Flare Scoreboard

Currently registered models:

|		
AMOS *Automatic McIntosh Occurrence probability of Solar activity*	**ASAP** *Automatic Solar Activity Prediction*	**ASSA** *Automatic Solar Synoptic Analyser*
BoM *Data-driven probabilistic flare forecast model*	**MAG4** *LOS and vector magnetogram forecasts*	**Met Office** *Issued Flare Forecast*
SolarMonitor.org *Flare Prediction System*	**SIDC** *Human operator moderated forecast*	**UFCORIN** *Universal Forecast Constructor by Optimized Regression of INputs*

Planning group:

J. Andries (SIDC), S. Bloomfield (Northumbria), V. Delouille (SIDC), A. Devos (SIDC), J. Guerra (TCD), S. Hong (KSWC), M. Kuznetsova (NASA GSFC), K. D. Leka (NWRA), L. Mays (NASA GSFC), S. Murray (TCD), G. Steward (BoM), M. Terkildsen (BoM).
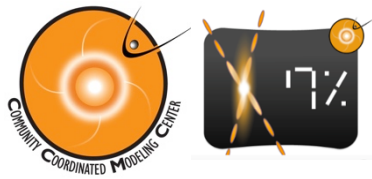
Flare Scoreboard

Model questionnaire example

1. Is the forecast human generated, model based, ...?

2. Does your flare prediction method forecast M1.0-9.9 or M and above?

3. How do you specify active regions in your model?

4. How far from disk center is your full disk forecast valid?

5. Does your model provide uncertainties for the forecasted probability?

   - If yes, what percentiles do you use to determine your upper

     and lower bound?

6. What prediction window(s) does your method use?

7. Do you have calibration for the probabilities from your model?

   - If yes, what is considered a low, medium, or high level?
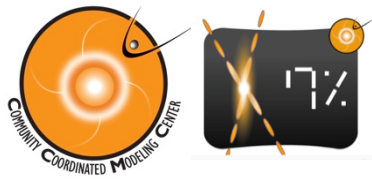
Flare Scoreboard

Full-disk forecast submission example

```
#File name format:          Flare_Forecast_modelname_yyyymmdd_hhmm.txt
Forecasting method:         MAG 4
Time:                       2015-11-25T12:00Z
Prediction Window Start Time:   2015-11-25T12:00Z
Prediction Window End Time:     2015-11-26T12:00Z
Probability Bins:           M+
Input data:                 SDO/HMI LOS_Magnetogram
Prediction window (hours):  24
```
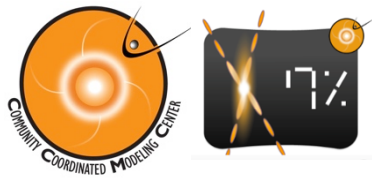
#Full Disk Forecast

#X_prob	X_uncert	X_Level	M_prob	M_uncert	M_Level	C_prob	C_uncert	C_Level
#0.4000	0.0800	3	0.6800	0.0500	3	0.7500	0.0500	3

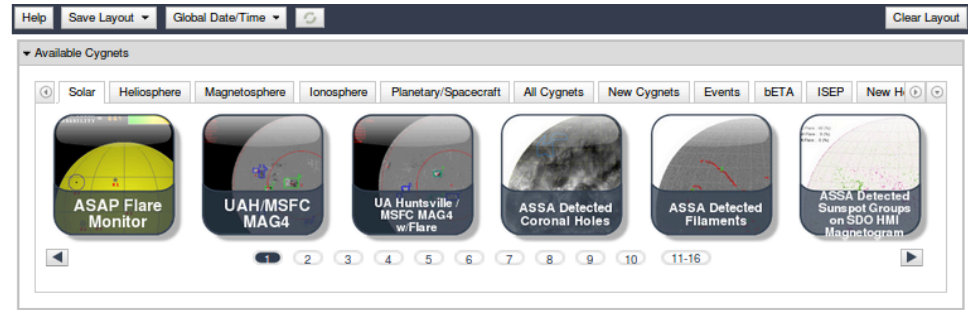*_prob: Probability of X, M, or C class flare in decimal format (4 places)*

_uncert: Uncertainty in X, M, or C class flare probability in decimal format (4 places) (optional)

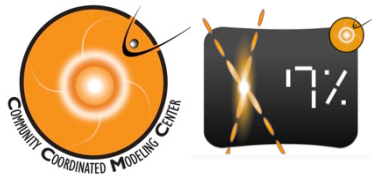*_level: Calibration of probability for the model for X, M, or C class flares (1=low, 2=medium, 3=high)*

iSWA

Beta version available on the integrated space weather analysis system

http://ccmc.gsfc.nasa.gov/challenges/flare.php

Flare Scoreboard

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Mock up

The full disk and active region flare forecasts can currently be viewed on an interactive display overlaid on an SDO/AIA or HMI image of then Sun and will be dynamically paired with a graph of flare probability vs. time (coming soon)

http://ccmc.gsfc.nasa.gov/challenges/flare.php

Validation
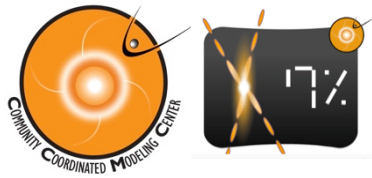
Convert probabilistic forecast to deterministic.
e.g., anything >25% is a 'yes' forecast..

	Forecast flare	Forecast no flare
Observed flare	TP	FN
Observed no flare	FP	TN

Metric Name	Short Name	Format	Worst Score	"No skill" Score	Perfect Score
Accuracy	ACC	(TP + TN) / N	0	...	1
Probability of detection	POD	TP / (TP + FN)	0	...	1
Probability of false detection (false alarm rate)	POFD	FP / (FP + TN)	1	...	0
False alarm ratio	FAR	FP / (TP + FP)	1	...	0
True skill statistic	TSS	POD - POFD	-1	0	1
Heidke skill score	HSS	(TP + TN - E_{random}) / (N - E_{random})	-1	0	1

where N = TP + FN + FP + TN
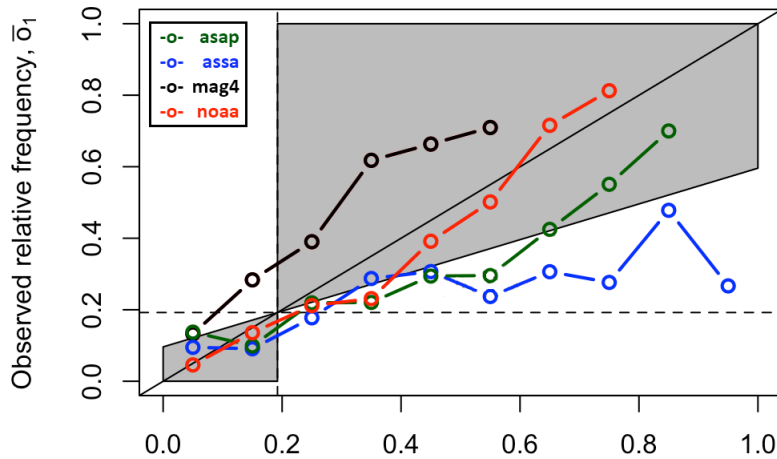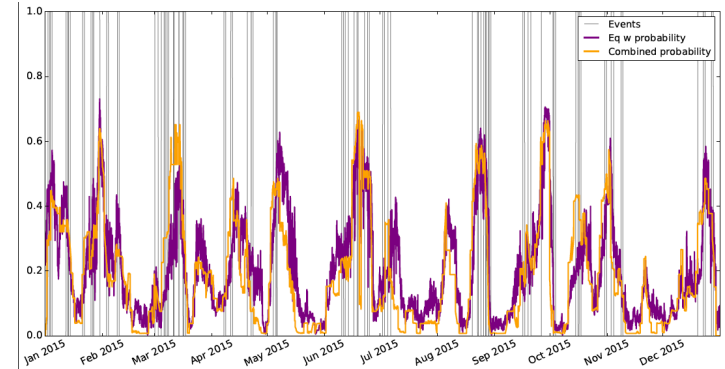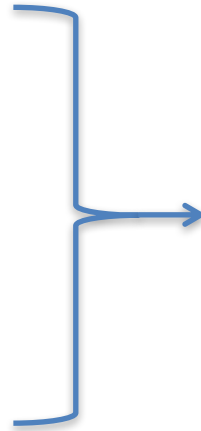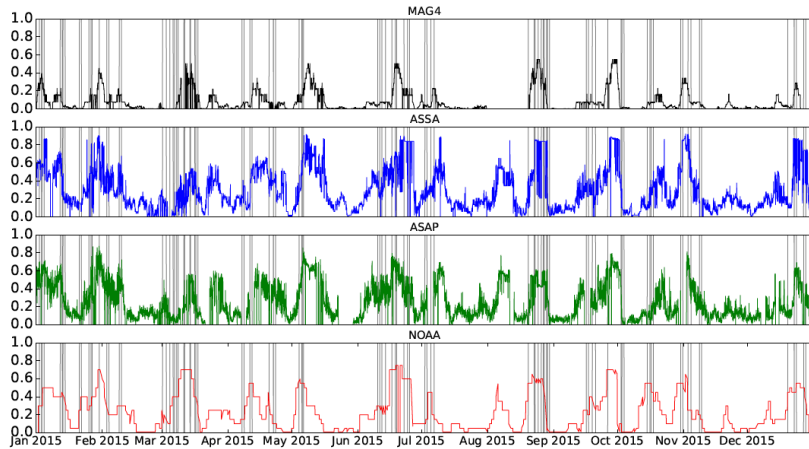
Validation

Validation

ROC area = 0.801
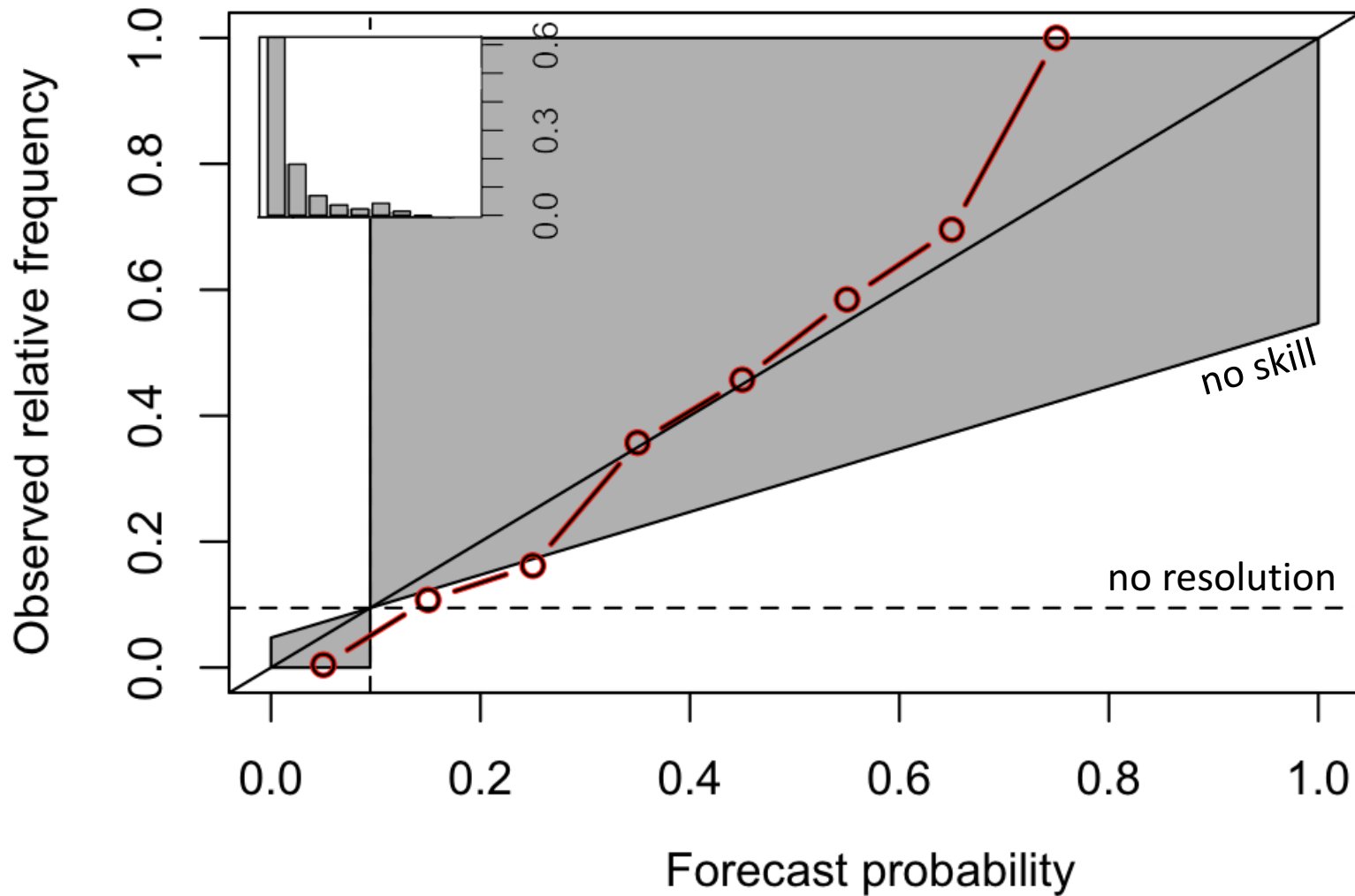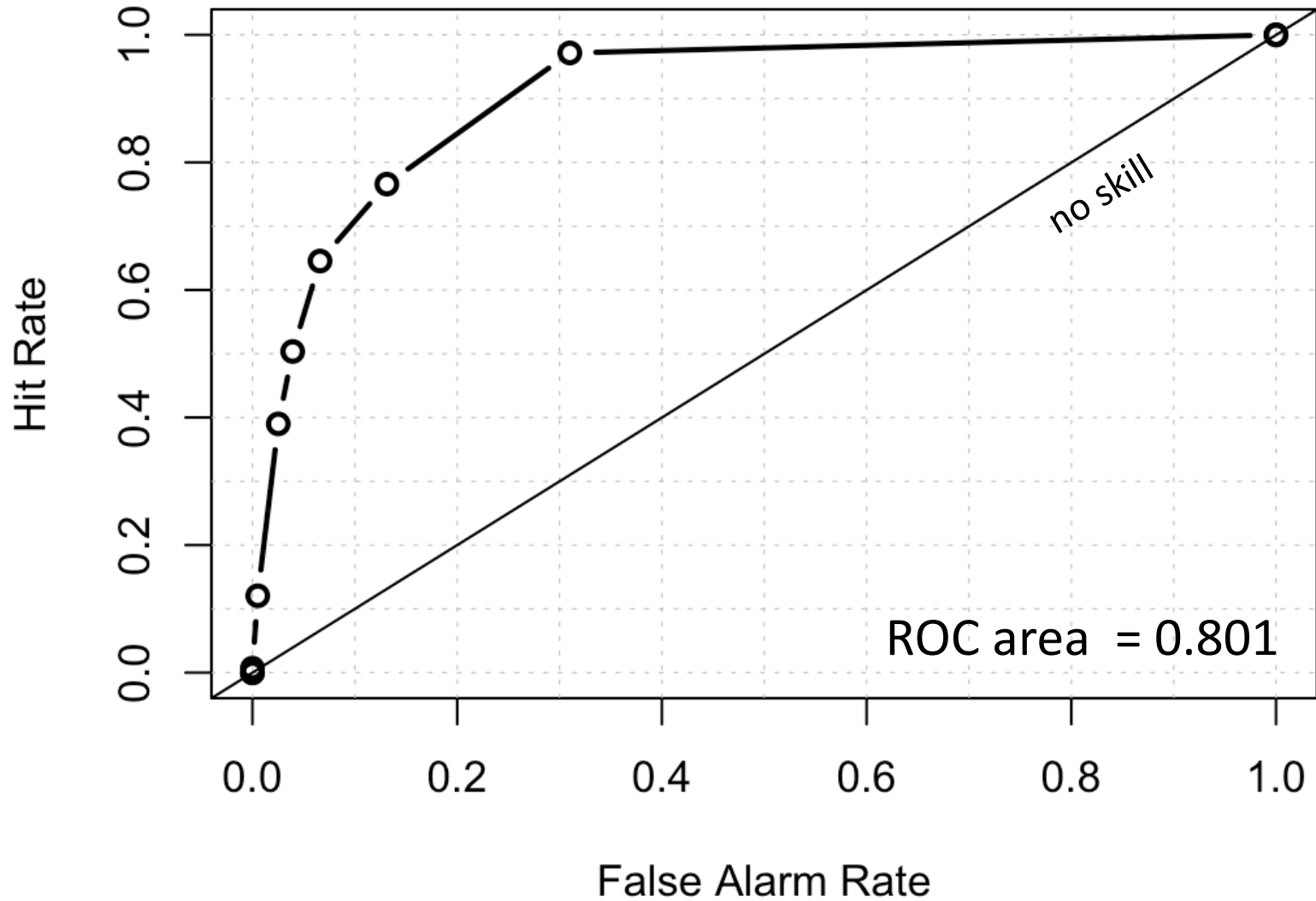
Ensemble Forecasting

Linear combination of probabilities

$$P^c(t; w) = \sum_{i=0}^{N} w_i P_i(t)$$
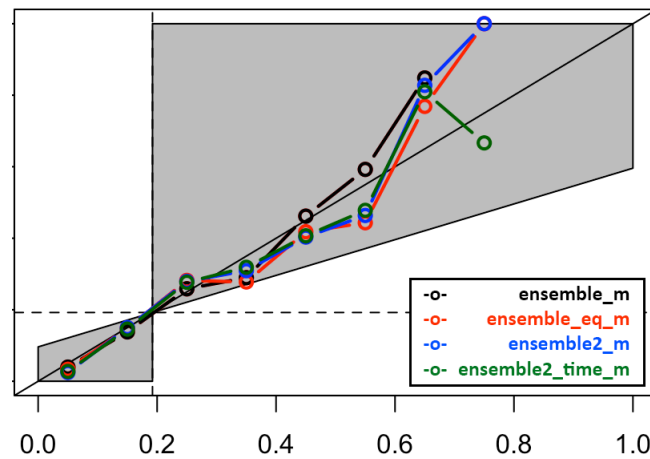
Forecaster
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J. A. Guerra