



# Actions in response to the User Survey

### FLARECAST Second Users Workshop

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## Outline



Results and Interpretations of the Users survey undertaken over First Workshop

Results / actions of an online mini poll at <u>http://flarecast.eu</u>

A note on custom-tailored performance verification (i.e., validation) of possible interest to Users

Conclusions



## **Users Survey**



User survey was taken in preparation of the First Users Workshop
 31 responses registered

## **Poll Questions:**

1. Do you currently use flare forecast or alert services?

**RE**: ~61% YES; ~39% NO

**ACTION**: Clean, easy-to-understand and digest results with possible alerts for those who do not tend to look on a regular basis





2. How useful or unuseful are there services?

**RE**: All (100%) responding positively, from extremely to slightly useful **ACTION (Not Req)**: A note of confirmation that what we do interests the community

3. How accurate or inaccurate do you find this service to be?
 RE: ~60% from very to fairly inaccurate; ~26% do not know
 ACTION: Properly explained, fully fledged validation required here





4. Based on your experience of this service, how likely is it that you would, or would not, recommend it to a colleague?

**RE**: ~63% are "shrugging" shoulders (passive), meaning that they do not know

### ACTION:

- We need to be clear, concise and convincing
- The outcome (i.e., forecast outputs) must be as clear-cut and digestible as possible





5. Are you planning to use the service differently in the future?

**RE**: ~26% YES; ~32% NO; ~42% do not know

Of those who responded YES, this is the justification given:

- Use of the service for more advanced purposes, to best use the work done
- Direct comparison with other flare forecasting tools and services
- Tailor services for S/C control aspects (e.g., Airbus)
- Cross-check the impact of SWx disturbances for GNSS
- Correlate flare occurrence with state of ionospheric TEC

### **ACTION**:

- How far can we go in "custom-tailoring" the output?
- $\circ~$  Apparent need for an integrated SWx platform (cf. Leila's presentation later)



7. Has your organization, or your customers' organizations, ever been affected by solar flare disruptions, or other disruptions related to HF?

- **RE**: ~50% YES; ~42% NO
- ACTION: Mixed picture probably need to make a case of actual flare-induced incidents
- Additional information on impacted sectors:
- SATCOM, radar, GNSS, GPS, amateur radio, etc.
  - Who responded to this question?
  - Civilians, emergency responders, maritime mobile service reps., etc

**NOTICE**: See discussion on custom validation, C/L ratio and value

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9. Which factors are / would be important to you in a flare forecasting service?

### RE:

- Most important: Accuracy & timeliness of data
- Least important: Scientific detail

**ACTION**: One of the cornerstone findings of the survey. It points to the following:

- Clear need to be as user-friendly as possible to the visualization of results
- Accuracy and timeliness tell us something about validation certain formulae and forecast window(s)



10. Ability to tailor forecasts?

RE: a total of ~84% find it fairly to very important
ACTION: Clear message – will aim to convey it, via forecast window(s) and latencies
11. Accuracy?
RE: virtually all (~97%) find it from very important to essential
ACTION: Again, a crystal-clear message toward validation practices
12. Content?

**RE**: virtually all (~97%) find it from fairly important to essential **ACTION**: Simplicity and precision in the forecast outcome

- 13. Details of potential impacts?
  - **RE**: a total of ~90% find it from essential to fairly important
  - **ACTION**: possibly to provide a standard tutorial to accompany results
- 14. Ease / method of delivery?
  - RE: virtually all (~97%) find it from essential to fairly important
  - ACTION: the results' visualization approach should be given adequate thought
- 15. Ease of use / understanding?
  - RE: virtually all (~97%) find it from fairly important to essential
  - **ACTION**: Further hint on the attention when needed to visualize results



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# **Poll Questions [cont'd]**

- 16. Frequency of forecasts?
  - RE: a total of ~90% find it from essential to fairly important
  - ACTION: frequency of forecasts should be adequate (several per day) but not excessive
- 17. Information on the uncertainty of forecast?
  - RE: <u>all</u> (100%) from essential to fairly important
  - ACTION: another cornerstone finding, that we pursue consistently throughout the project
- 18. Presentation of forecasts?
  - RE: a total of 87% find it from essential to fairly important
  - **ACTION**: no surprises here, based on the previous findings

19. Timeliness of data?

RE: virtually all (~97%) find it from essential to fairly important

20. Scientific detail?

#### RE:

a total of ~60% find it from fairly important to essential

 $\circ$  a total of ~40% find it not very important to totally unimportant

ACTION: point taken, as mentioned before

21. Would "all clear" forecasts be useful to your organization?

**RE**: ~77% respond YES

ACTION: need to adhere to this, providing an "all clear" forecast from binary results





22. Do you know what the NOAA R-scales are?

RE:~77% respond YES

**ACTION**: need to somehow adhere to those and highlight the direct flare connection

- 23. Are NOAA R-scales useful to your organization?RE:~88% respond YES; ~12% respond NO although they use them
  - ACTION: point taken, as mentioned before

Of those who say NO, most important reasons are uncertainties, lack of other information (e.g., GIC), reliance on the physical operator (e.g., MOSWOC).

**ACTION**: (again) uncertainties are essential information to show, as well as to move toward an integrated SWx forecasting platform in the future



## **Conclusions on user survey**



- TOP Level: FLARECAST end users seem to be primarily forecasters and operators themselves, interfacing between the forecasting platform and the untrained civilian or military stakeholder
- Accuracy and timeliness of forecasts most important; scientific detail is least important
- Forecast uncertainties are very important
- Custom-tailoring of results important (flares, forecast window[s], alerts) one size does NOT fit all
- "All-clear" forecast also important
- □ Integration of flare forecasting into a more general SWx forecasting platform

### How FLARECAST works





To enhance simplicity and efficiency, FLARECAST relies on three visualization platforms: one for the administrator / developer, another for the scientist and yet another for the end user

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# Another (mini) poll at flarecast.eu

WHAT WOULD YOU LIKE TO SEE ON THE FLARE PREDICTION USER INTERFACE?







Solar x-ray flux



Major flare risk %



Check one or more options Full-Sun view Solar x-ray flux Major flare risk (%) □ Graded flare risk Other Are you a student, scientist, amateur,

satellite operator, pilot ...?

Submit »

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# **Findings of mini-poll**



- Poll exists at http://flarecast.eu (close to bottom you can still take it).
- How many? 21 responses registered
- U Who? Amateurs, Teachers, Students, Scientists, Pilots, S/C Operators

### RE:

- A fragile majority (11 / 21) prefers <u>all four</u> alerts to be issued (full-Sun forecast, solar X-ray flux, major flare risk, color-coded grade flare risk)
- Ranked parameters, in terms of importance to show (from high to low): <u>major flare</u> <u>risk</u>; full-Sun forecast; solar X-ray flux; color-coded grade flare risk



# A note on performance verification



A clear need for <u>each sector independently</u> to understand its own needs:

|                       | Forecast<br>NO Event    | Forecast Event  |
|-----------------------|-------------------------|-----------------|
| Observed NO<br>Event  | True<br>negative<br>(d) | False alarm (b) |
| <b>Observed Event</b> | Miss (c)                | Hit (a)         |

To start of simply, in the classical 2 x 2 contingency table, what costs more? A miss, or a false alarm?

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What is most detrimental <u>not</u> to predict should be penalized more in the calculation of skill scores:

Probability of detection:  $\text{POD} = \frac{a}{a+c}$ 

> Probability of false  $POFD = \frac{b}{b+d}$ detection:

Optimize false alarms vs. misses via the TSS and the ROC curve

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# A note on performance verification (cont'd)

- A ROC curve is nothing more than the comparison between the POD (hit rate) and the POFD (false alarm rate).
- Distance between circles and the diagonal correspond to different TSS values
- Which TSS / interplay between
   POD and POFD is best for your
   business?





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# In a bit more detailed manner: value and costto-loss ratio

Establish an expense model on the basis of an action and inaction:

|                       | Take<br>Action | Take NO<br>Action |
|-----------------------|----------------|-------------------|
| Observed NO<br>Event  | Cost (CS)      | 0                 |
| <b>Observed Event</b> | Cost (CS)      | Loss (LS)         |

Total expense:

 $E_{tot} = (a+b) \times CS + c \times LS$ 

Value of a forecast:

 $V = \text{POD} - \frac{1-s}{s} \frac{\alpha}{1-\alpha} \text{POFD}$ Solution FLARECAST Second Users Workshop



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### Conclusions



- □ No "silver bullet" one size does <u>not</u> fit all
- Need to customize forecasts
- Before doing this, however, it would help forecasters to have the business model of an industry in terms of susceptibility to costs & losses
- Validation could then turn to optimizing a forecast and customizing it for the industry
- Validation-based decision making in action!