Atmospheric motion vectors derived from MSG Rapid Scanning Service data at EUMETSAT

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EUMETSAT

SUMMARY

1. **GENERAL CHARACTERISTICS OF THE RAPID SCANNING SERVICE**
2. COMPARISON OF RAPID SCANNING (RSS) AND FULL-EARTH SCANNING (FES)
3. LIMITATIONS OF RSS
4. TESTS CARRIED OUT
5. RESULTS AND STATISTICS
6. CONCLUSIONS

1. GENERAL CHARACTERISTICS OF THE RAPID SCANNING SERVICE

- Rapid Scanning Service (RSS) from Meteosat-8 started on 13 May 2008 from a position at 9.5ºE.
- The MSG RSS provides images of about one third of the full Earth disc every five minutes.
- The rapid scan area for the MSG RSS covers a latitude range from approximately 15ºN to 70ºN for all channels.
- RSS data dissemination is identical to normal data dissemination.
- Image segments are based on 464 lines, which are compatible with the full-disc level 1.5 data scans.
- RSS is periodically interrupted for short periods of time in order to exercise the instrument mechanics in Full-Earth Scanning (FES) mode.
- The baseline operational period for MSG RSS is 26 days of continuous rapid scanning followed by 2 days of full-Earth disc scanning, over 11 months per year.

1. GENERAL CHARACTERISTICS OF THE RAPID SCANNING SERVICE

- The 12th month (around December and January) is devoted to either FES or no imaging.
- Interruptions to RSS can be expected if the equipment is needed to support the service of Meteosat-9 at 0º.
- The following meteorological products are produced from RSS data:

Product	Format	Frequency
Atmospheric Motion Vectors (AMV)	BUFR	Every 20 minutes
Clear Sky Radiances (CSR)	BUFR	Every 15 minutes
Multi-sensor Precipitation Estimate (MPE)	BUFR	Every 5 minutes
Active Fire Monitoring (FIRG)	GRIB	Every 5 minutes
Active Fire Monitoring (FIRA)	ASCII	Every 5 minutes
Global Instability Index (GII)	BUFR	Every 5 minutes

1. GENERAL CHARACTERISTICS OF THE RAPID SCANNING SERVICE

- Products are distributed via EUMETCast and the GTS, as for 0º data.

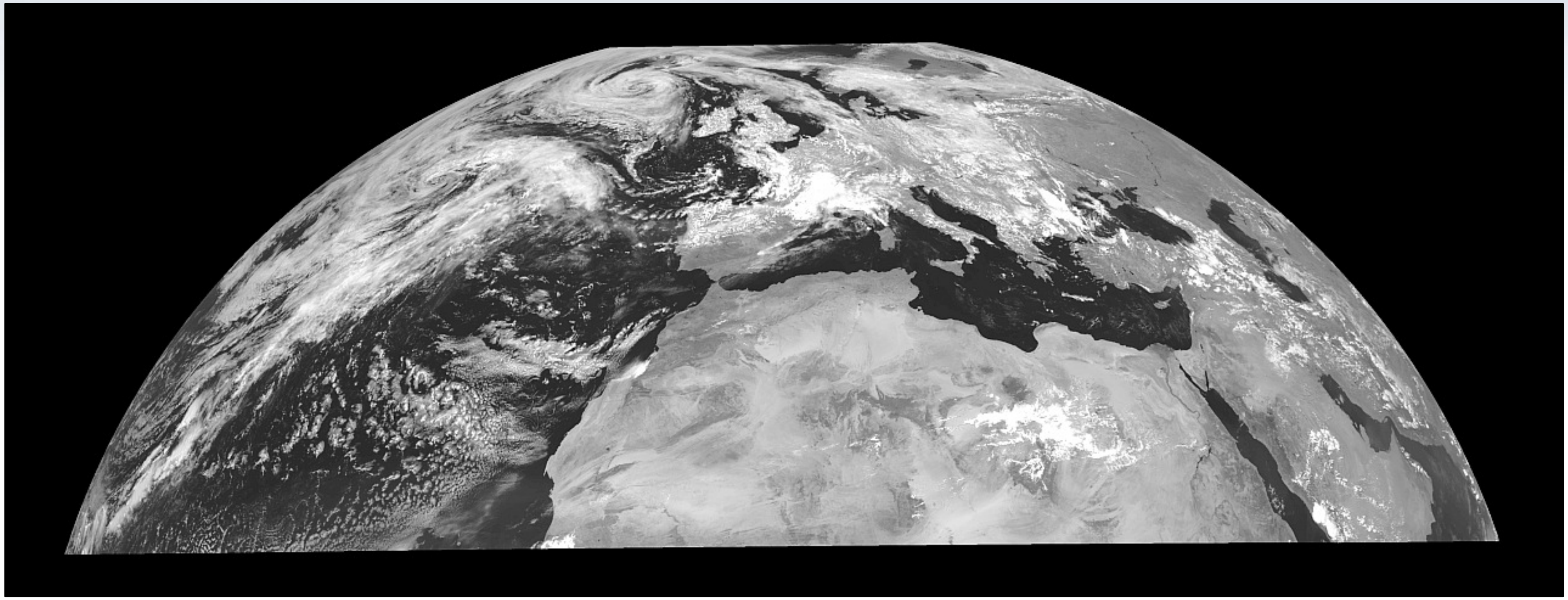

Figure 1.1. Meteosat-8 rapid scan area.

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2. COMPARISON OF RAPID SCANNING (RSS) AND FULL-EARTH SCANNING (FES)

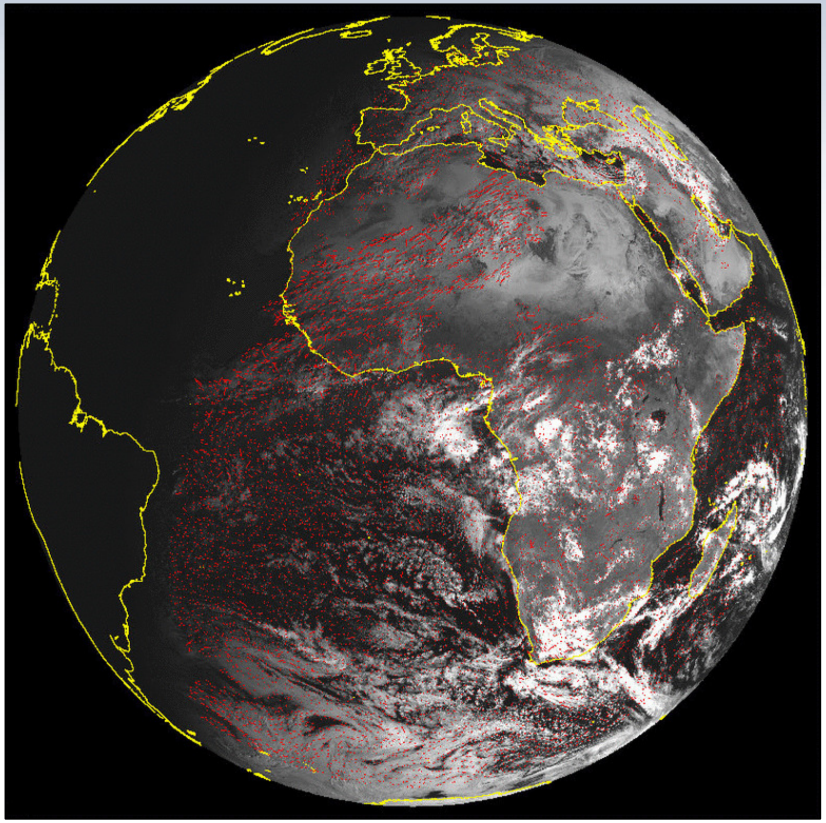


Figure 2.1. VIS 0.8 μm full-Earth disc (25/01/2010 – 08:15 to 08:45).

2. COMPARISON OF RAPID SCANNING (RSS) AND FULL-EARTH SCANNING (FES)

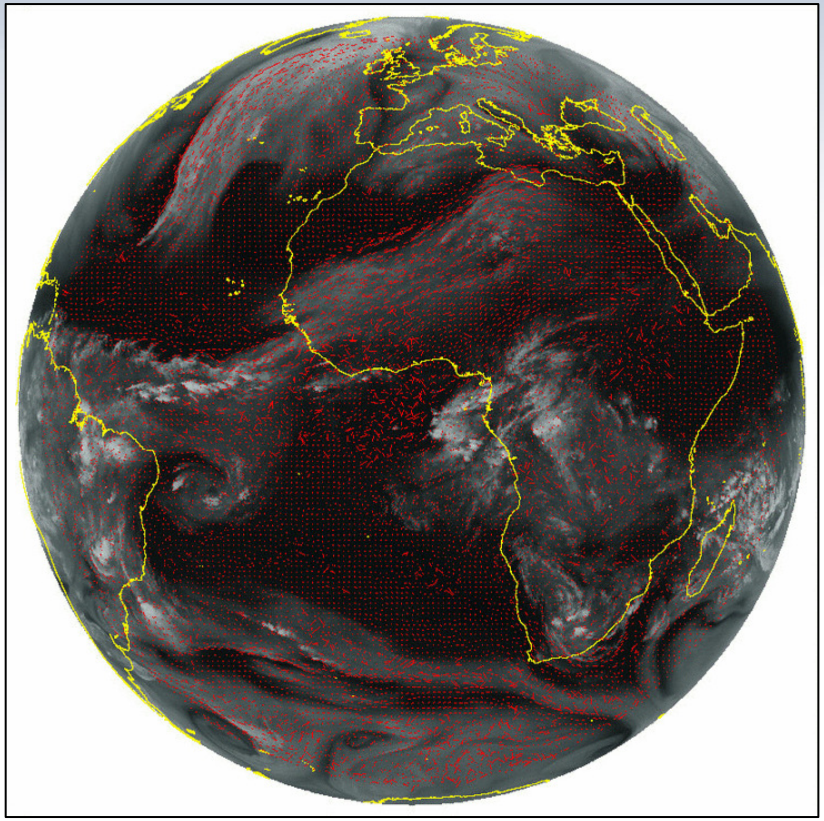


Figure 2.2. WV 6.2 μm full-Earth disc (25/01/2010 – 08:15 to 08:45).

2. COMPARISON OF RAPID SCANNING (RSS) AND FULL-EARTH SCANNING (FES)

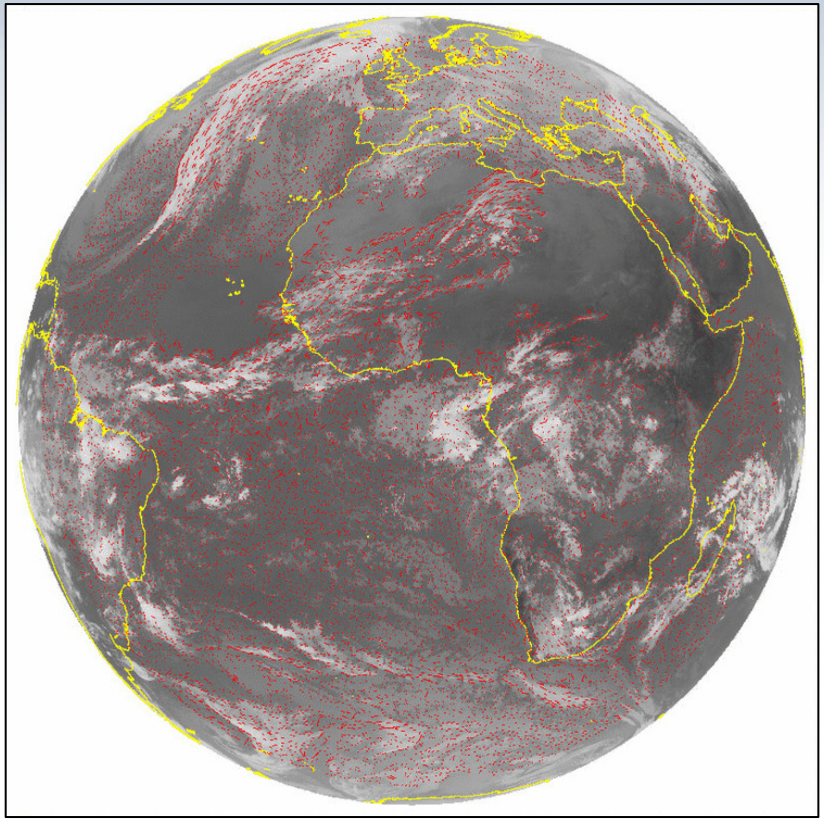


Figure 2.3. IR 10.8 μm full-Earth disc (25/01/2010 – 08:15 to 08:45).

2. COMPARISON OF RAPID SCANNING (RSS) AND FULL-EARTH SCANNING (FES)

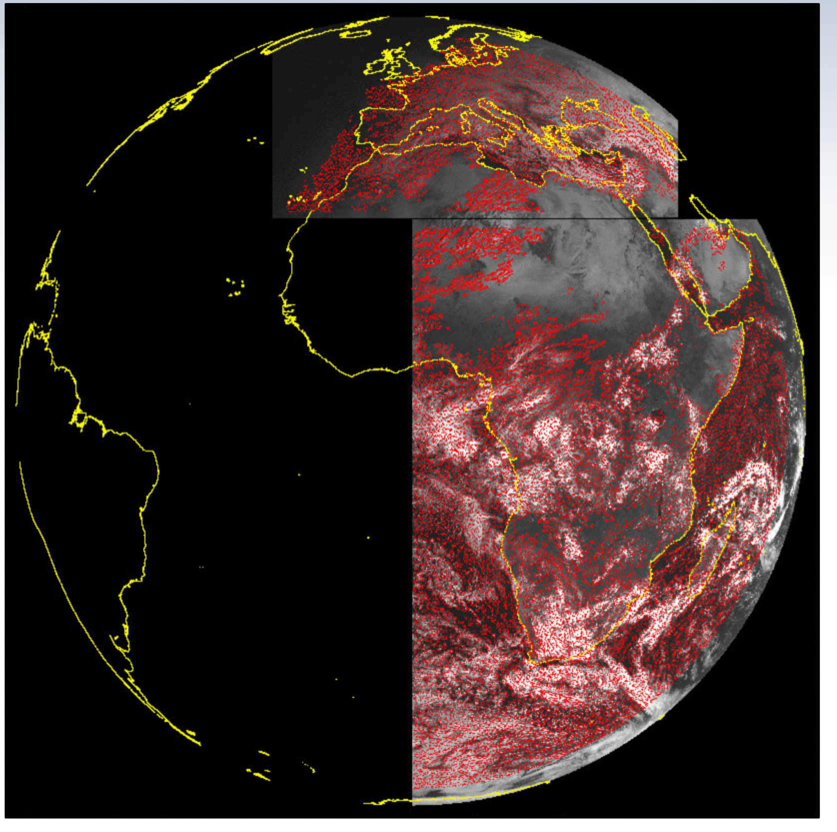


Figure 2.4. HRVIS full-Earth disc (25/01/2010 – 08:15 to 08:45).

2. COMPARISON OF RAPID SCANNING (RSS) AND FULL-EARTH SCANNING (FES)

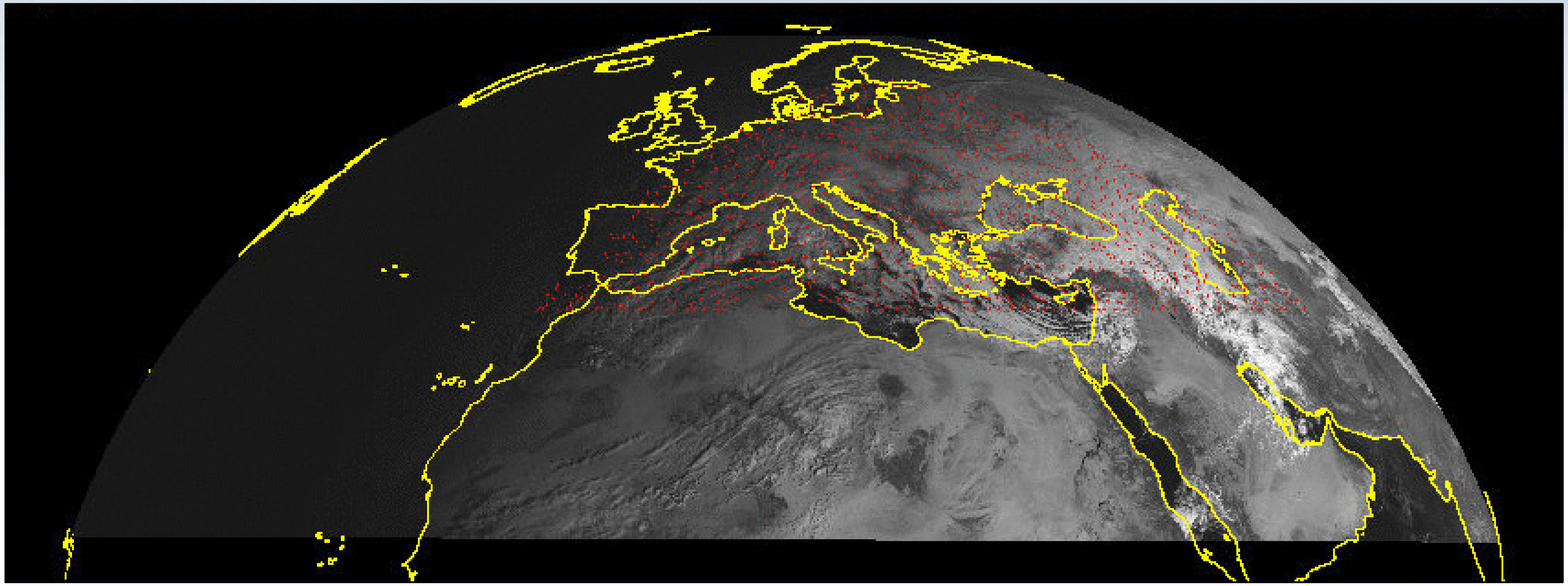


Figure 2.5. VIS 0.8 μm rapid scan area (25/01/2010 – 08:05 to 08:15).

2. COMPARISON OF RAPID SCANNING (RSS) AND FULL-EARTH SCANNING (FES)

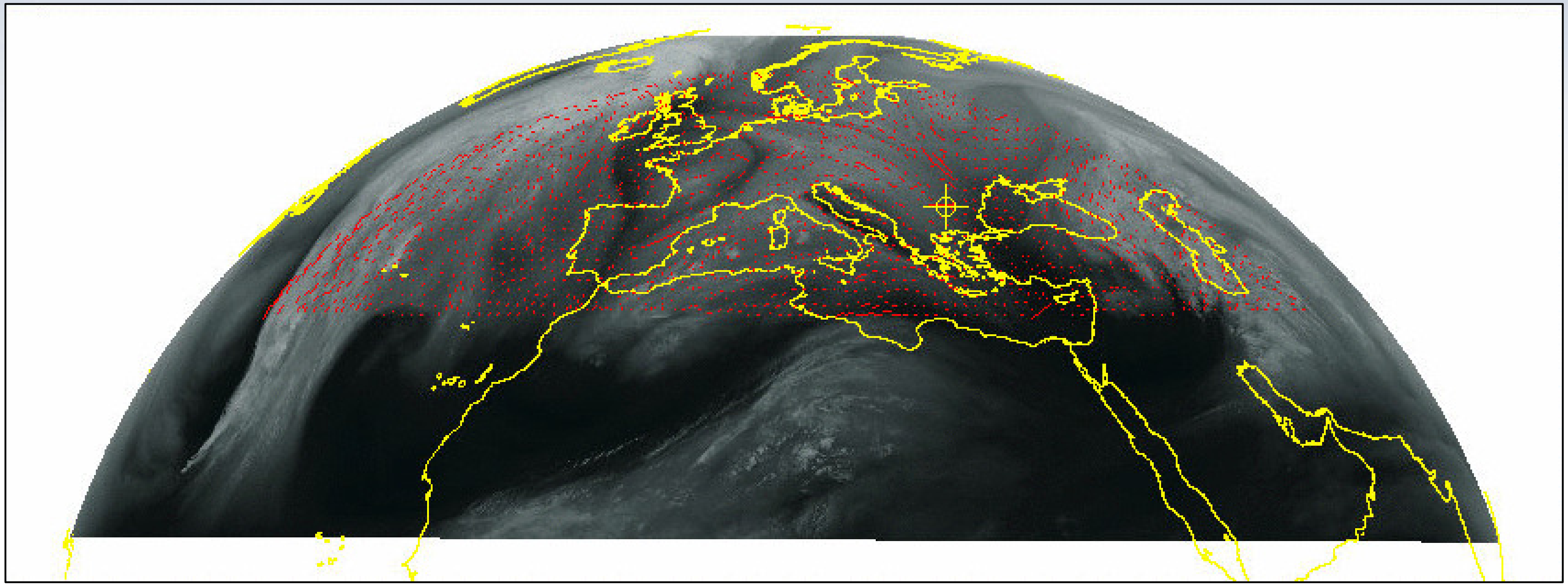


Figure 2.6. WV 6.2 μm rapid scan area (25/01/2010 – 08:05 to 08:15).

2. COMPARISON OF RAPID SCANNING (RSS) AND FULL-EARTH SCANNING (FES)

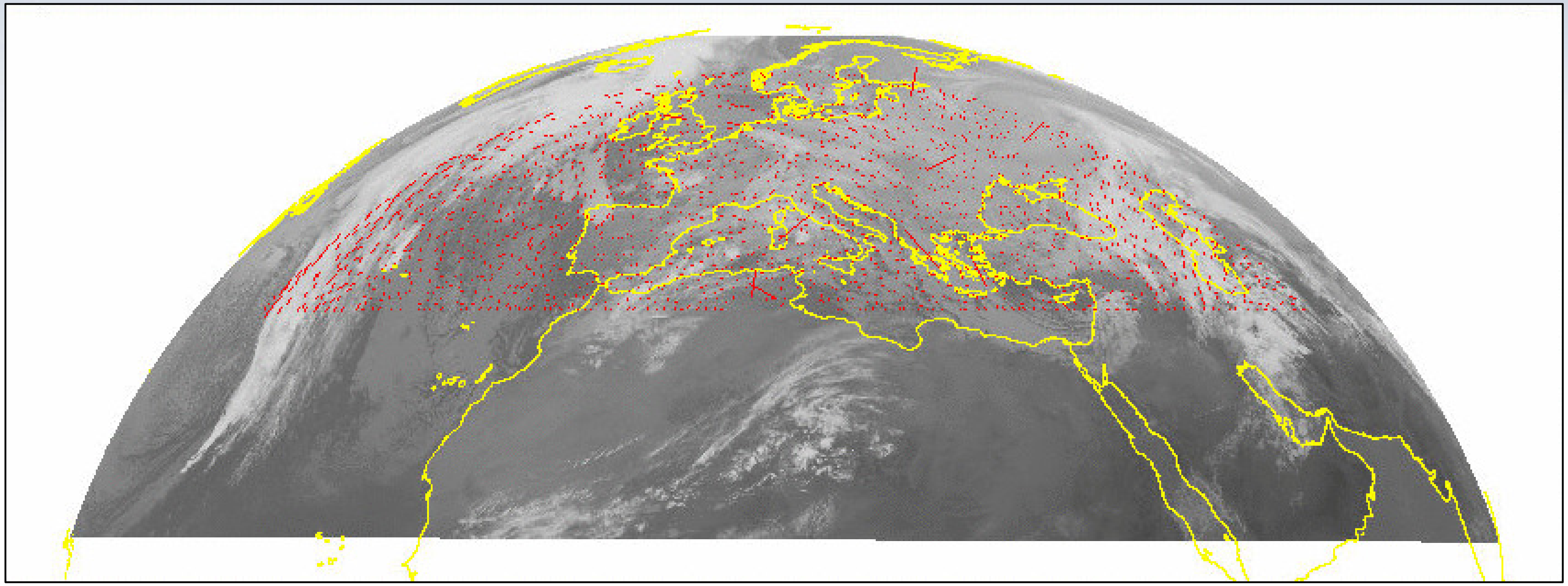


Figure 2.7. IR 10.8 μm rapid scan area (25/01/2010 – 08:05 to 08:15).

2. COMPARISON OF RAPID SCANNING (RSS) AND FULL-EARTH SCANNING (FES)

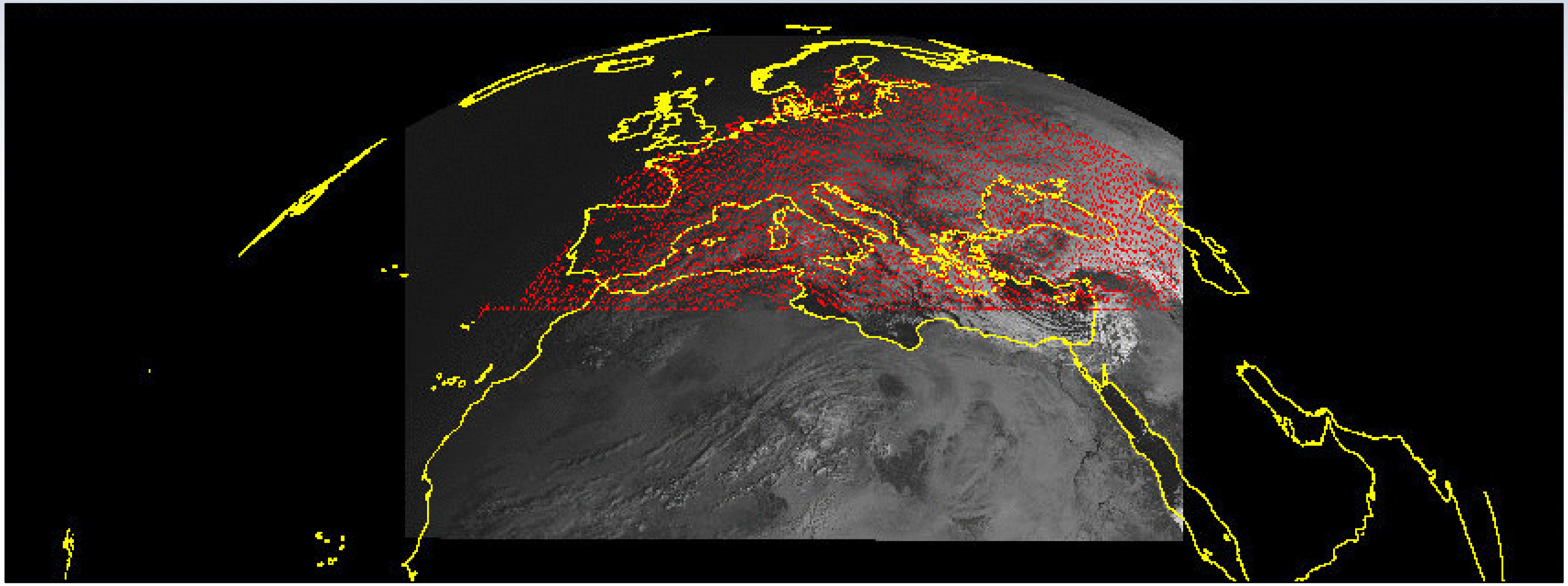


Figure 2.8. HRVIS rapid scan area (25/01/2010 – 08:05 to 08:15).

2. COMPARISON OF RAPID SCANNING (RSS) AND FULL-EARTH SCANNING (FES)

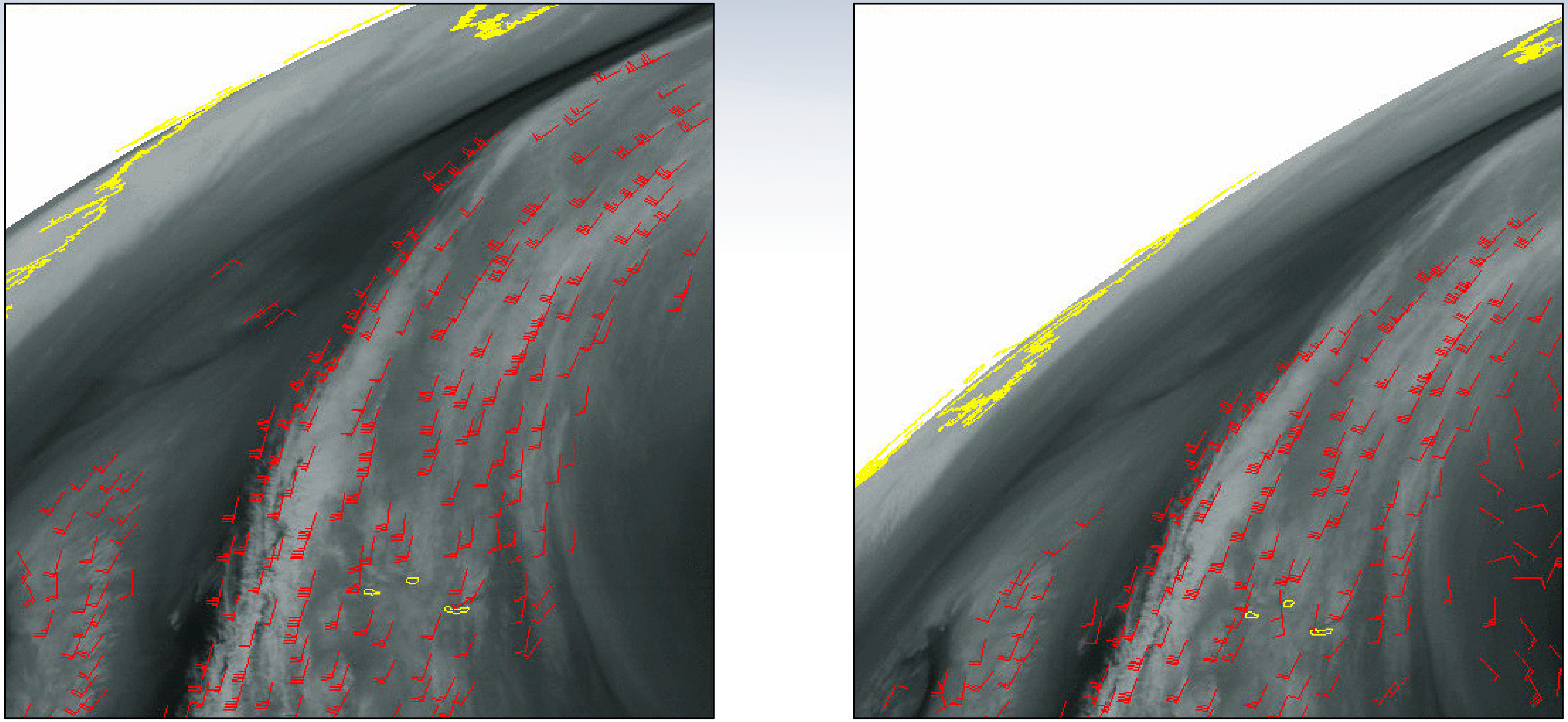


Figure 2.9. WV 6.2 µm FES (left) and RSS (right) comparison (26/01/2010 – 10:15 to 10:45).

2. COMPARISON OF RAPID SCANNING (RSS) AND FULL-EARTH SCANNING (FES)

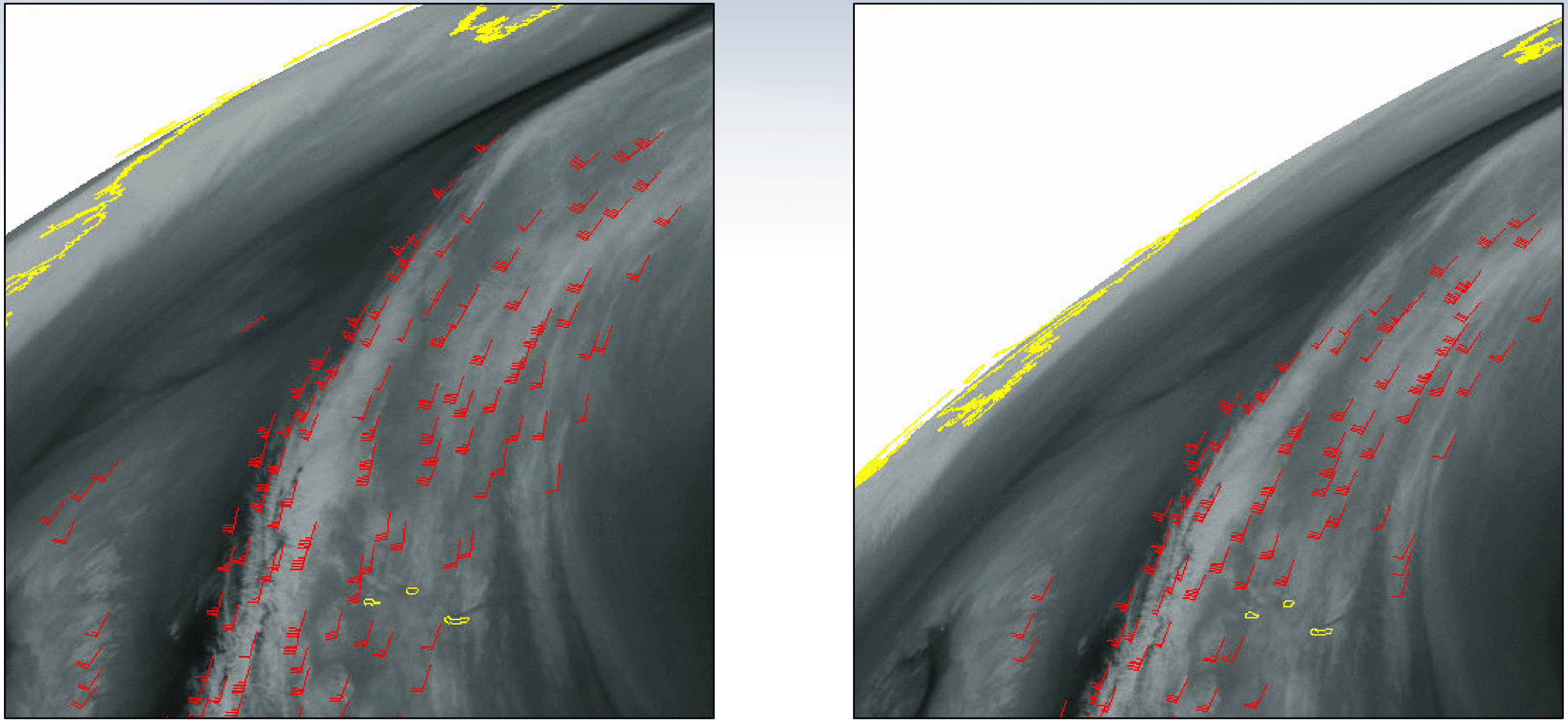
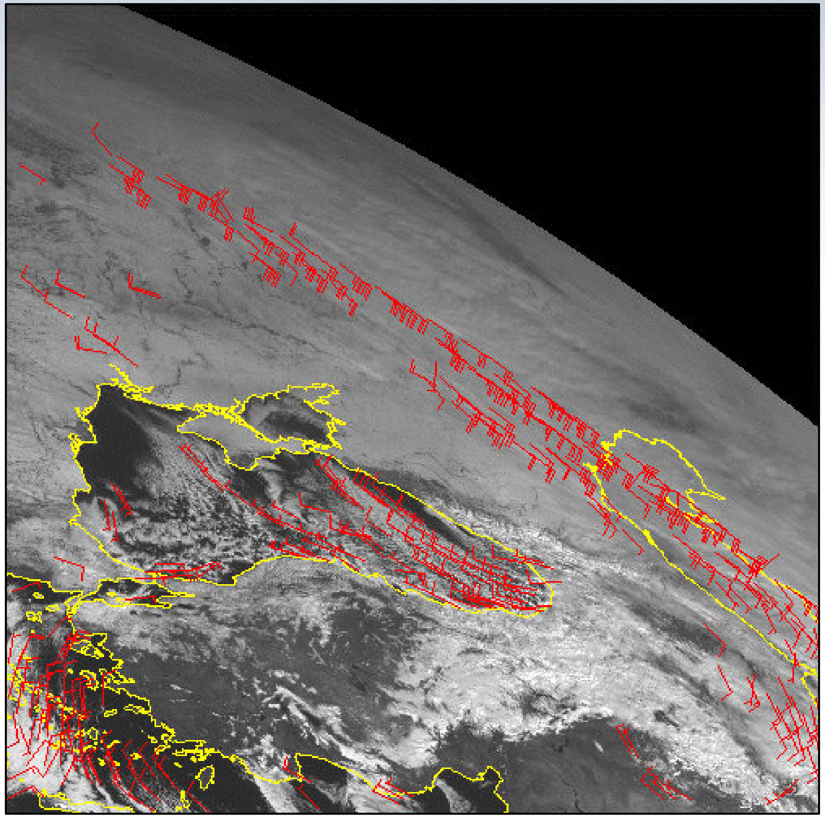


Figure 2.10. WV 6.2 µm FES (left) and RSS (right) comparison (26/01/2010 – 10:15 to 10:45). QI > 90%.

2. COMPARISON OF RAPID SCANNING (RSS) AND FULL-EARTH SCANNING (FES)



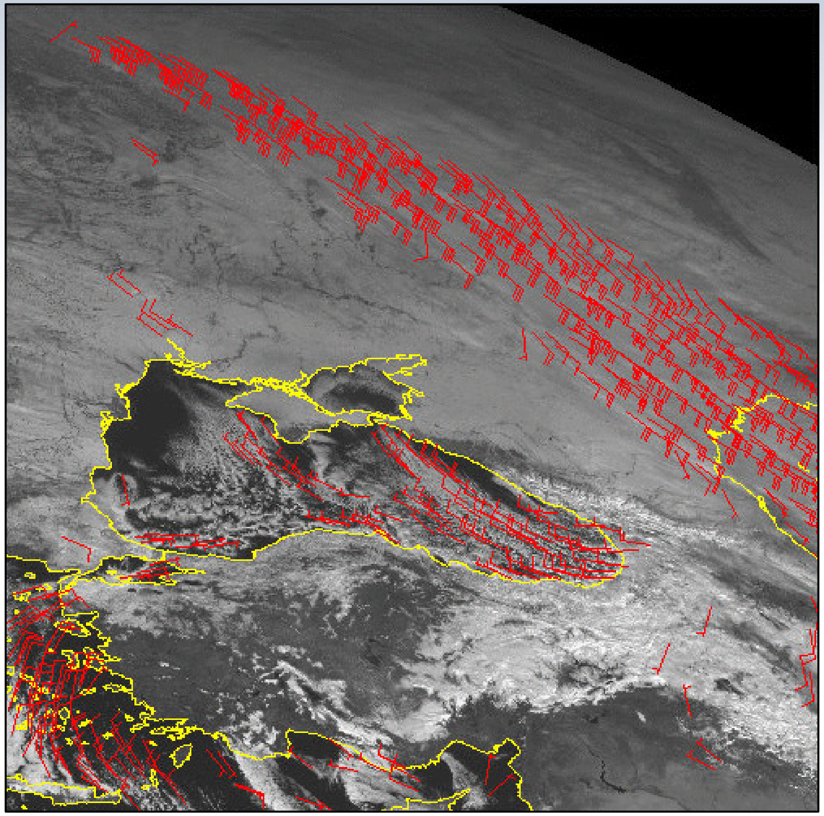
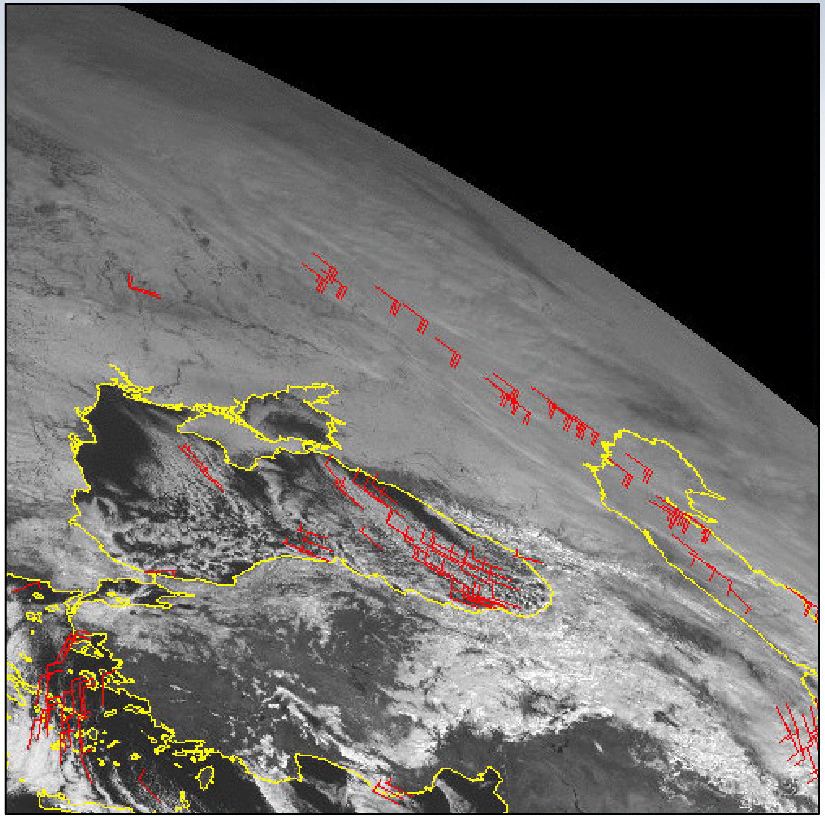


Figure 2.11. HRVIS FES (left) and RSS (right) comparison (26/01/2010 – 10:15 to 10:45).

2. COMPARISON OF RAPID SCANNING (RSS) AND FULL-EARTH SCANNING (FES)



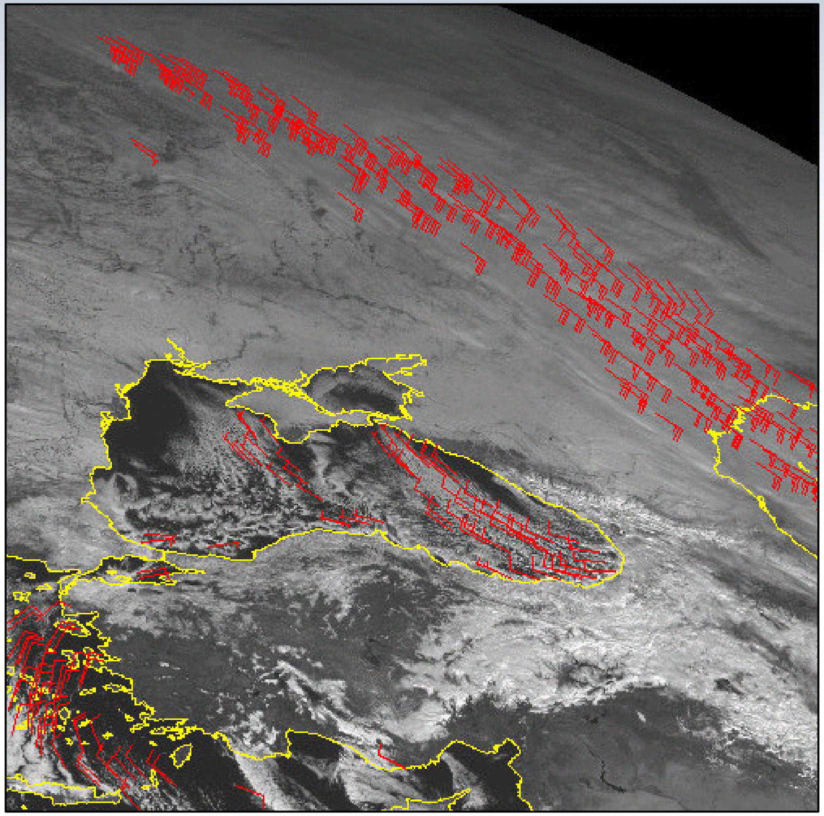


Figure 2.12. HRVIS FES (left) and RSS (right) comparison (26/01/2010 – 10:15 to 10:45). QI > 90%.

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1. GENERAL CHARACTERISTICS OF THE RAPID SCANNING SERVICE
2. COMPARISON OF RAPID SCANNING (RSS) AND FULL-EARTH SCANNING (FES)
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4. TESTS CARRIED OUT
5. RESULTS AND STATISTICS
6. CONCLUSIONS

3. LIMITATIONS OF RSS

- Winds are difficult to derive from RSS images, because cloud systems do not travel far in 5 minutes.
- Due to the characteristics of the RSS, there is a limitation in the minimum wind speed that can be derived:

Channel	Type	Pixel size at nadir	Corresponding wind speed	
			FES	RSS
1-11	VIS, WV, IR	3 km	3.3 m/s	10.0 m/s
12	HRVIS	1 km	1.1 m/s	3.3 m/s

Channel	Type	Pixel size at 60ºN	Corresponding wind speed	
			FES	RSS
1-11	VIS, WV, IR	6 km	6.7 m/s	20.0 m/s
12	HRVIS	2 km	2.2 m/s	6.7 m/s

SUMMARY

4. TESTS CARRIED OUT

- Several comparisons of RSS and FES data have been carried out.
- Three different configurations have been used:
  - OPE-A: Operational RSS
  - OPE-B: Operational FES
  - VAL-A: Validation RSS
- The following parameters have been used for RSS:

Parameter	Non-HRVIS		HRVIS	
	OPE-A	**VAL-A**	**OPE-A**	**VAL-A**
Target area size (pixels)	24	16	32	24
Search area size (pixels)	80	32	96	48

- The geographical area used for the comparison covers a latitude range from 36ºN to 58ºN, and a longitude range from 20ºW to 45ºE.

4. TESTS CARRIED OUT

- OPE-A, OPE-B and VAL-A data have been collected from 20th January 2010 to 5th February 2010, both around noon and midnight.
- A thorough complementary comparison of FES and RSS data with radiosonde observations has been carried out, spanning between 18th December 2009 and 12th January 2010.

4. TESTS CARRIED OUT

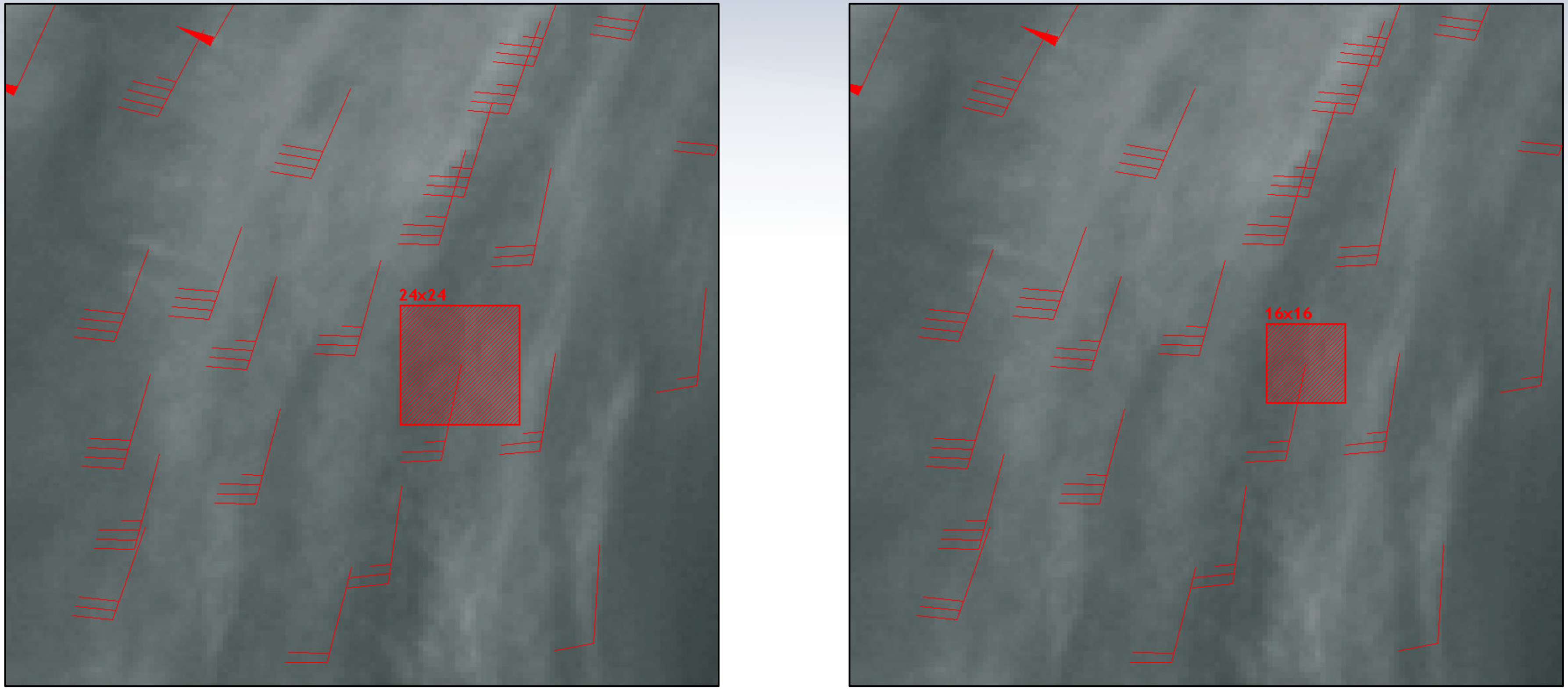
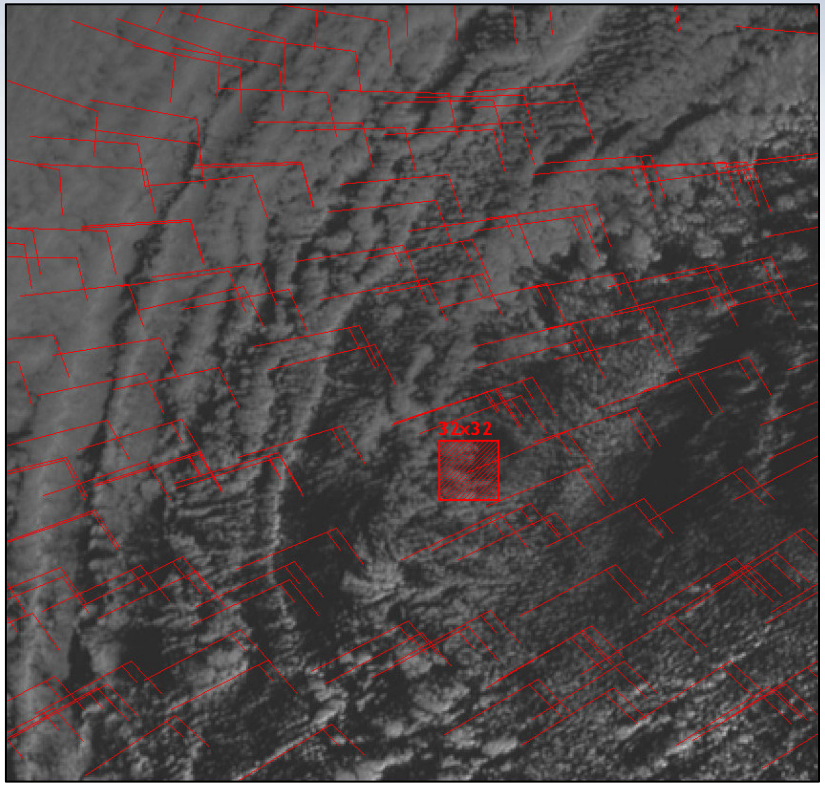


Figure 4.1. Non-HRVIS OPE-A (left) and VAL-A (right) target area size comparison.

4. TESTS CARRIED OUT



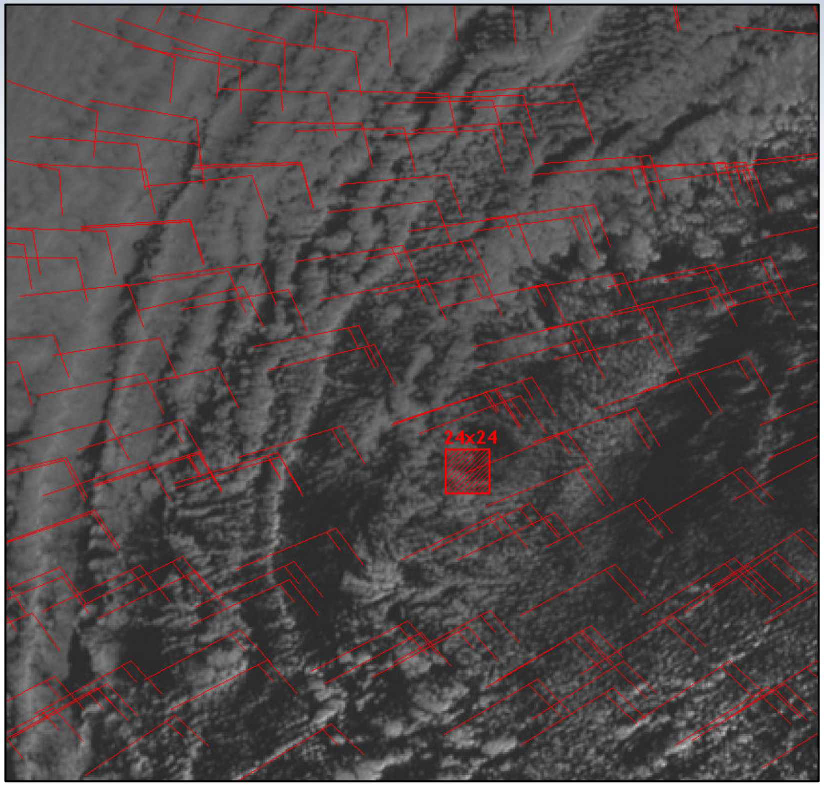


Figure 4.2. HRVIS OPE-A (left) and VAL-A (right) target area size comparison.

SUMMARY

5. RESULTS AND STATISTICS

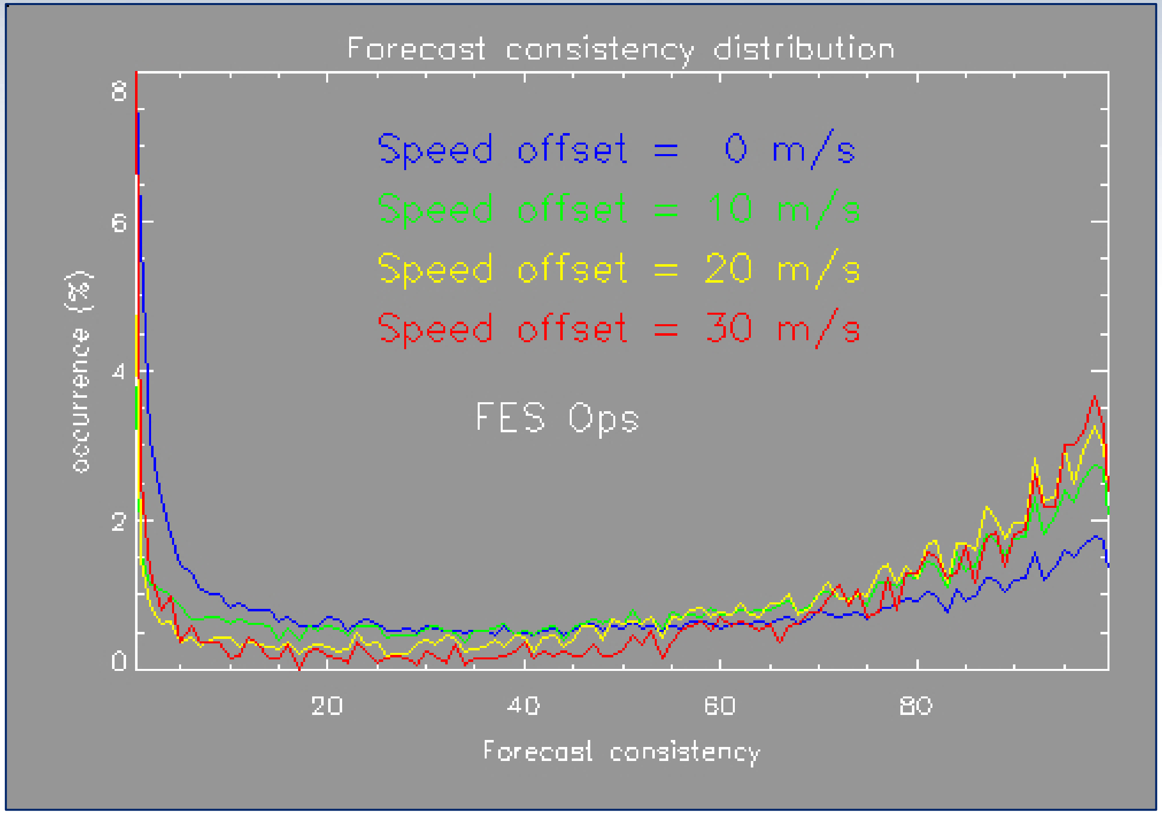


Figure 5.1. IR 10.8 µm operational FES wind forecast consistency.

5. RESULTS AND STATISTICS

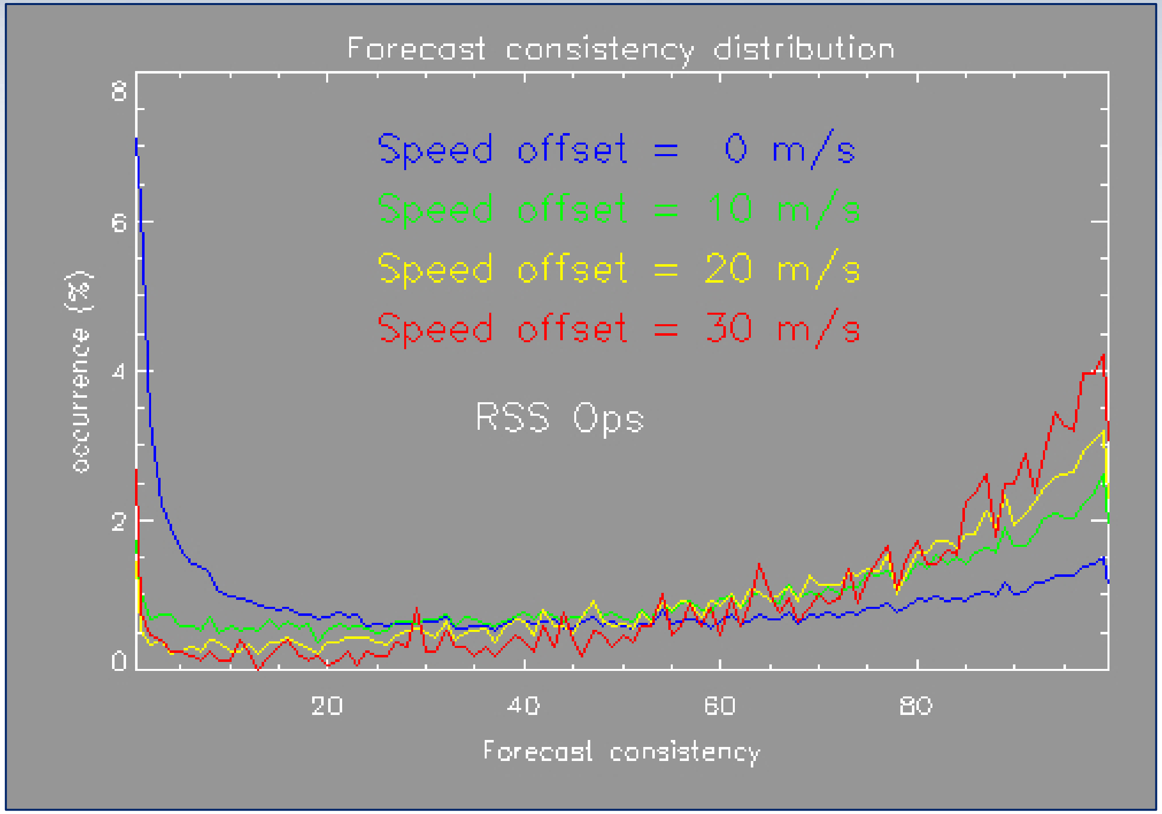


Figure 5.2. IR 10.8 µm operational RSS wind forecast consistency.

5. RESULTS AND STATISTICS

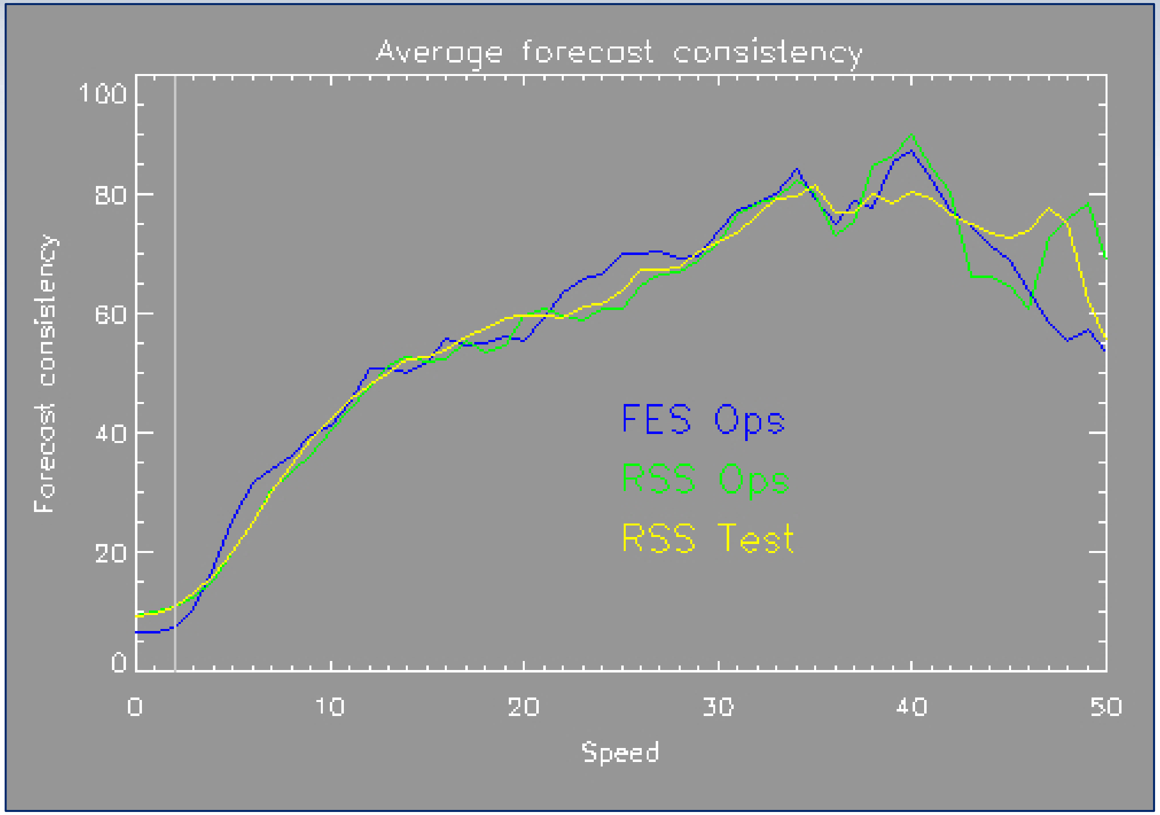


Figure 5.3. VIS 0.8 μm wind forecast consistency comparison.

5. RESULTS AND STATISTICS

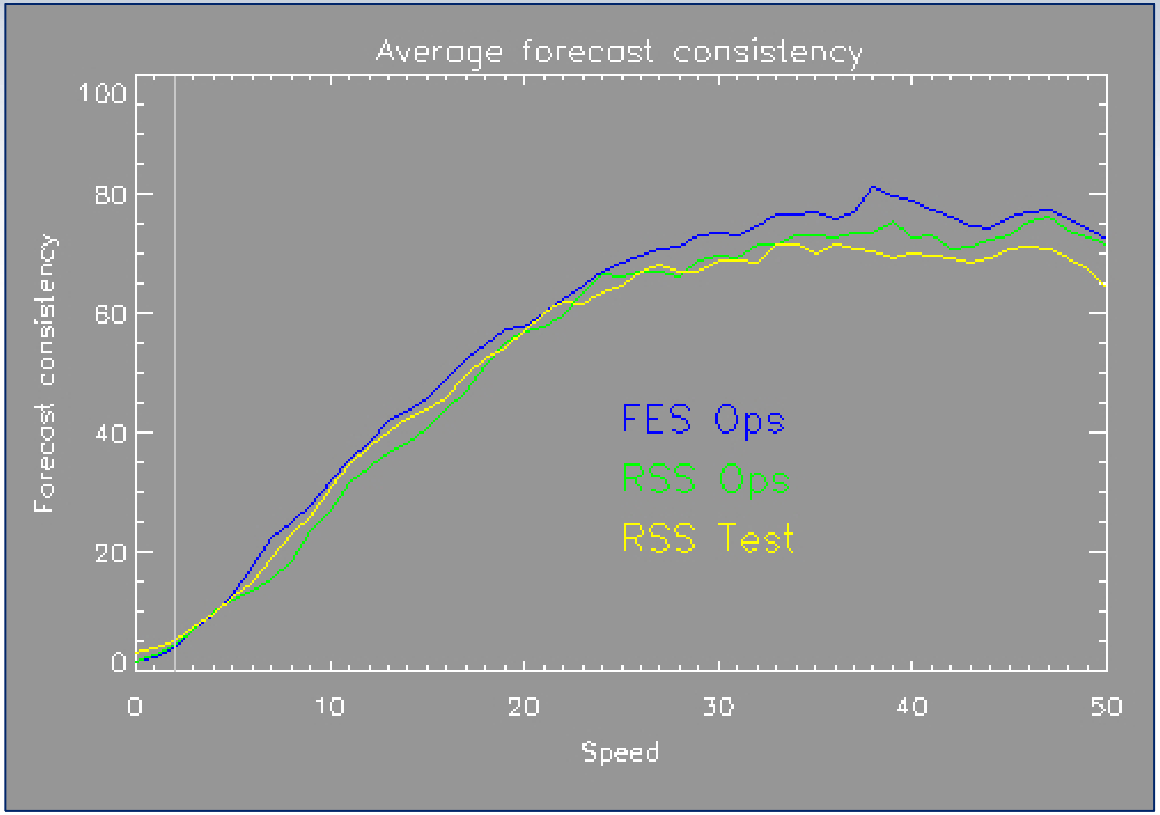


Figure 5.4. WV 6.2 μm wind forecast consistency comparison.

5. RESULTS AND STATISTICS

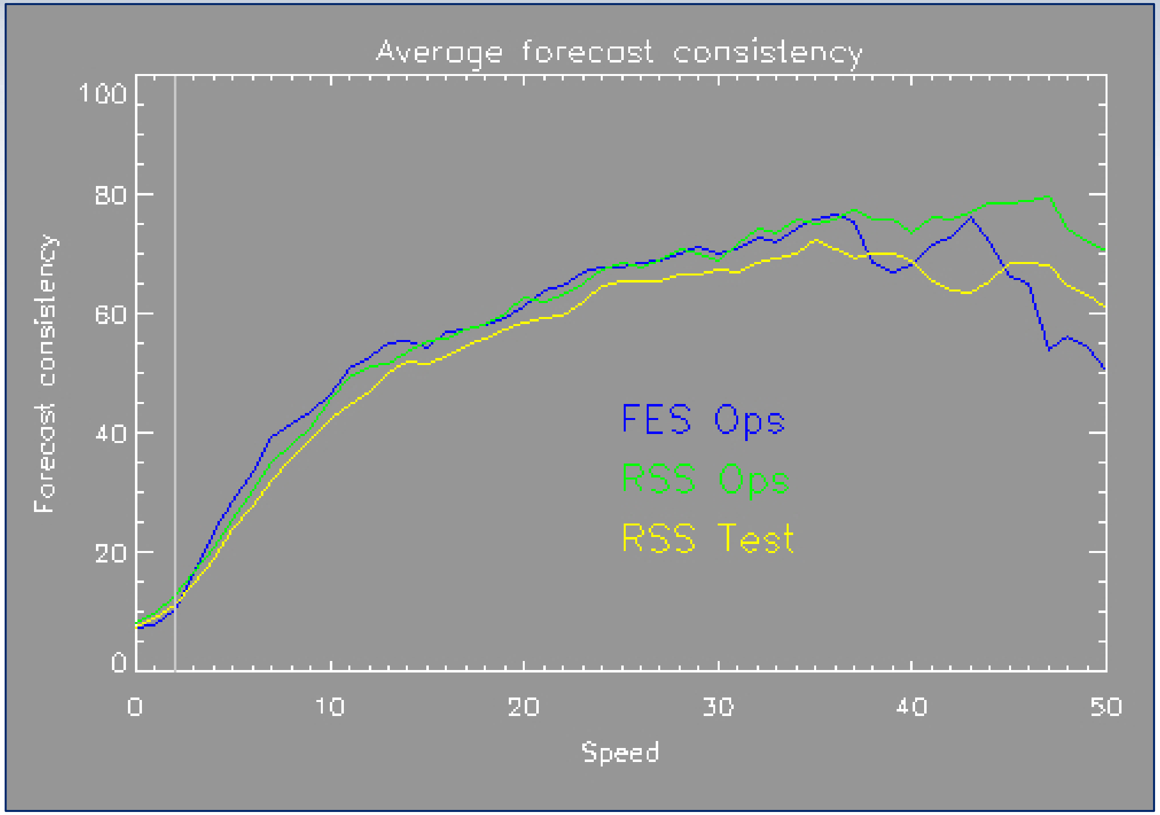


Figure 5.5. IR 10.8 µm wind forecast consistency comparison.

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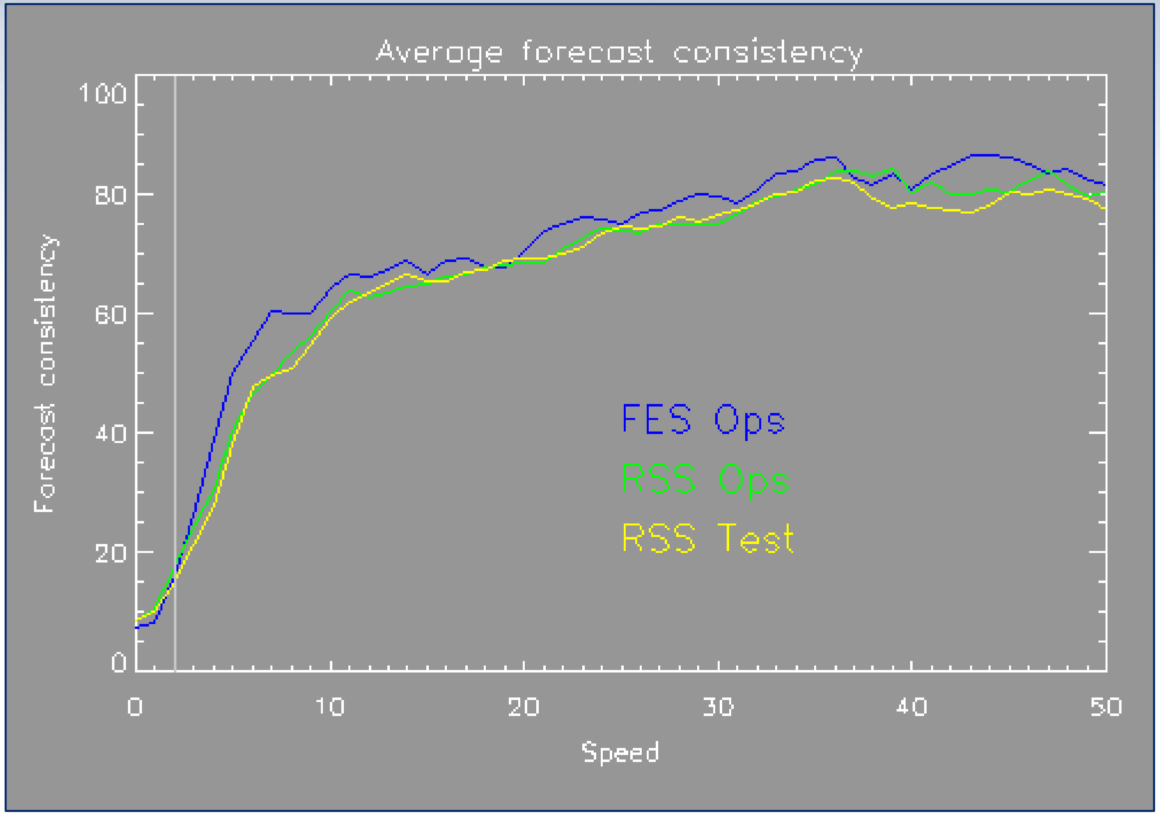

Figure 5.6. IR 10.8 μm wind forecast consistency comparison. QI > 80%.

5. RESULTS AND STATISTICS

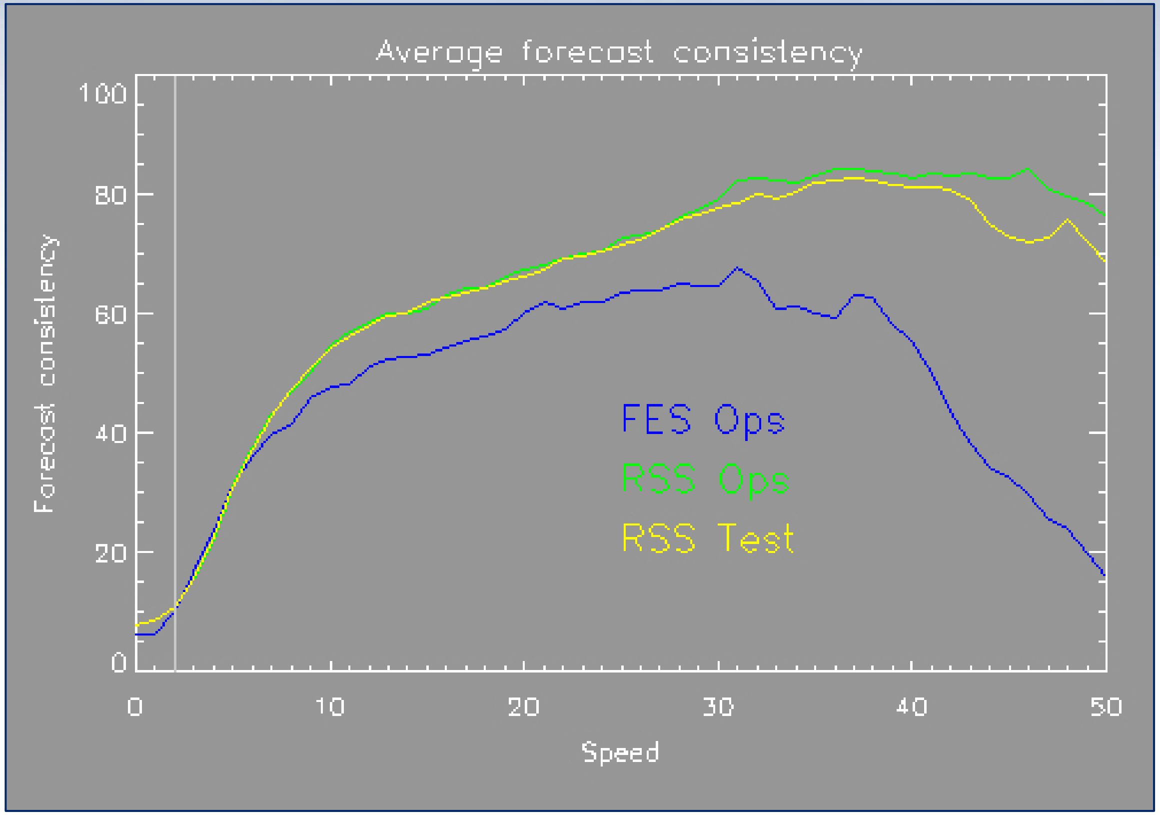

Figure 5.7. HRVIS wind forecast consistency comparison.

5. RESULTS AND STATISTICS

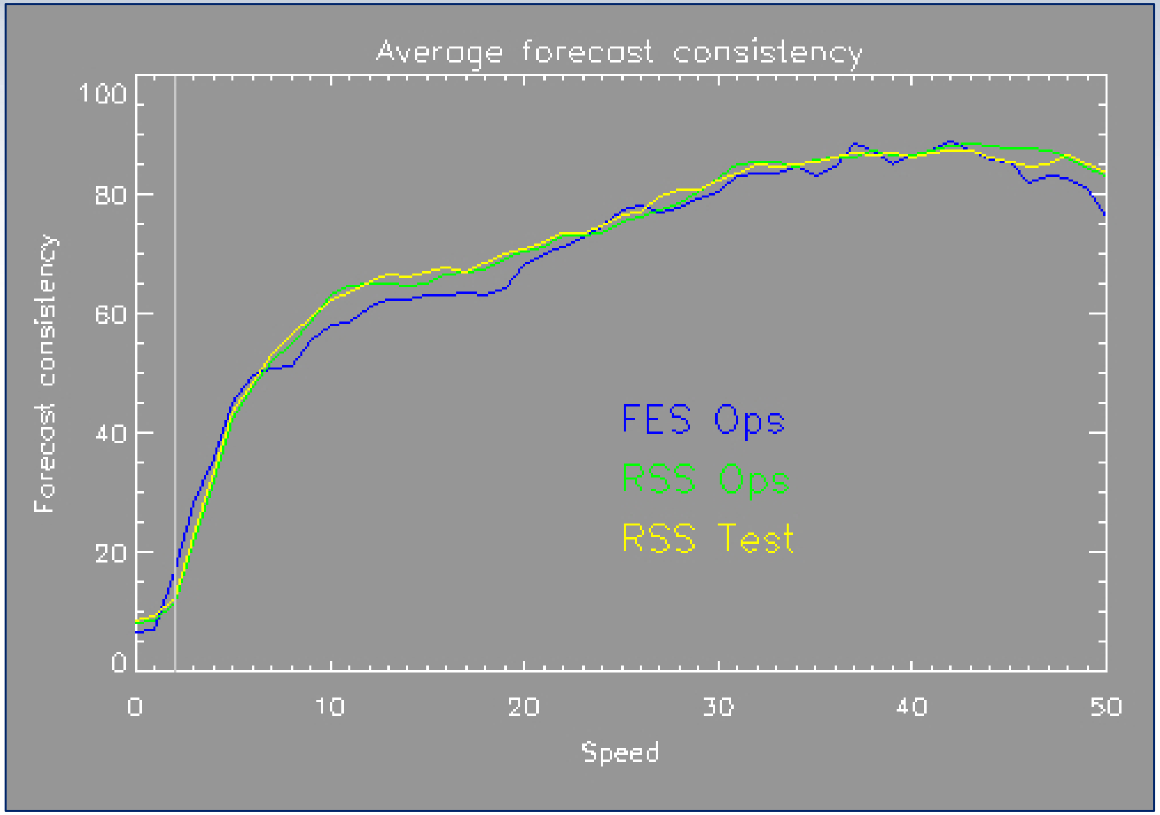

Figure 5.8. HRVIS wind forecast consistency comparison. QI > 80%.

5. RESULTS AND STATISTICS

- The comparison with radiosonde observations yields many more collocations for RSS, specially for the HRVIS channel.

Channel	Target type	Number of collocations			Speed bias (m/s)		RMS error (m/s)	
		FES	RSS	Δ (%)	FES	RSS	FES	RSS
VIS 0.8 μm	Cloudy	655	982	+49.9	–0.67	–1.14	5.84	6.31
WV 6.2 μm	Clear	222	182	–18.0	–1.78	–2.90	11.29	13.97
	Cloudy	16,180	16,866	+4.2	–3.01	–3.46	9.58	10.25
IR 10.8 μm	Cloudy	13,572	15,110	+11.3	–4.23	–4.87	9.83	10.59
HRVIS	Cloudy	3,700	7,721	+108.7	0.34	–0.19	6.05	6.47

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6. CONCLUSIONS

- RSS has a neutral impact for VIS 0.8 μm winds, in terms of forecast consistency.
- RSS has a slightly negative impact for WV 6.2 μm winds.
- RSS has a slightly positive impact for IR 10.8 μm fast winds. The impact is slightly negative for winds with QI > 80%.
- RSS has a large positive impact for HRVIS winds, specially for fast winds. The impact is only slightly positive for slow and very fast winds with QI > 80%.
- Reducing the target area has a neutral or slightly negative impact.
- RSS winds yield many more collocations than FES winds.
- Still, it is convenient to do RSS for HRVIS winds, because:
  - The overall impact, though small, is positive.
  - The overall number of winds is larger if a smaller target is used.