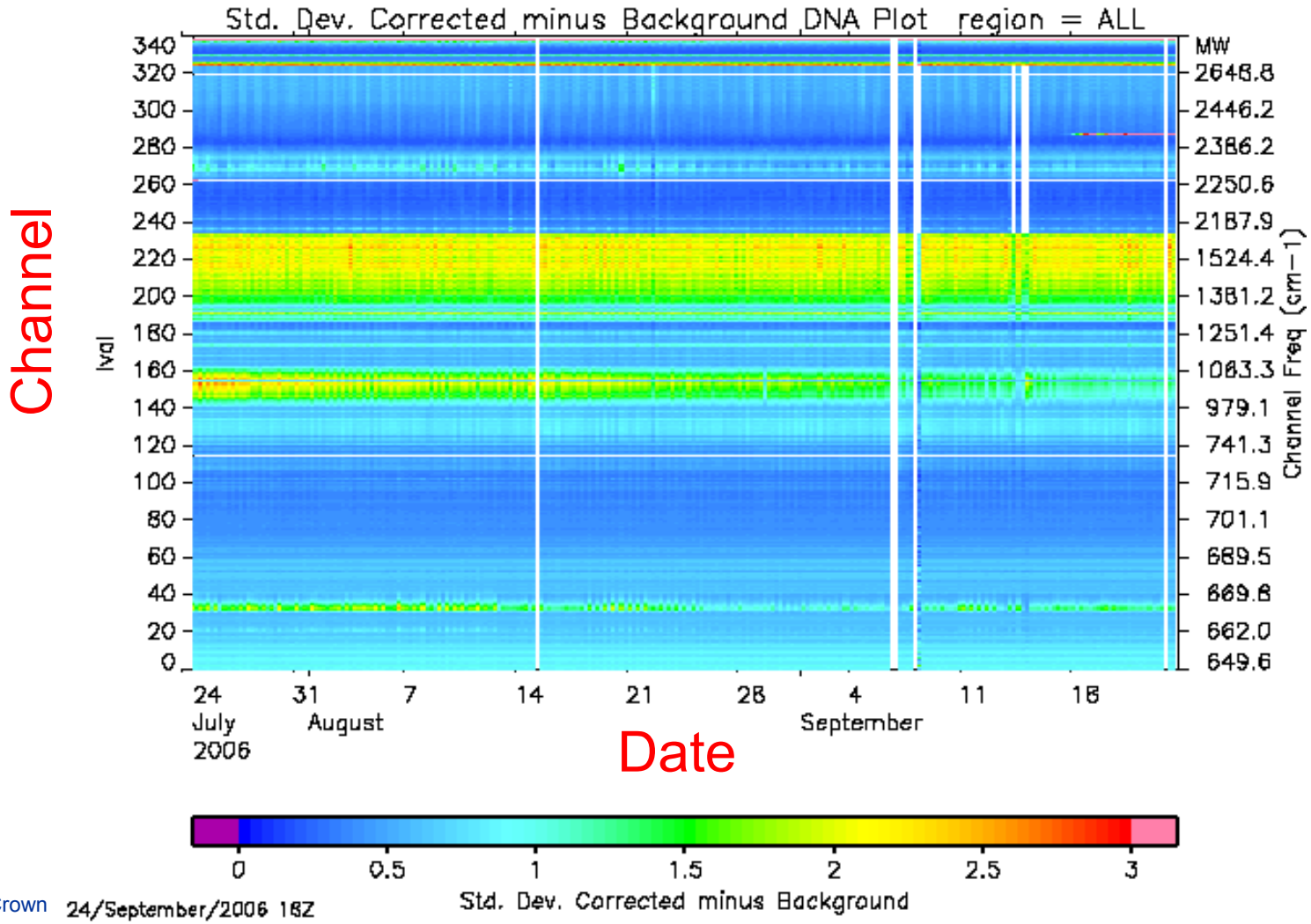
Example monitoring plots
Hovmoeller plot

Example from ECMWF AIRS monitoring of selected channel



Example monitoring plots
DNA plot

Example plot from Met Office AIRS monitoring



Example monitoring plots Summary Map

ABS(Mean(O-B)/SD(O-B))

All channels plotted together

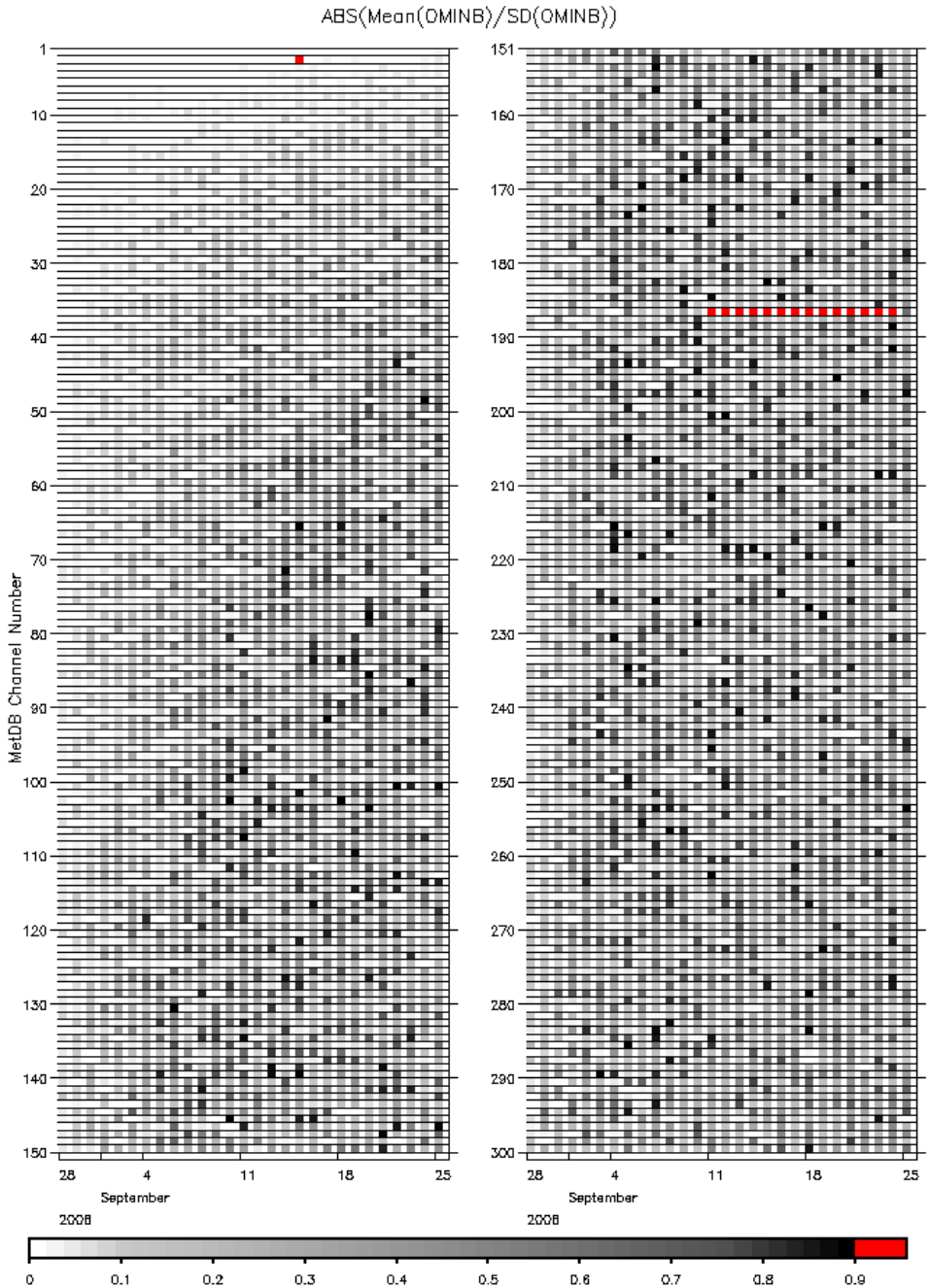
Colour scale used to easily

Identify outliers in red

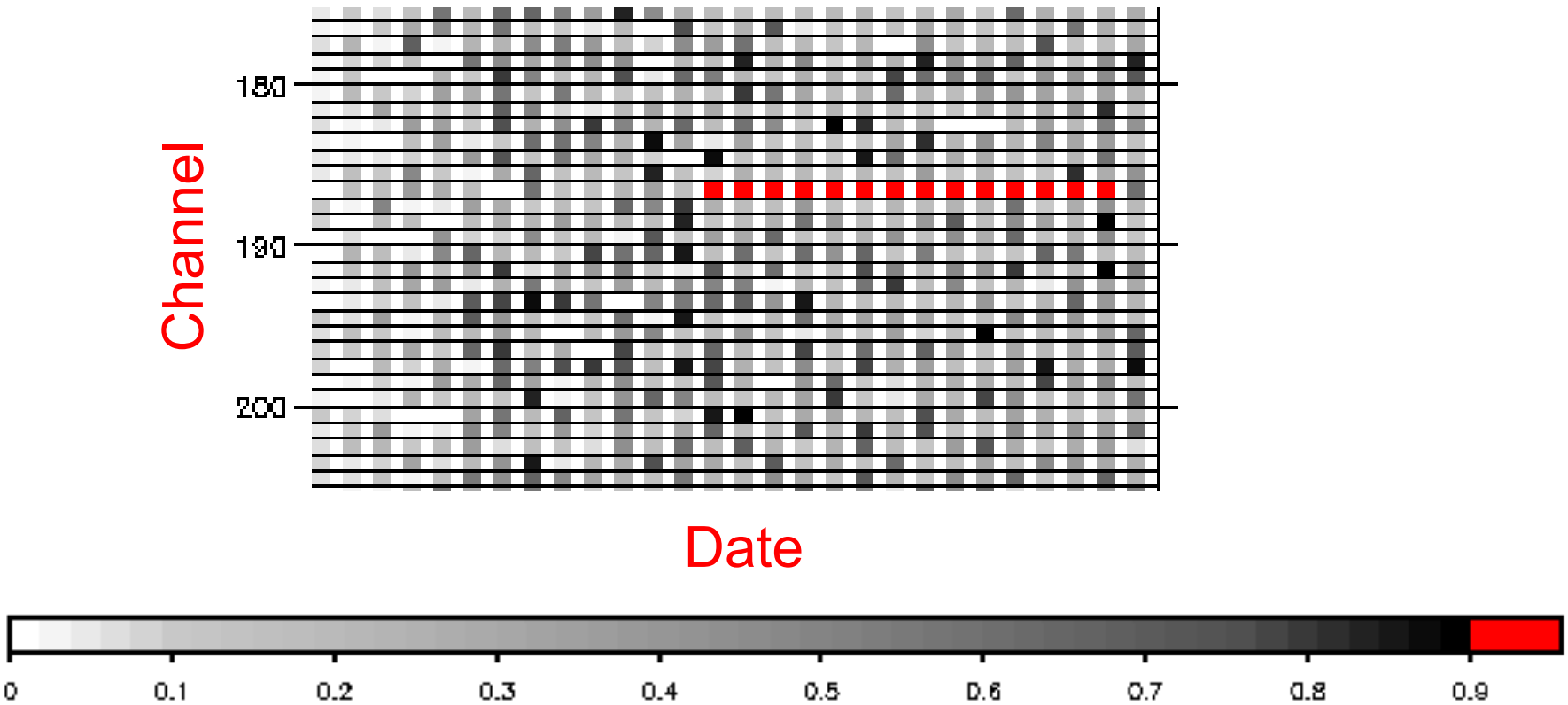
(next slide)

Example plot with

made-up data



Example monitoring plots
Summary Map (Zoom)



Any Questions?