



Australian Government

Bureau of Meteorology

# International Communication and Coordination Related to Extreme Space Weather Events

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## A. A large, complex active region quickly forms on the solar disk.

### BoM / IPS Actions

- Duty Forecaster monitors situation
- Severe space weather team notified
- Issue standard HF warnings, etc
- [ Issue Severe Space Weather OUTLOOK ]

### Customer

- Nothing
- [ Heightened awareness (possibility of HF fade, SPE, 'long-range' notification of possible GM storm) ]

### Issues



## B. An X20 flare erupts with a large proton event and 2500 km/s halo CME

### BoM / IPS Actions

- Run statistical models for severe storm probability based on solar observations (only)
- DF consultation with severe space weather team
- If warranted, issue **Severe Space Weather WATCH**
- Monitor SpWx email groups for TOA predictions [run TOA model in-house]

### Customer

- Energy market operator (power grids):
  - Maintain increased awareness for follow-on warnings
  - Maintain increased awareness of GIC monitoring equipment levels within the power system

### Issues

- No formal arrangement for exchange of TOA predictions (leverage range of forecasts)
- Limitations of non 24/7 operation. Benefits of information exchange



## C. ACE detects -100 nT Bz, with no solar wind speed information due to the proton contamination

### BoM / IPS Actions

- Re-run statistical model with updated ACE information
- Auto-issue **Severe Space Weather WARNING**
- Notification to government and critical infrastructure groups through established BoM channels

### Customer

- Energy market operator (power-grids):
  - Action specified in internal operating procedures based on type of warning (short duration / sustained GIC). Options include maximizing reactive power reserves, re-rating transformers, heightened awareness

### Issues

- Short lead time for model running / issue of warnings
- Limitations of non-24/7 operation



## D. Ground mags show massive disturbances and calls from power grids start to come in

### BoM / IPS Actions

- Auto-Issue **Severe Space Weather EVENT IN PROGRESS** (when AusDst index exceeds **-250nT**)
- DF and severe space weather team monitor event
- Manage direct communications (field calls, issue updates through SSW service and government channels as required)

### Customer

- Energy market operator (power grids):
  - Monitor GIC activity
  - Manage loads in networks, as per standard operating procedures
  - Maintain lines of communication with BoM/IPS

### Issues

- Responding to queries generated by international media
- Addressing differences in forecasts between agencies



# Key issues related to global coordination/communication

- Formal exchange mechanism for forecasts, eg through an open portal (≠ “consensus”)
  - Standardisation of reporting metrics
- Reinforce notion of regional forecast centres

| Institution<br>(Input Time) | date | CME Time of Arrival<br>(UT) | TOA error<br>(hours) | Forecast IMF orientation<br>(eg SEN) | Severe Event Probability (%)<br>Dst<-250nT<br>G5 or higher |
|-----------------------------|------|-----------------------------|----------------------|--------------------------------------|--|
| BAO                         | 27   |                             |                      |                                      |  |
|                             | 28   | 20UT (ev #201309)           | +/- 6 (ev #201309)   | SWN (ev #201309)                     | 60 (ev #201309)  |
|                             | 29   |                             |                      |                                      |  |
| IPS                         | 27   |                             |                      |                                      |  |
|                             | 28   |                             |                      |                                      |  |
|                             | 29   | 03UT (ev #201309)           | +/- 12 (ev #201309)  |                                      | 50 (ev #201309)  |
| KSWC                        | 27   |                             |                      |                                      |  |
|                             | 28   | 21UT (ev #201309)           | +/- 6 (ev #201309)   | SEN (ev #201309)                     | 50 (ev #201309)  |
|                             | 29   |                             |                      |                                      |  |
| NIST                        | 27   |                             |                      |                                      |  |
|                             | 28   |                             |                      |                                      |  |
|                             | 29   |                             |                      |                                      |  |