Long Term Statistics of MPEF Winds

Arthur de Smet
Manuel Carranza
Marie Doutriaux-Boucher

Contents

Operational AMV products:

- Description
- Quality parameters
- Database storage
- Monitoring

Long term statistics:

- Number and quality of winds
- Co-locations with radiosonde and Met Office model

Atmospheric Motion Vectors (AMVs)

Channels:

- VIS-0.8
- WV-6.2
- WV-7.3
- IR-10.8
- HRVIS

Main parameters:

- Speed & direction
- Height (pressure)
- Quality

Every hour (for each channel):

- 3 intermediate AMV products
- 1 final AMV product

Quality parameters

Three consistency checks:

- Temporal vector consistency: compares each vector to corresponding one in previous intermediate product
- Spatial vector consistency: compares each vector to vectors in close vicinity
- Forecast consistency: compares each vector to forecast wind

Two quality indicators:

- Including forecast consistency
- Excluding forecast consistency

AMV data in database

In MPEF database:

- Data from final and BUFR products
- Mainly numbers of winds & quality
- Stratification according to:
  - Level (low, medium, high)
  - Region (global, tropics, NH, SH)
- Little information about height assignment
- Co-locations with radiosondes

Monitoring of AMVs

Monitoring within MPEF:

- Radiosonde observations
- Aircraft observations
- Forecast

Monitoring at NWP SAF and ECMWF / Met Office:

- Forecast
- NWP monitoring pages
- Wind fellow (Kirsti Salonen)

This presentation

Statistics from our AMV products:

- Number of generated winds
- Quality development
- Daily averages

Statistics from co-locations against radiosonde:

- Number of co-locations
- Speed bias
- Monthly data

Statistics from verification against Met Office model (provided by Met Office):

- Speed bias
- Monthly data

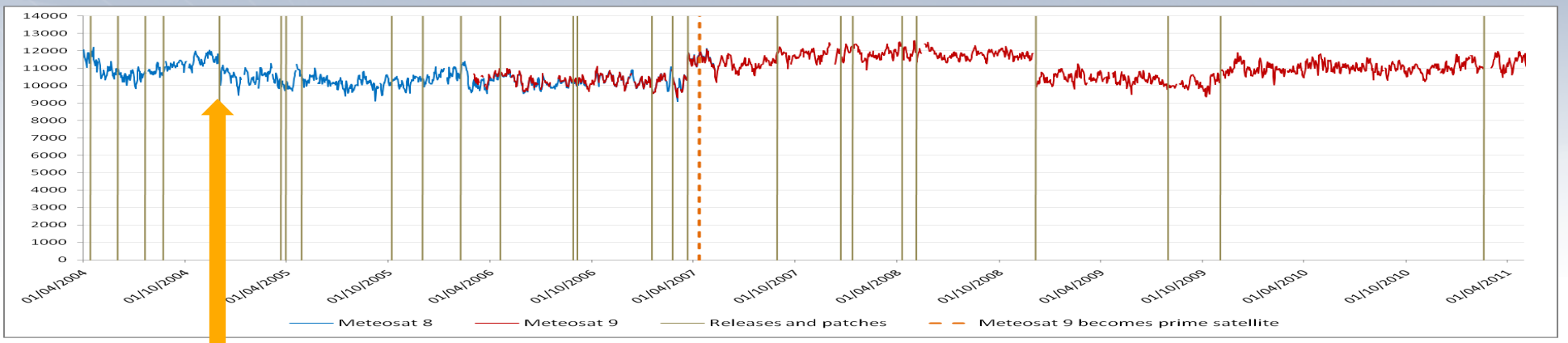
According to CGMS recommendations

This presentation

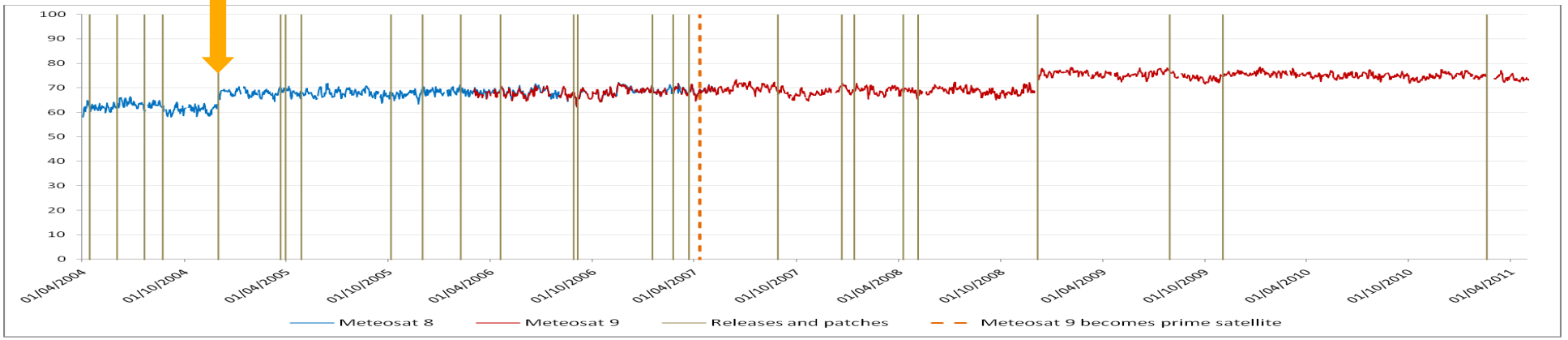
Time period:

- Meteosat-8: April 2004 – May 2007
- Meteosat-9: March 2006 – now

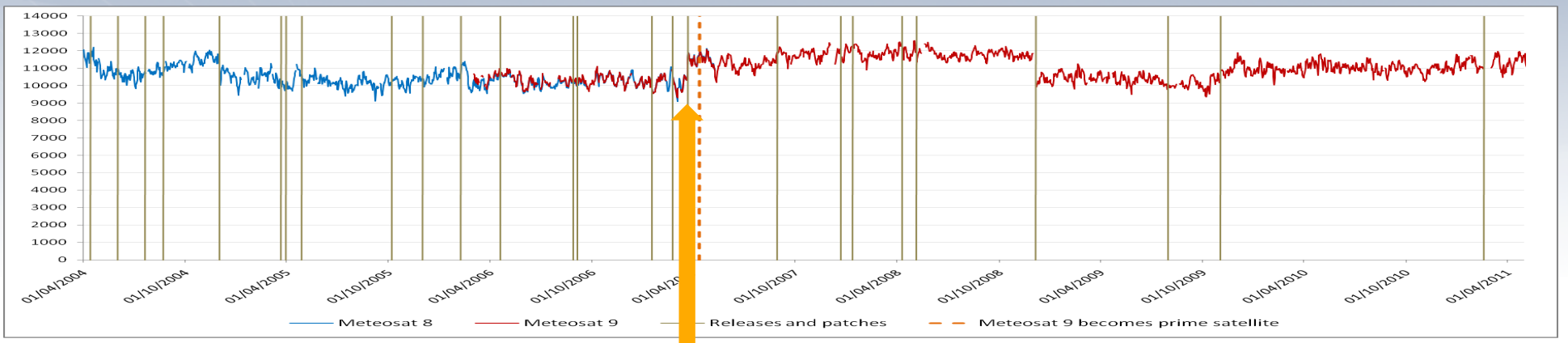
IR-10.8 Jumps related to algorithm changes



Several changes to height assignment and quality control

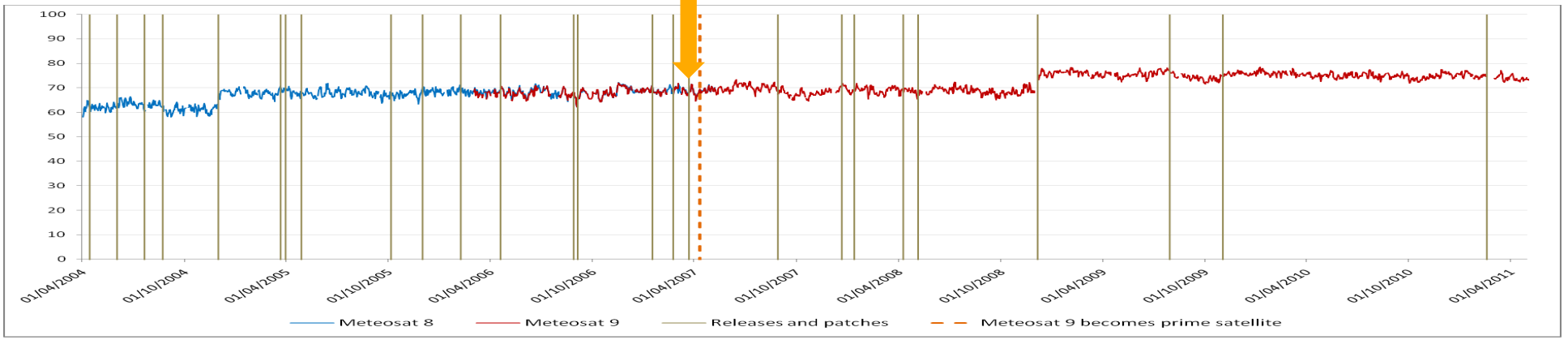


IR-10.8 Jumps related to algorithm changes

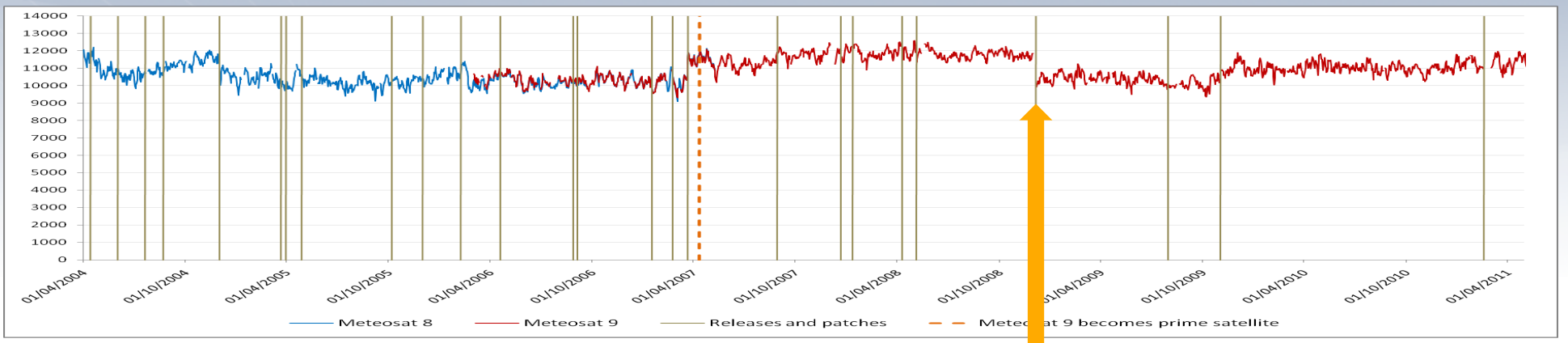


- Many small changes in height assignment

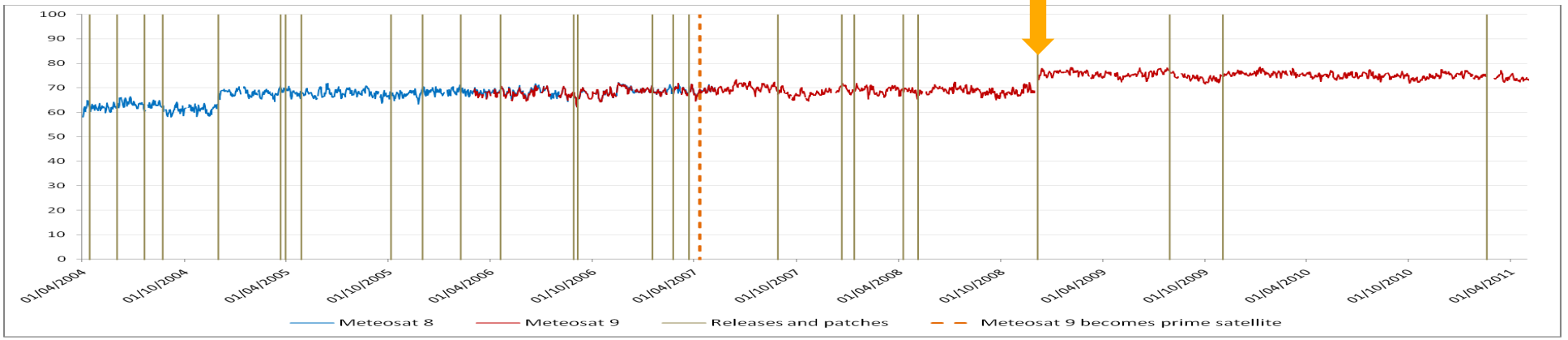
- Increase of Earth disc coverage



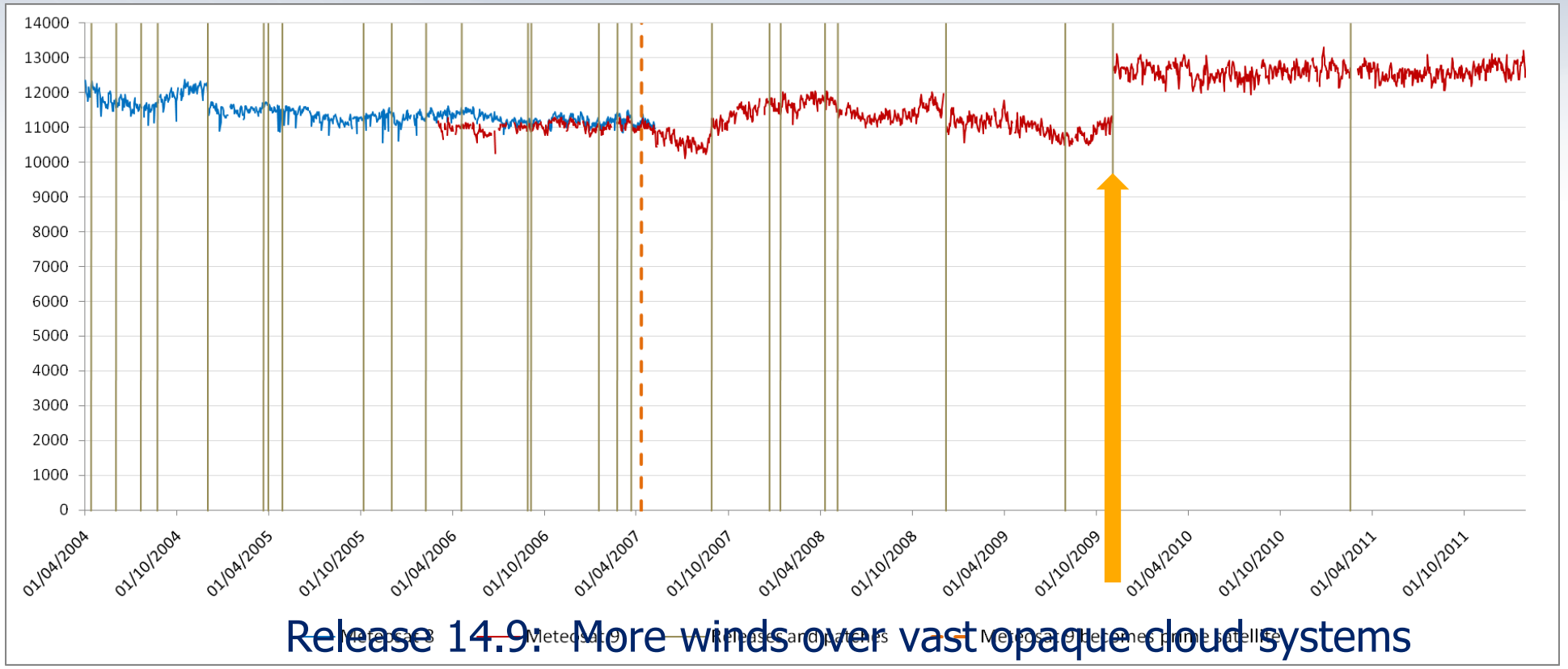
IR-10.8 Jumps related to algorithm changes



Release 14.8: only small AMV changes

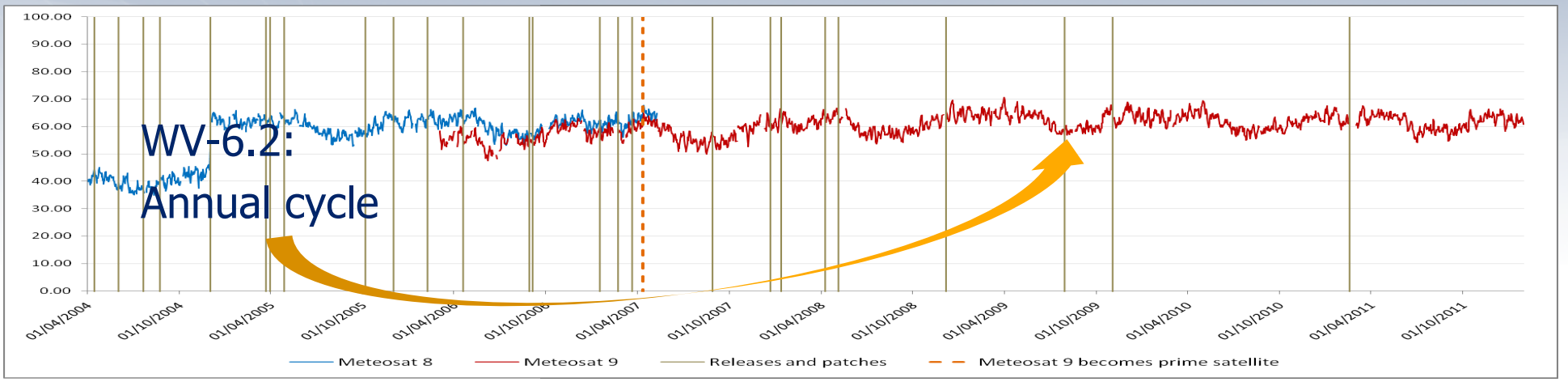


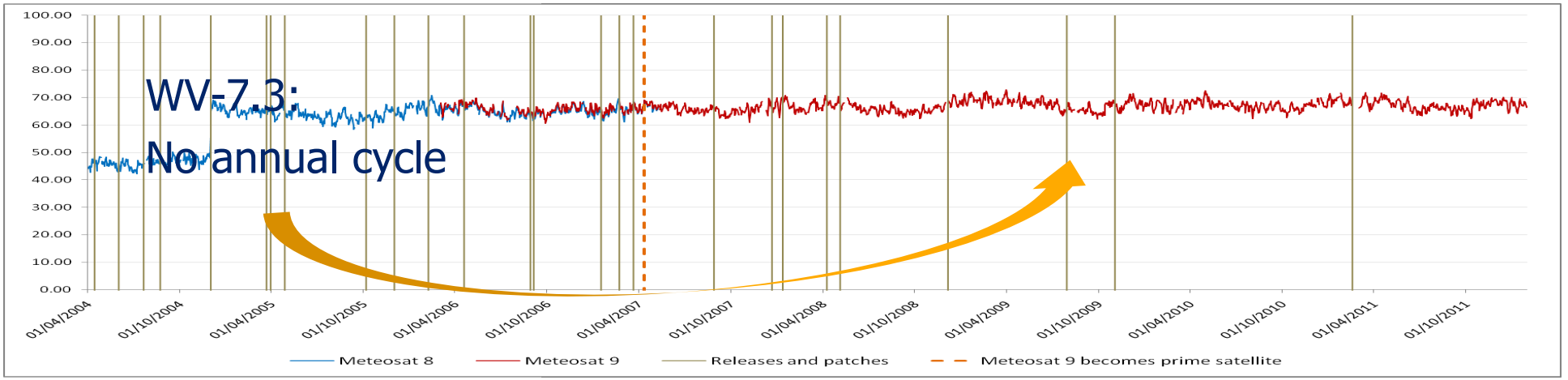
WV-6.2 Total number of winds



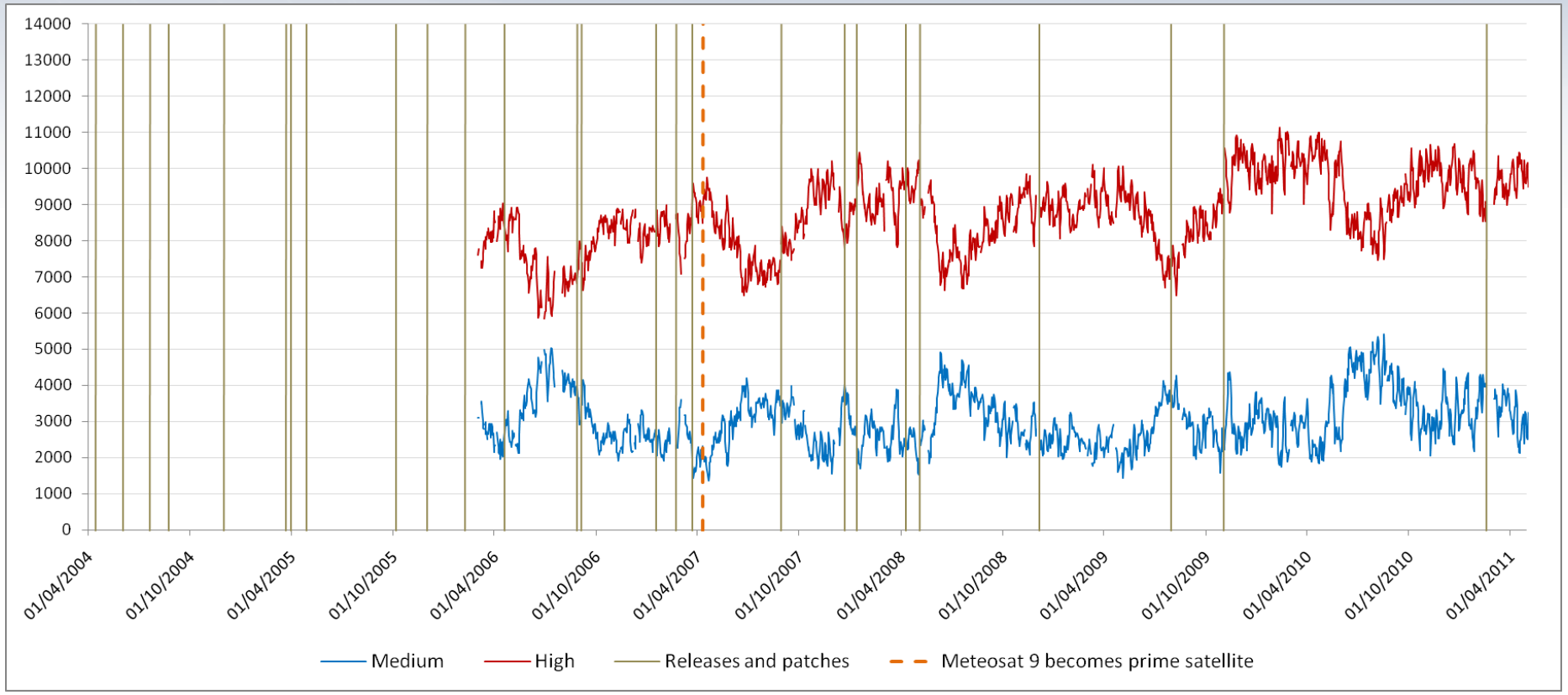
Release 14.9: More winds over vast opaque cloud systems

WV-6.2 versus WV-7.3 QI excluding f/c consistency



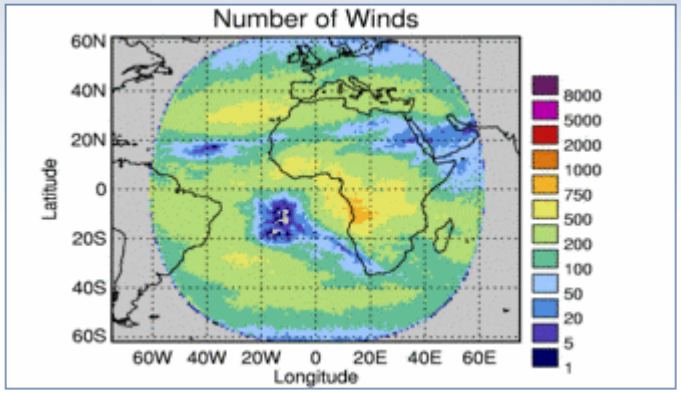


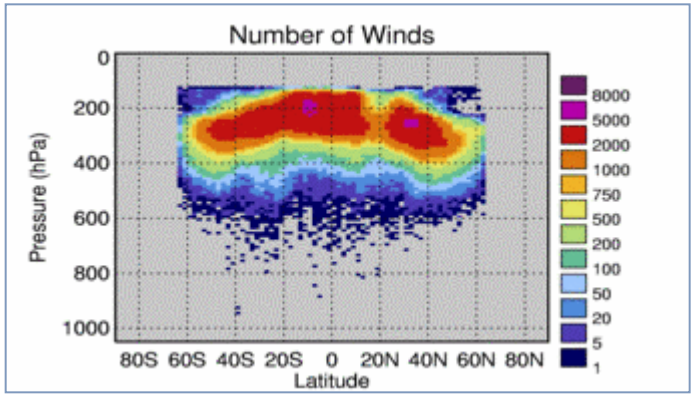
WV-6.2: Number of medium and high level winds



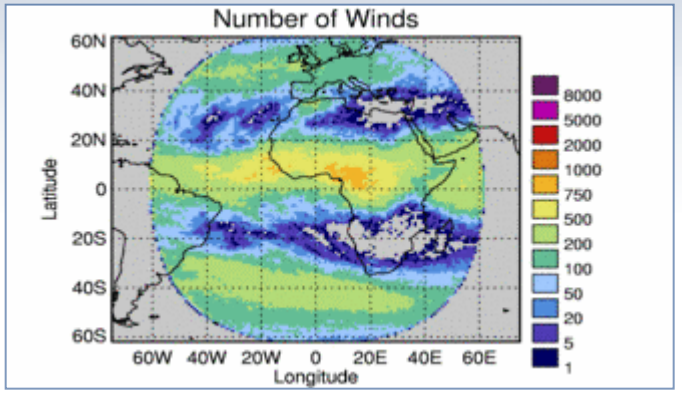
NWP SAF pages: number of WV-6.2 winds

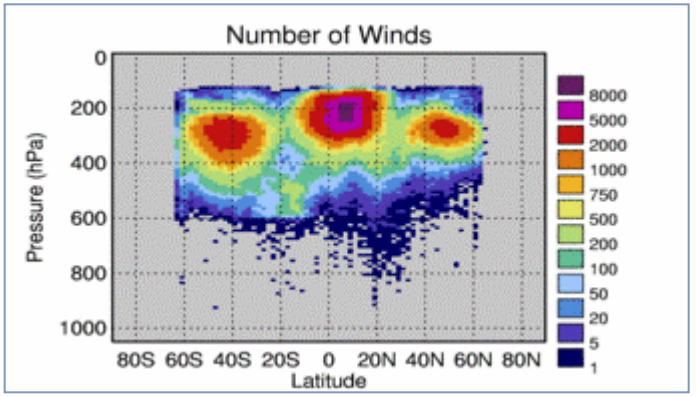
March 2010





July 2010





WV-6.2: Explanation of annual cycle

AMVs in Tropics:

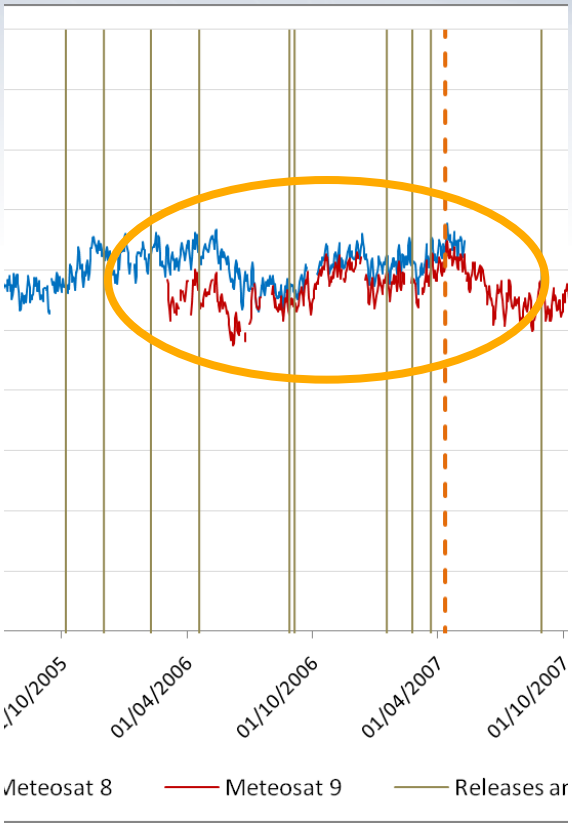
- Mainly convective cells that do not meet assumption of 'passive cloud tracer'
- Therefore lower vector consistencies (both spatial and temporal)

Annual cycle:

- Proportion of tropical winds peak around July
- Proportion is lowest around March

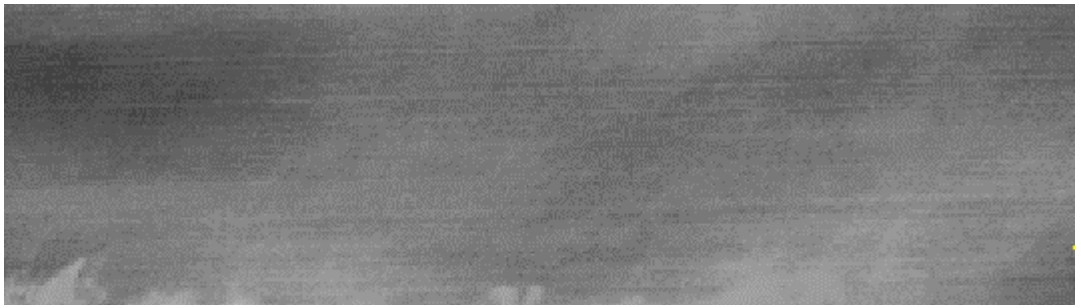
(remember: this is all about high / medium level winds)

WV-6.2 QI excluding forecast consistency



WV-6.2 anomaly:

- First observed by Jörgen Gustafsson
- Two of the three WV-6.2 detectors have increased low frequency noise
- This results in striping



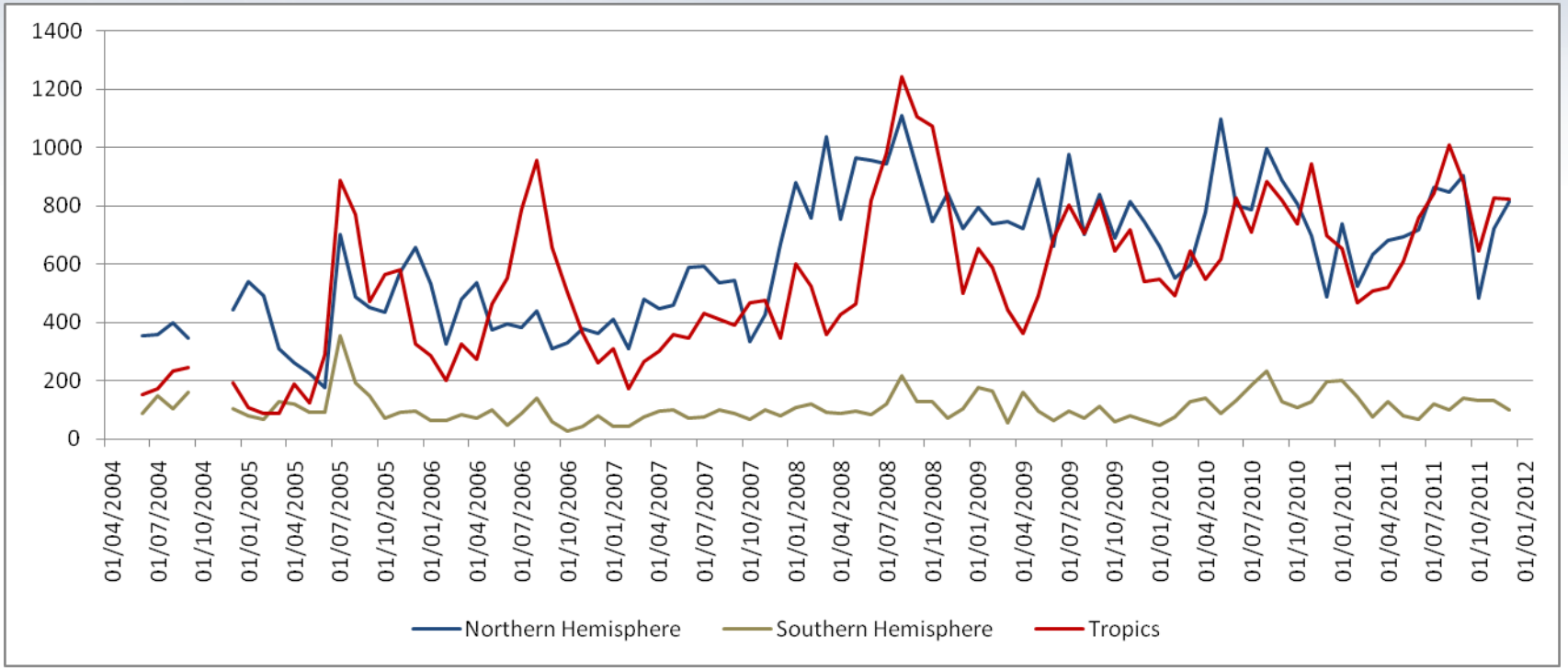
- Root cause has never been found
- IMPF corrections since November 2006

Model and radiosonde verifications

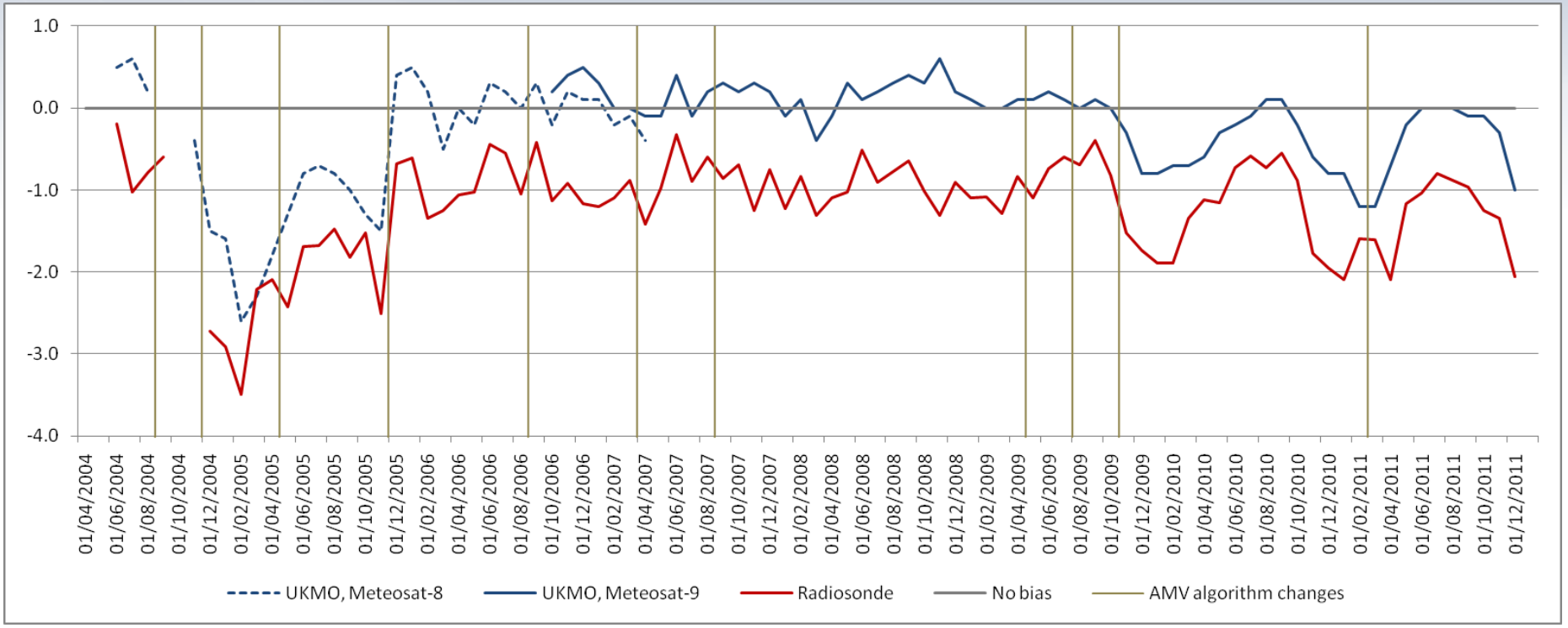
Comparison of AMVs against:

- Radiosonde observations
- Met Office and ECMWF models
- According to CGMS criteria:
  - Maximum horizontal separation 150 km
  - Maximum vertical separation 25 hPa
  - Maximum time difference 90 minutes
  - One co-location per AMV only, i.e. the nearest
- Results: mean and normalised RMS vector differences, bias

Number of radiosonde co-locations: VIS-0.8

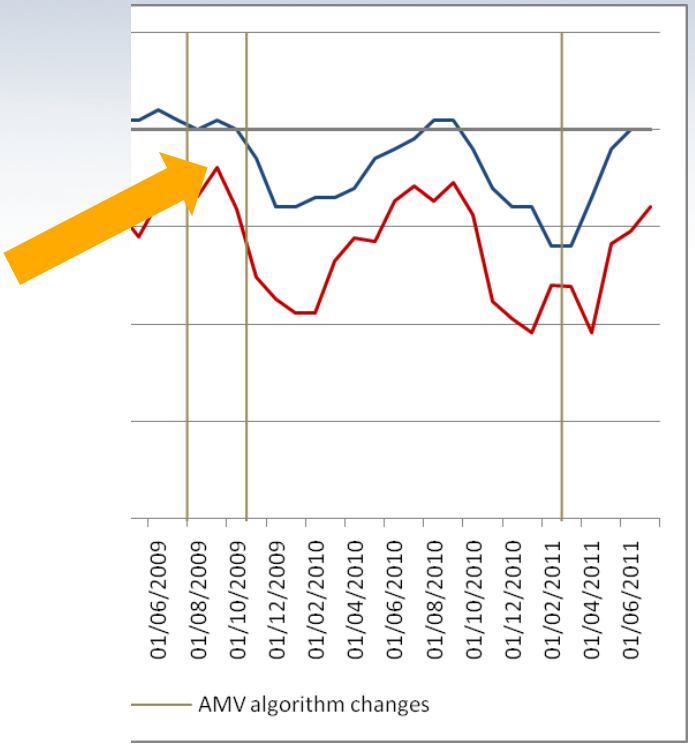


WV-6.2 high level winds: bias Northern Hemisphere



WV-6.2 high level winds: bias Northern Hemisphere

- Radiosonde and Met Office model biases clearly correlated
- Significant bias change after Release 14.9 on 2 November 2009
- Bias is obvious for all high level winds, as well as the bias change:
  - Both WV channels and IR channel
  - Also over S.H., but not over Tropics



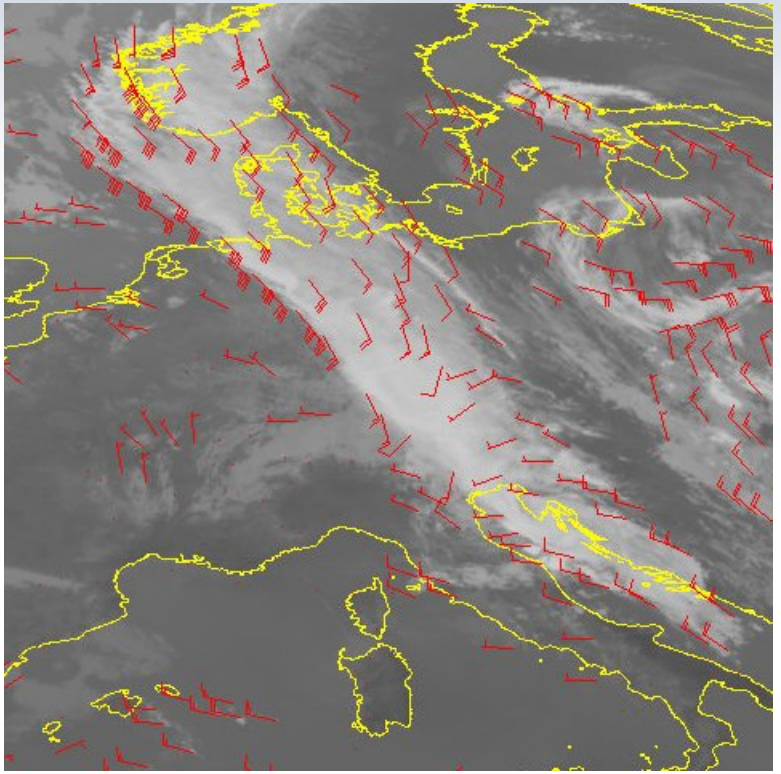
High level winds: extra-tropical bias change

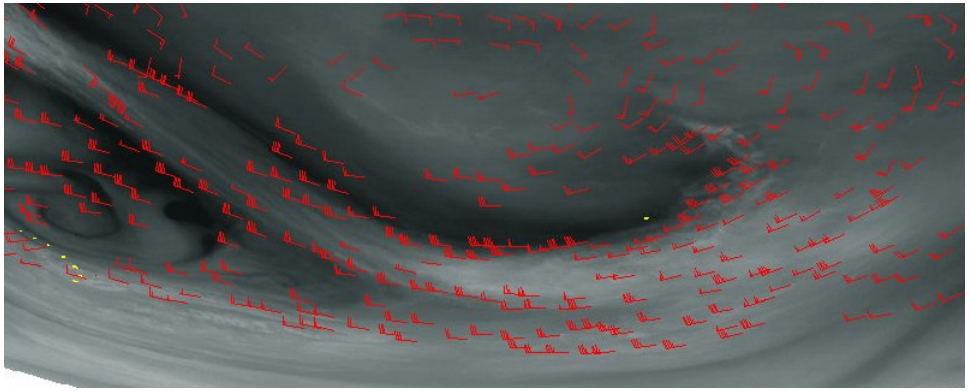
Main AMV change in Release 14.9:

Solution to problem of 'no winds over large opaque cloud systems'

This solution caused:

- Significant increase in AMV numbers
- Small drop in average AMV pressure
- No change in average AMV speed

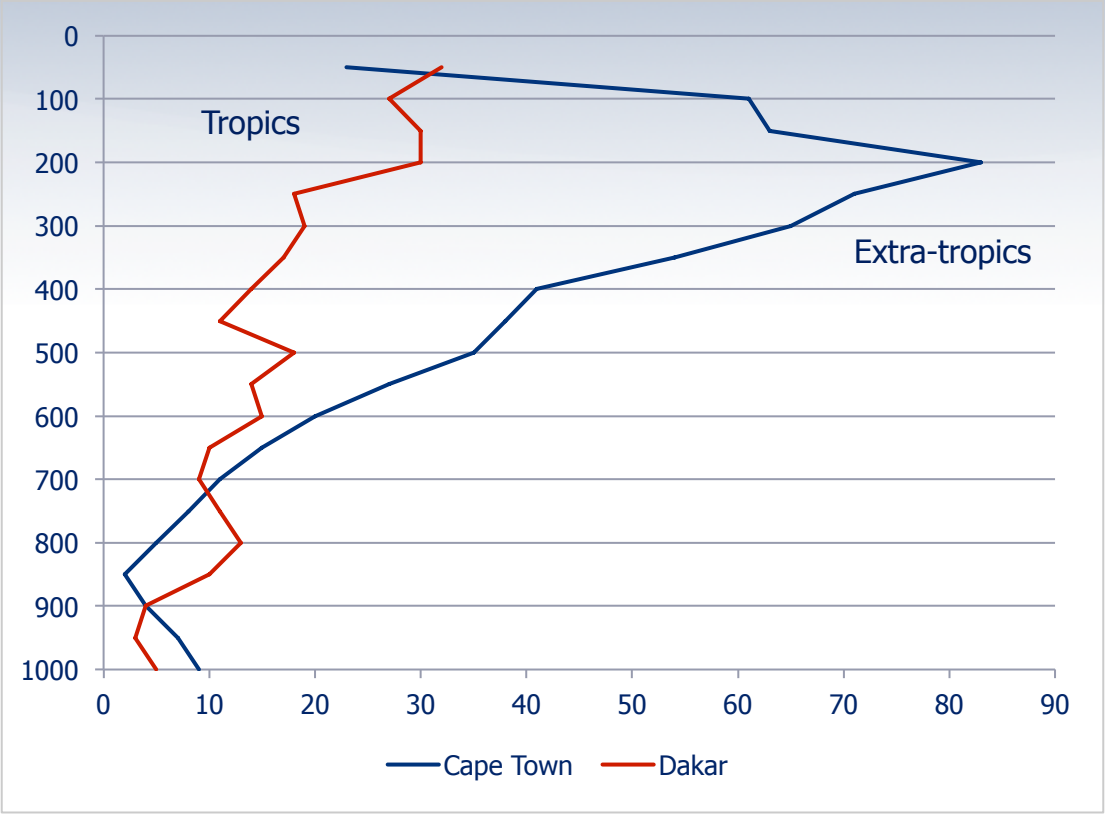




High level winds: extra-tropical bias change

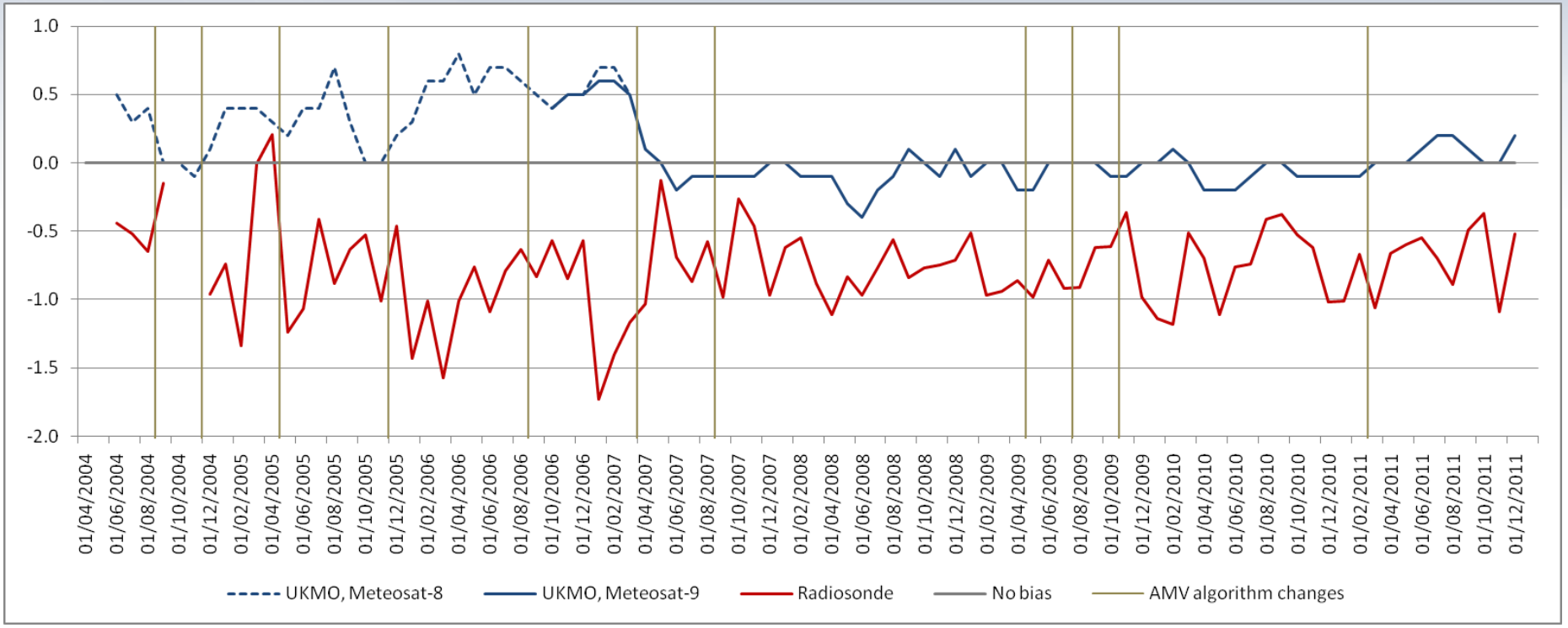
Effect of AMV pressure drop on biases:

- Depends mainly on level and magnitude of wind-shear
- Small in Tropics
- Potentially large in extra-Tropics
- Bias will decrease when AMV is below wind maximum



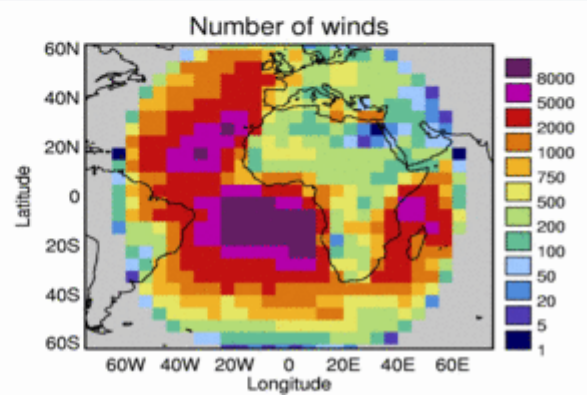
Radiosonde wind speed, 9 August 2011, 0.00 UTC
Cape Town (36º S) and Dakar (15 º N)

VIS-0.8 low level winds: bias Tropics



VIS-0.8 low level winds: bias Tropics

- Radiosonde and Met Office model biases not correlated
- Negative radiosonde bias is found for all low level winds:
  - VIS, HRVIS and IR channels
  - Mainly over Tropics, but also in S.H.
- Reason not clear
- Majority of those AMV heights result from *Inversion Height Assignment*



Conclusions

- Gradual improvement in AMV quality
- Impact of algorithm changes can be visualised
- Some features can not easily be explained
- Information in database currently very limited (e.g., hardly any height data)

Thank you