Verification of Flare Forecasts at the Met Office Space Weather Operations Centre

Sophie A. Murray, David Jackson, Suzy Bingham, Mike Sharpe

European Meteorological Society Annual Meeting
2017 September 6
Space Weather

Space weather can disrupt:

- GPS positioning and timing
- Satellite operations
- Communications
- Energy supply
- Surveillance

sophie.murray@tcd.ie
Active Regions

Sunspot groups

Active regions

solarmonitor.org

sophie.murray@tcd.ie
Solar Flares

GOES Xray Flux (1-minute data)

Updated 2015 Nov 10 23:59:11 UTC
NOAA/SWPC Boulder, CO USA

sophie.murray@tcd.ie
Flare Forecast
...for each active region identified

<table>
<thead>
<tr>
<th>Flare class</th>
<th>Model Probability</th>
<th>Issued Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>12%</td>
<td>10%</td>
</tr>
<tr>
<td>X</td>
<td>3%</td>
<td>1%</td>
</tr>
</tbody>
</table>

What is the chance a flare will occur somewhere in the next 24 hours?

Forecasts archived since 2015
Raw vs issued

Observed relative frequency vs forecast probability for Raw and Issued data.
Raw vs issued

![Graph showing the relationship between hit rate and false alarm rate for raw and issued data.](image-url)
Flare Forecast  
...for the full disk  

<table>
<thead>
<tr>
<th>Flare class</th>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>5%</td>
<td>10%</td>
<td>15%</td>
<td>15%</td>
</tr>
<tr>
<td>X</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
</tbody>
</table>

Forecasts archived since 2014
Four-day forecast

Day 1

Day 2

Day 3

Day 4
Four-day forecast
Real time verification

M. Sharpe
Summary

- Flare forecasts produced daily at MOSWOC.
- Forecasts since 2014 now verified.
- Clear benefit to human ‘influence’ on issued flare forecasts.
- Forecast skill shown to decrease for longer forecast lead times.
- Real time verification has been implemented for forecaster use.

Watch this space
- M. Sharpe paper using climatology.
- NASA/CCMC Flare Scoreboard (international comparison).
- Improved system incorporating active region monitoring with ensemble flare forecasting.

sophie.murray@tcd.ie