Overview and status of the GERB instruments

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Introduction
• Positioned close to the rim of the geostationary Meteosat satellite
  • Endure 16g centrifugal force
  • Quite exposed to radiation
• 256 broadband sensors record vertical section of the image
• De-Spin Mirror (DSM)
  • Counteract rotation of the satellite
  • Allows to select horizontal section
• Each side of DSM alternatively used for recording a vertical section
• Measures TW and SW (with quartz filter)
### Meteosat schedule

<table>
<thead>
<tr>
<th>S/C</th>
<th>i = 8°</th>
<th>Propellant EOL</th>
<th>Baseline End of service</th>
<th>Re-orbiting</th>
</tr>
</thead>
<tbody>
<tr>
<td>GERB-2</td>
<td>Meteosat-8</td>
<td>Jun 2022 Jan 2023 (i=8.3°)</td>
<td>FES June 2022</td>
<td>October 2022</td>
</tr>
<tr>
<td>GERB-1</td>
<td>Meteosat-9</td>
<td>Apr 2025 May 2026 (i=8.8°)</td>
<td>RSS Apr 2022 FES Apr 2025</td>
<td>May/June 2025</td>
</tr>
<tr>
<td>GERB-3</td>
<td>Meteosat-10</td>
<td>Sep 2030 Mar 2031 (i=8.4°)</td>
<td>RSS end 2022 FES Q2 2030</td>
<td>September 2030</td>
</tr>
<tr>
<td>GERB-4</td>
<td>Meteosat-11</td>
<td>Dec 2033 Mar 2034 (i=8.3°)</td>
<td>RSS end 2026 FES Q4 2033²</td>
<td>January 2033</td>
</tr>
</tbody>
</table>

Table 1: End of Service(s) and Re-orbiting dates

- Operational: inclination maintained within 2°
- Meteosat-8 in best effort operation
Meteosat schedule

- Meteosat-9 will replace Meteosat-8 in 2022
- Will use a different longitudinal position
  - Only 1 move of 1 satellite needed
  - 37.5 E and 45.5 E considered
- Most probable position 45.5 E
  - Favoured by most member states
  - Needs less propellant to maintain position
- Operate in parallel for 2 months

Figure 1: Useful Field of View (±60° longitude and latitude from sub-satellite point) for Meteosat-8 at 41.5°E (blue) and Meteosat-9 at either 37.5°E (green) or & 45.5°E (yellow) as well as Meteosat-11 at 0° (red).
GERB De-Spin Mirror operation

Designed life expectancy DSM: 3.5 years
Status of GERB 1-4
GERB2 (Meteosat-8)

- Primary instrument at longitude 0° from April 2004 - May 2007
- Instrument operated at longitude 41.5° E from September 2016 - ...
- Oldest instrument
  - Has dead pixels
  - One side of the rotating mirror has aged considerably more
• SSU obscured from mid February -> mid August
  • SSU and ESU determine when the satellite has made a complete rotation
  • SSU is more accurate
  • Use ESU for recording when SSU is obscured
  • ESU signal has noise -> jitter -> inaccurate pointing
  • ESU signal jitter can be determined from satellite parameters
  • SSU images taken with 282 columns (standard)
  • ESU images taken with 564 columns
    • Retain only 282 columns taken with the ‘good’ DSM face

SSU=Sun Sensor Unit
ESU=Earth Sensor Unit
- Correct column position by using available satellite information
- Reorder columns
- Interpolate to wanted position using only columns with the same face of the DSM
- Still problem of different response of both DSM faces
• Record ESU images with 564 columns
• Reorder columns
• Drop columns taken by ‘bad’ face of the DSM
• Interpolate columns to wanted position
• GERB1 (Meteosat-9)
  • Primary instrument from May 2007 - Jan 2013
  • Currently switched off

• GERB3 (Meteosat-10)
  • Primary instrument from Jan 2013 - Feb 2018
  • Rotating mirror blocked from Apr 2013 - Feb 2015 -> ageing of exposed mirror side
  • Different ageing of DSM faces corrected
  • A number of periods with quartz filter problem (see GERB-4)
  • Currently in SAFE mode
• Primary instrument at longitude 0° from Feb 2018 - ...
• Both sides of rotating mirror not completely parallel
  • Vertical shift of 0.8 pixel between odd and even columns
  • Corrected
• Some periods operated with quartz filter not completely in place
  • Uniform darkening of the SW signal
  • Overestimation of the LW signal

More details in talk of Christine Aebi about data validation
COVID-19
Impact of COVID-19

- Until now all members of the GERB team still in good health
- Mostly working from home with remote access to the institutes
  - Impact on working conditions strongly depending on the family situation
    - Schools closed mid-March, partially reopened in June
  - Impacted by level of data availability
- Access to the premises discouraged or difficult (government decision)
  - Technical problems take more time to be solved
  - Operations that need physical access not obvious
  - Data needed to correct GERB2, GERB3 and GERB4 images delayed
  - Reprocessing of GERB data stalled
The Royal Meteorological Institute

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