

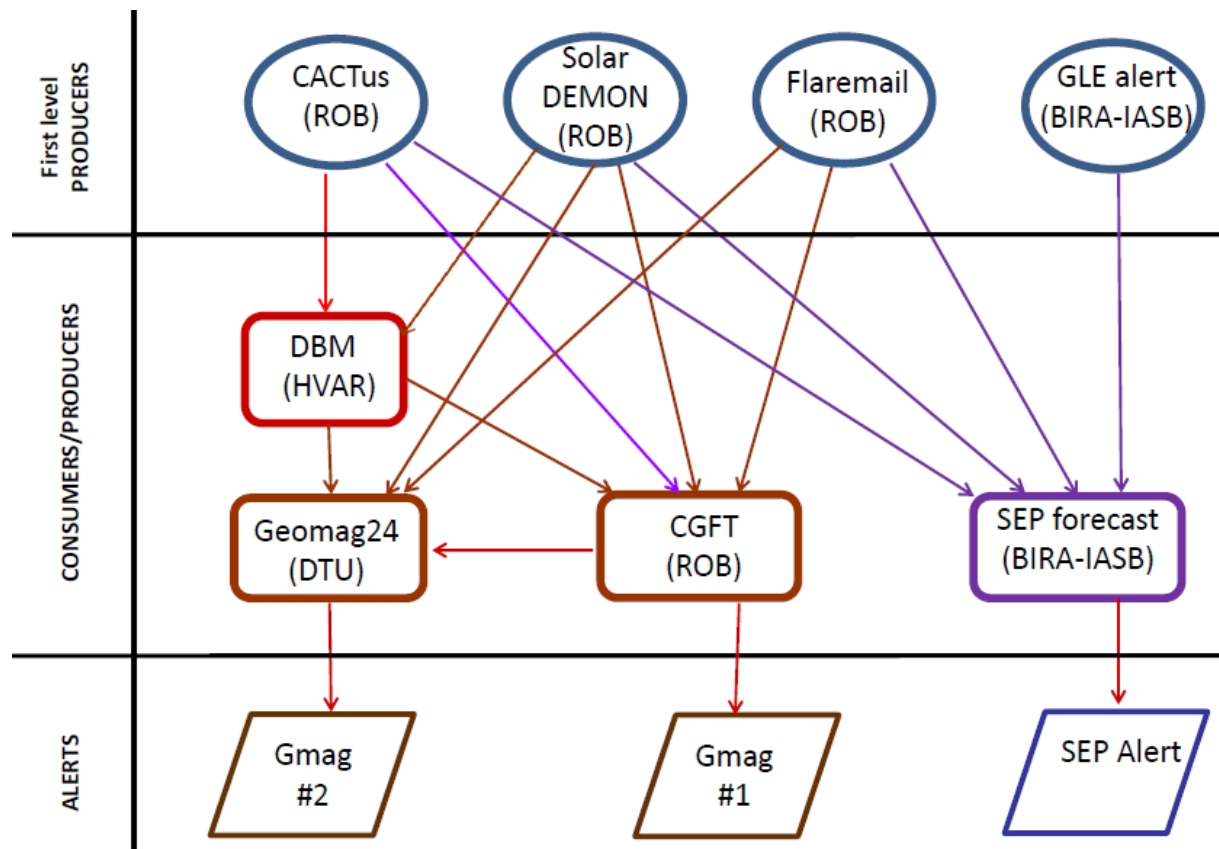


Figure 1. Flow diagram of the tools used in and alerts issued by the COMESEP Alert System.

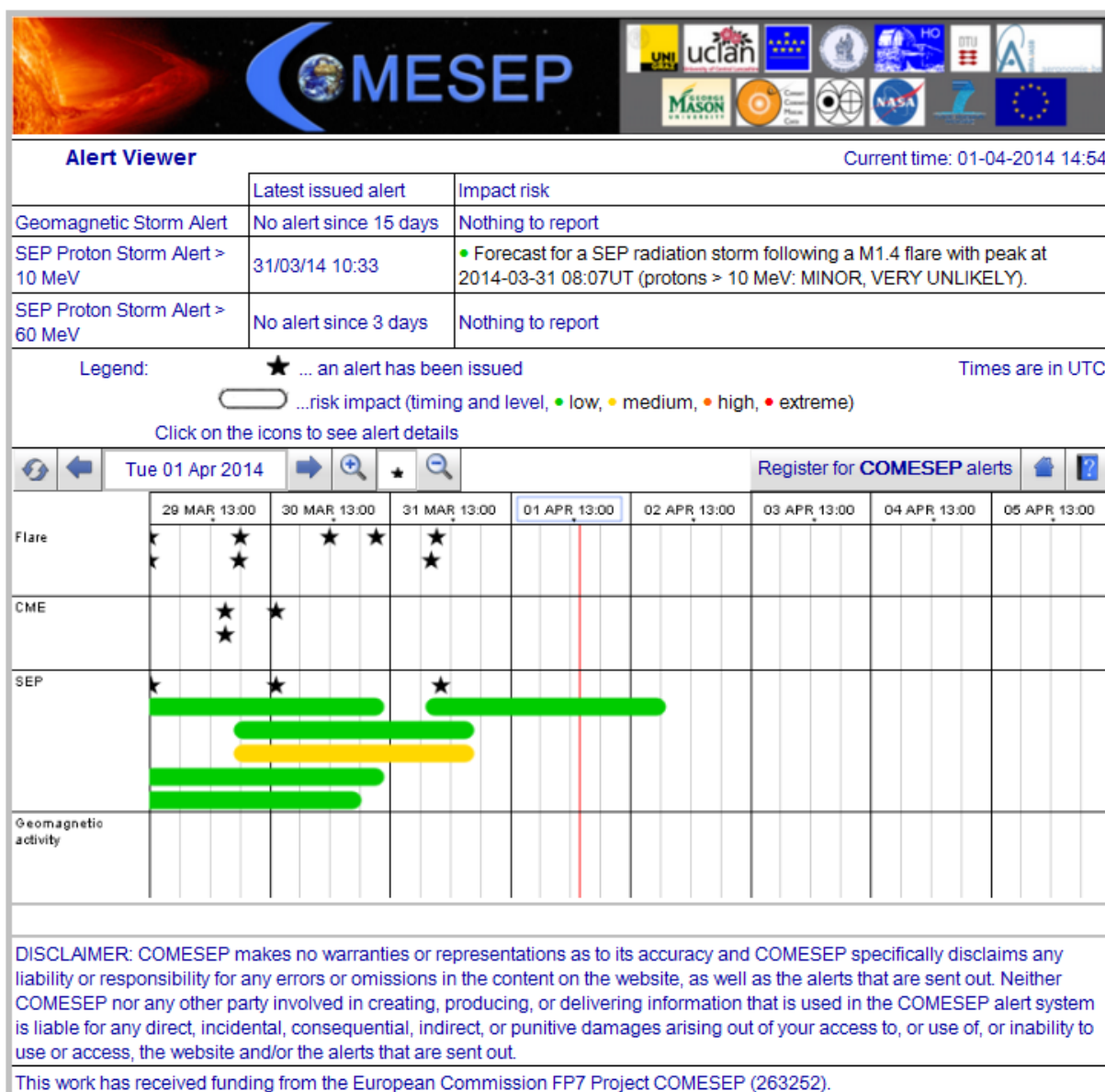


Figure 2. The layout of the COMESEP Alert System (<http://www.comesep.eu/alert/>).

|                                                                                |                          |                       |                                  |                                  |                                              |                                              |                      |
|--------------------------------------------------------------------------------|--------------------------|-----------------------|----------------------------------|----------------------------------|----------------------------------------------|----------------------------------------------|----------------------|
| Arrival of CME / Likelihood of occurrence                                      | Ongoing<br>(100%)        | L                     | M                                | H                                | H                                            | E                                            | E                    |
|                                                                                | Very likely<br>(90-100%) | L                     | M                                | H                                | H                                            | E                                            | E                    |
|                                                                                | Likely<br>(70-90%)       | L                     | M                                | M                                | H                                            | H                                            | E                    |
|                                                                                | Possible<br>(40-70%)     | L                     | L                                | M                                | M                                            | H                                            | E                    |
|                                                                                | Unlikely<br>(10-40%)     | L                     | L                                | M                                | M                                            | H                                            | H                    |
|                                                                                | Very Unlikely<br>(0-10%) | L                     | L                                | L                                | M                                            | M                                            | H                    |
| Storm Level                                                                    |                          | None                  | Minor                            | Moderate                         | Strong                                       | Severe                                       | Extreme              |
| Geomagnetic  D <sub>st</sub>  <br>in nT                                        |                          | <50                   | 50-100                           | 100-200                          | 200-300                                      | 300-400                                      | >400                 |
| SEP peak flux > 10<br>MeV in s <sup>-1</sup> sr <sup>-1</sup> cm <sup>-2</sup> |                          | <10 <sup>1</sup>      | 10 <sup>1</sup> -10 <sup>2</sup> | 10 <sup>2</sup> -10 <sup>3</sup> | 10 <sup>3</sup> -10 <sup>4</sup>             | 10 <sup>4</sup> -10 <sup>5</sup>             | >10 <sup>5</sup>     |
| SEP peak flux > 60<br>MeV in s <sup>-1</sup> sr <sup>-1</sup> cm <sup>-2</sup> |                          | <7.9×10 <sup>-2</sup> | 7.9×10 <sup>-2</sup> -<br>1.4    | 1.4 -<br>2.5×10 <sup>1</sup>     | 2.5×10 <sup>1</sup> -<br>4.5×10 <sup>2</sup> | 4.5×10 <sup>2</sup> -<br>7.9×10 <sup>3</sup> | >7.9×10 <sup>3</sup> |
| K <sub>p</sub>                                                                 |                          | <5                    | 5                                | 6                                | 7                                            | 8                                            | 9                    |

Figure 3. Risk matrix used to estimate geomagnetic storm and SEP radiation storm risk levels in the COMESEP Alert System. L stands for low, M for medium, H for high and E for extreme risk.

| <b>CME: 2014-01-07T18:24:00-CME-001</b>      |                  |                   |                 |                                                          |                                              |                          |
|----------------------------------------------|------------------|-------------------|-----------------|----------------------------------------------------------|----------------------------------------------|--------------------------|
| Actual Shock Arrival Time: 2014-01-09T19:32Z |                  |                   |                 |                                                          |                                              |                          |
| Observed Geomagnetic Storm Parameters:       |                  |                   |                 |                                                          |                                              |                          |
| Max Kp: 3.0                                  |                  |                   |                 |                                                          |                                              |                          |
| Predicted Shock Arrival Time                 | Difference (hrs) | Submitted On      | Lead Time (hrs) | Predicted Geomagnetic Storm Parameter(s)                 | Method                                       | Submitted By             |
| 2014-01-09T19:26Z (-10.0h, +10.0h)           | -0.10            | 2014-01-07T21:00Z | 46.53           | ----                                                     | STOA                                         | Leila Mays (GSFC)        |
| 2014-01-09T00:38Z (-7.0h, +7.0h)             | -18.90           | 2014-01-08T00:41Z | 42.85           | Max Kp Range: 6.0 - 8.0                                  | WSA-ENLIL + Cone (GSFC SWRC)                 | Leila Mays (GSFC)        |
| 2014-01-09T08:00Z                            | -11.53           | 2014-01-08T01:31Z | 42.02           | Max Kp Range: 6.0 - 7.0                                  | <a href="#">WSA-ENLIL + Cone (NOAA/SWPC)</a> | Leila Mays (GSFC)        |
| 2014-01-08T22:00Z                            | -21.53           | 2014-01-08T03:17Z | 40.25           | Dst min. in nT: -146<br>Dst min. time: 2014-01-09T11:00Z | <a href="#">Anemomilos</a>                   | WKent Tobiska (SET SWD)  |
| 2014-01-09T00:17Z (-6.9h, +9.2h)             | -19.25           | 2014-01-08T04:11Z | 39.35           | Max Kp Range: 6.0 - 8.0                                  | Ensemble WSA-ENLIL + Cone (GSFC SWRC)        | Leila Mays (GSFC)        |
| 2014-01-09T04:30Z (-2.5h, +2.5h)             | -15.03           | 2014-01-08T05:02Z | 38.50           | Max Kp Range: 5.0 - 8.0                                  | <a href="#">Other (SIDC)</a>                 | Leila Mays (GSFC)        |
| 2014-01-08T12:30Z                            | -31.03           | 2014-01-08T05:58Z | 37.57           | ----                                                     | ESA                                          | Leila Mays (GSFC)        |
| 2014-01-09T12:00Z (-7.0h, +7.0h)             | -7.53            | 2014-01-08T06:32Z | 37.00           | ----                                                     | WSA-ENLIL + Cone                             | RWC Jeju (KSWC)          |
| 2014-01-09T04:00Z (-6.0h, +6.0h)             | -15.53           | 2014-01-08T09:42Z | 33.83           | ----                                                     | <a href="#">DBM</a>                          | Manuela Temmer (UNIGRAZ) |
| 2014-01-10T04:04Z (-16.0h, +36.0h)           | 8.53             | 2014-01-08T14:56Z | 28.60           | Max Kp Range: 8.0 - 8.0<br>Dst min. in nT: -300          | <a href="#">COMSEEP</a>                      | Andy Devos (SIDC)        |
| 2014-01-09T08:02Z                            | -11.50           | 2014-01-08T16:37Z | 26.92           | ----                                                     | Expansion Speed Prediction Model             | Alisson Dallago (INPE)   |
| 2014-01-09T02:00Z                            | -17.53           | 2014-01-08T17:53Z | 25.65           | Max Kp Range: 8.0 - 9.0                                  | <a href="#">BHV</a>                          | Volker Bothmer (UGOE)    |
| 2014-01-09T01:00Z                            | -18.53           | 2014-01-08T23:00Z | 20.53           | Dst min. in nT: -142<br>Dst min. time: 2014-01-09T12:00Z | <a href="#">Anemomilos</a>                   | WKent Tobiska (SET SWD)  |
| 2014-01-09T13:00Z (-7.0h, +7.0h)             | -6.53            | 2014-01-08T23:17Z | 20.25           | Max Kp Range: 6.0 - 8.0                                  | WSA-ENLIL + Cone                             | Duty Forecaster (ASFC)   |
| 2014-01-09T11:22Z (-11.7h, +9.1h)            | -8.17            | 2014-01-09T18:57Z | 0.58            | Max Kp Range: 3.0 - 5.0                                  | Ensemble WSA-ENLIL + Cone (GSFC SWRC)        | Leila Mays (GSFC)        |

Table 1. Shock arrival time of the 9 Jan. 2014 event based on various prediction methods.