# IMF Bz Team

Neel Savani | (Pete Riley)

- Team Set up:
  - What we have achieved so far.

- Summary:
  - What we have achieved so far.

- Moving forward:
  - Strategy of keeping up the momentum

# Team Set up

## Core team

- Small team of active participants from around the world:
  - National forecasters
  - Scientists
  - Other Team Leads

- Slack communication system
  - 18 people
  - 6 Countries
  - 10 Time Zones

### Scientists

| | |
|---|---|
| N. Savani | P. Riley |
| L. Mays | M. Owens |
| Y. Collado Vega | A. Vourlidas |
| S. Patsourakos | C. DeForest |
| A. Rouillard | S. Poedts |
| D. Shiota | E. Henley |
| C. Verbeke | N. Lugaz |
| R. Steenburgh | C. Dekonig |
| M. West | H. Singer |

### Forecasting agencies

US NOAA / SWPC
UKMO / MOSWOC
Japan NICT / SWx

Community Coordinated Modeling Center

# Summary

## Open Themes

- Draft Document sent to whole Community
  - Feb 2017
  - > 110 participants
  - 6 themes were discussed
  - Also found on CCMC site

## Document Topics

1. Background Solar Wind
2. Core event selection
3. Magnetic What?
4. B Magnitude threshold
5. Time resolution
6. Validation Metric

Community Coordinated Modeling Center

International Forum for Space Weather Capabilities Assessment

Related Links | Frequently Asked Questions | Community Feedback | Downloads | Sitema

About | Models at CCMC | Request A Run | View Results | Instant Run | Metrics and Validation | Education | R2O Support | Mission Support | Community Support | Tools

Forum Home | Working Teams & Topics | Overall Goals and Deliverables | CCMC-LWS Working Meeting | Contact Us/Sign Up | FAQ

### IMF Bz at L1 Working Team

**Leads:** N. Savani, P. Riley (contact team leads/forum organizers to be added to the team)

**Communications:** ccmc-imf-bz@googlegroups.com (mailing list)
**Participants:** Eric Adamson · Nick Arge · Michael Balikhin* · Francois-Xavier Bocquet · Sean Bruinsma* · Yaireska Collado-Vega* · Pedro Corona-Romero* · Curt de Koning* · Manolis K. Georgoulis* · Edmund Henley · Bernard Jackson* · Lan Jian · Christina Kay · Noé Lugaz · Anthony Mannucci* · Periasamy K Manoharan* · Slava Merkin* · Marilena Mierla · Joseph Minow* · Christian Moestl · Karin

# Summary

## Main conclusions

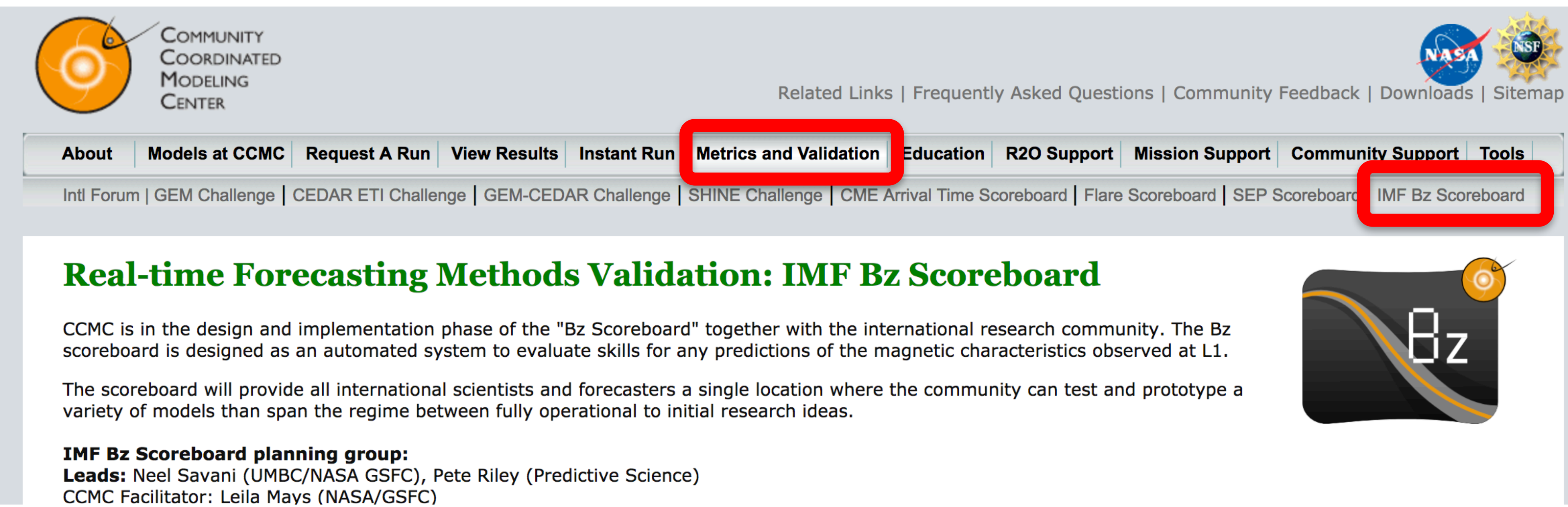
- Forecaster end result should work towards a single sentence that identifies 3 quantities:
  - A duration window for the forecast in the future
  - A field strength to exceed
  - An probability of uncertainty.

*"We forecast, in the next 24 hours for a minimum of 60 minutes the IMF Bz will drop below -10nT with 75% probability.*

# Summary

## Main conclusions

- NEW scoreboard for IMF Bz on the CCMC site.
  - CCMC will work towards providing an interface where the international community can upload forecasts
  - The format is currently being finalised



# Moving Forward

## Scientists metric of success

- Scientists want a variety of methods to check and improve their models – many Skill metric available

- But will work towards same measure to compare between models.
  - ROC curve
  - Cost-Loss Analysis

- Benefits of these curves:
  - Use many skill tables numbers to simply display in a single schematic – (for scientist comparison)

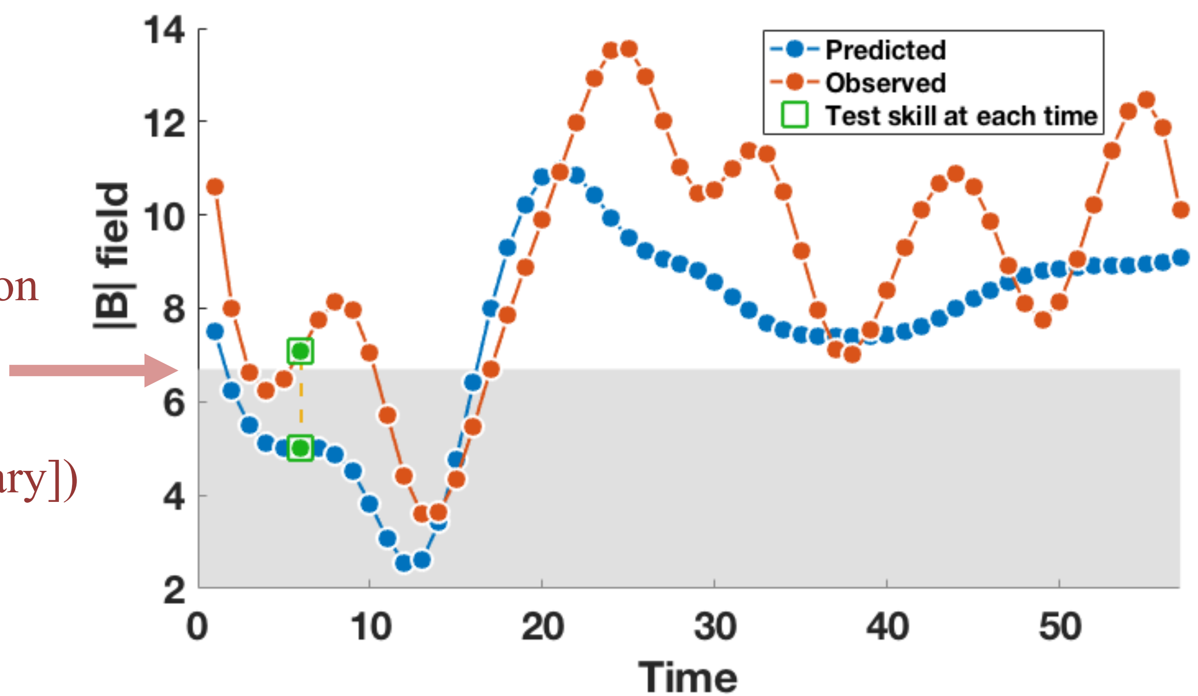
  - ROC Curve can be converted to a single number (Area under the ROC) – (for forecaster comparison)

# Moving Forward

## ROC curve

- Work in progress.
  - Conversion of a deterministic forecast into probabilistic ➜ uncertainty.
  - Guidance taken from flare forecasting

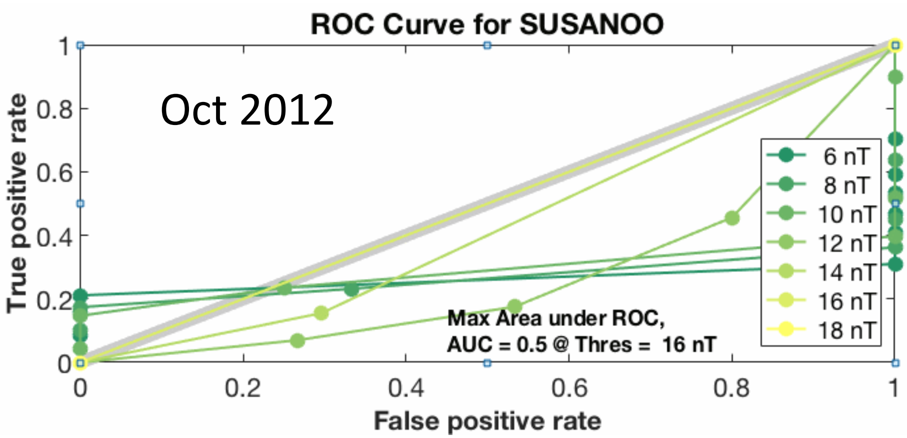
(Event Definition Intensity, I.
[equivalent to M-class boundary])

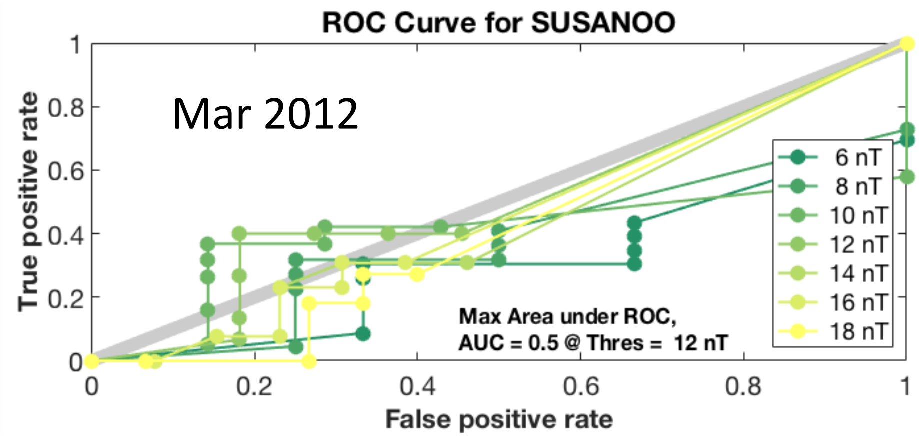


# Moving Forward

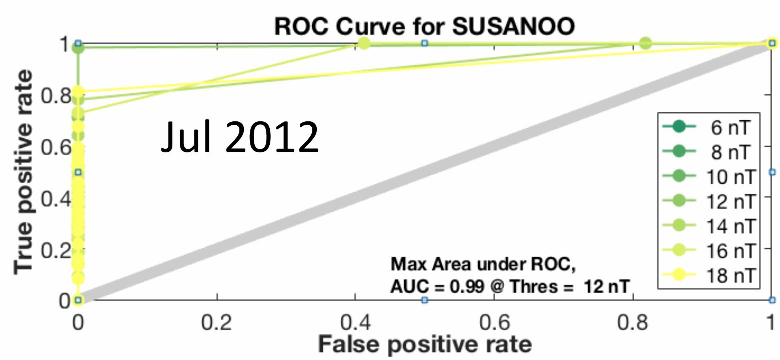
## ROC curve

- Preliminary results using SUSANOO
- Variety of results shown:
  - lack of independence between points is the cause?
  - Period of analysis require more than CME time?

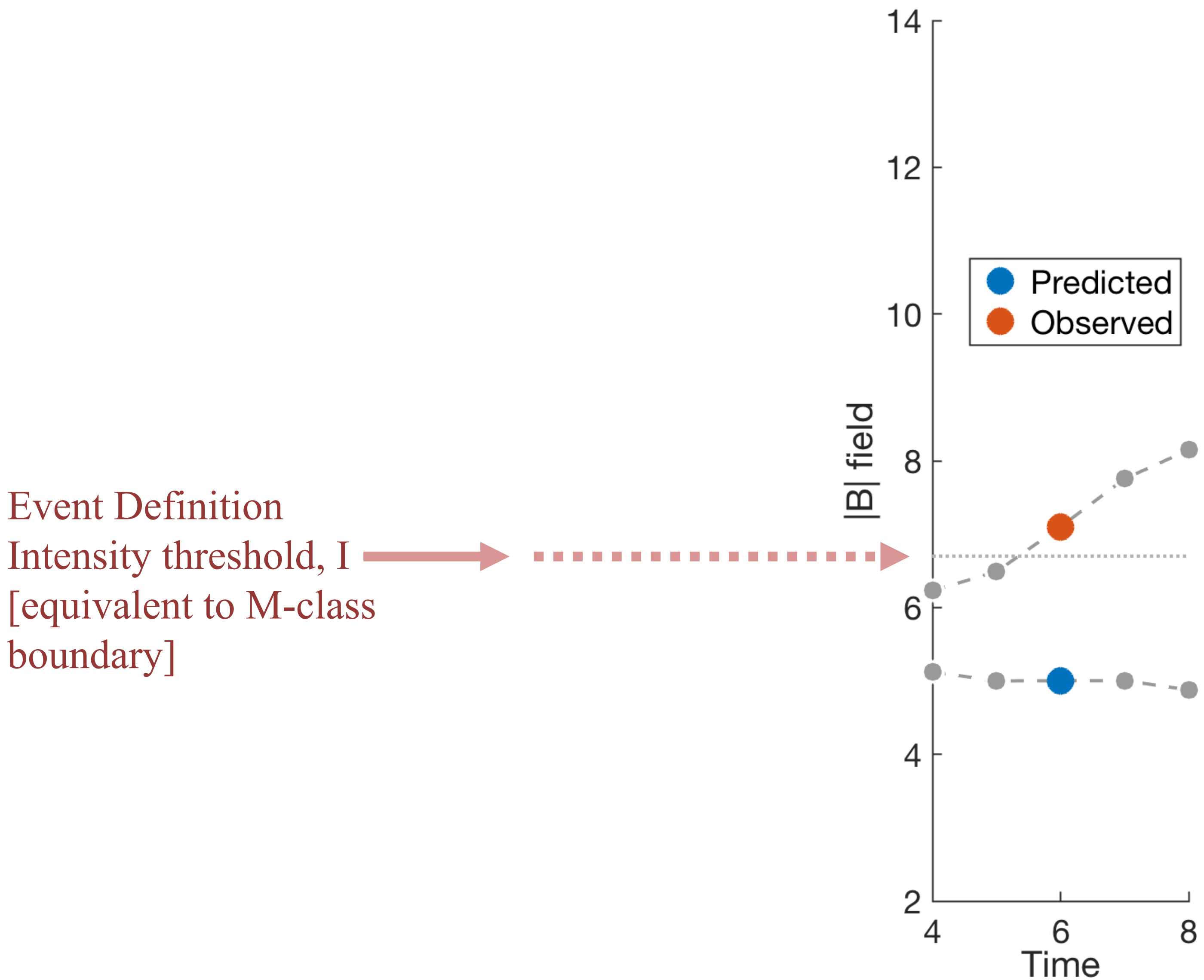



A report of the methodology will be sent to everyone for comment in the coming months

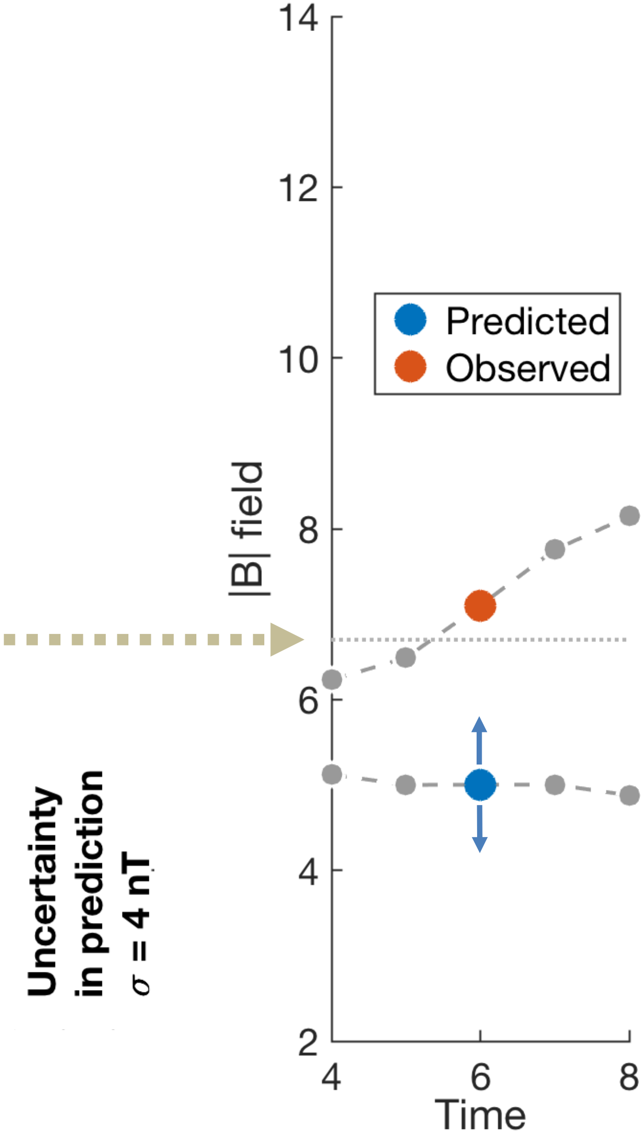


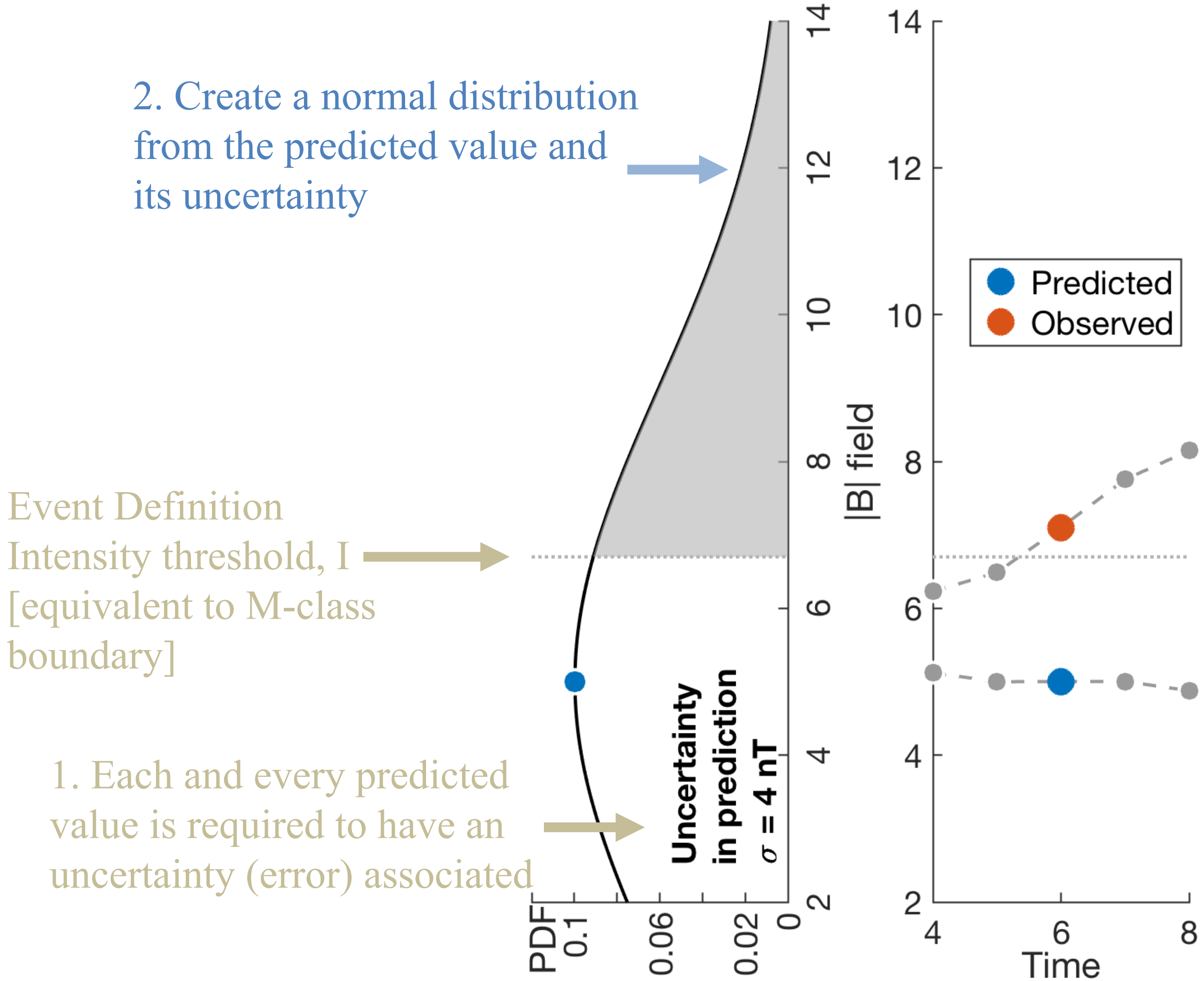
EXTRA SLIDES


Event Definition
Intensity threshold, I
[equivalent to M-class
boundary]
Predicted
Observed
|B| field
Time
14
12
10
8
6
4
2
4
6
8

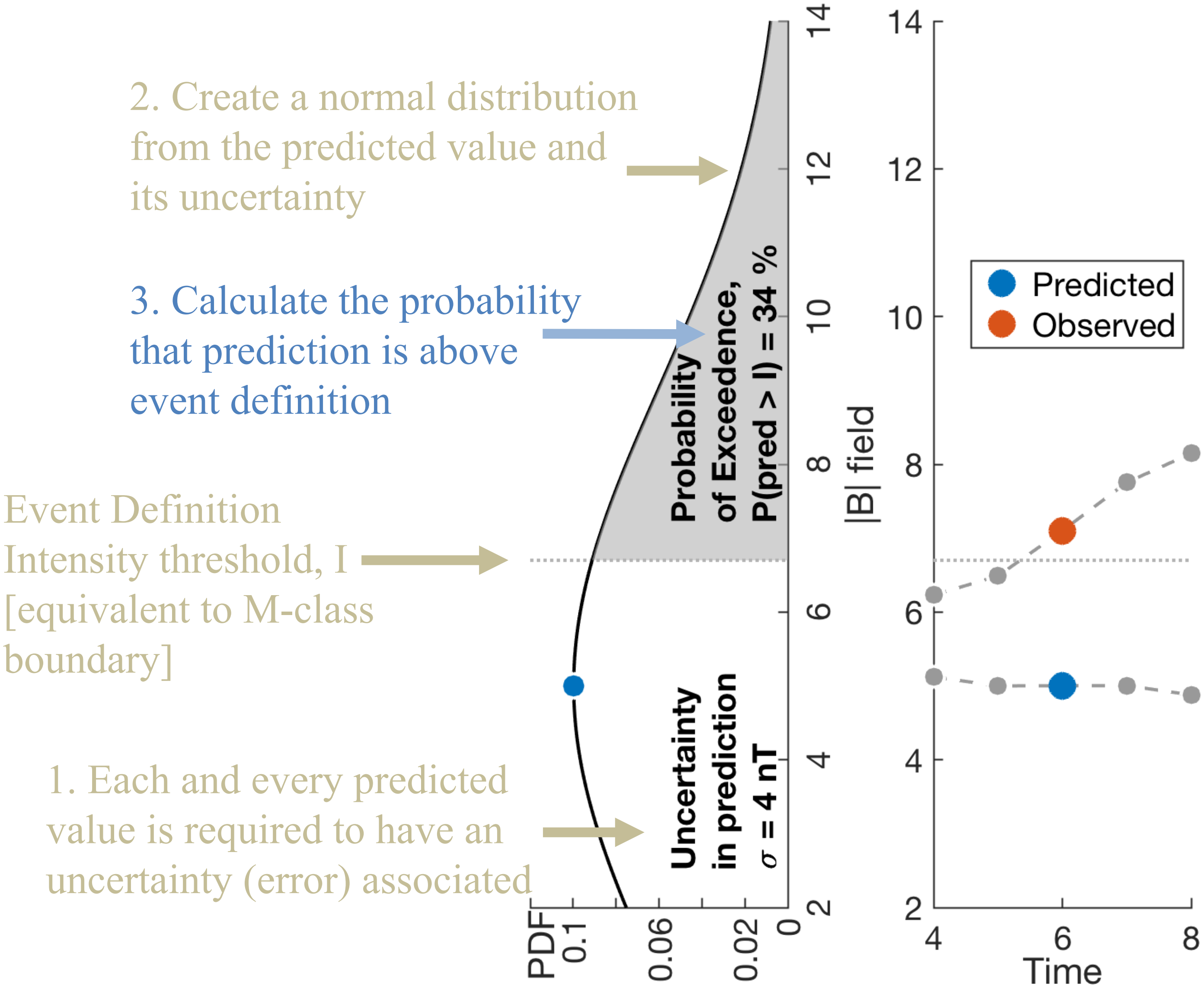
Event Definition
Intensity threshold, I
[equivalent to M-class boundary]

1. Each and every predicted value is required to have an uncertainty (error) associated





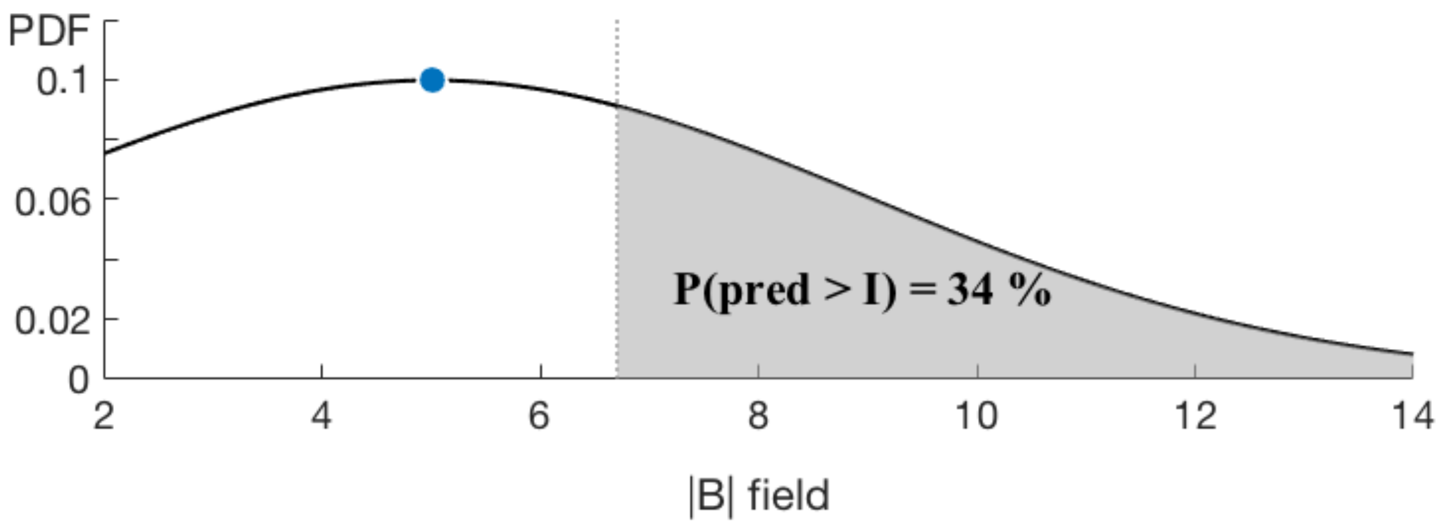
2. Create a normal distribution from the predicted value and its uncertainty
Event Definition
Intensity threshold, I
[equivalent to M-class boundary]
1. Each and every predicted value is required to have an uncertainty (error) associated
Uncertainty
in prediction
σ = 4 nT
PDF
0.1
0.06
0.02
0
2
4
6
8
10
12
14
|B| field
Predicted
Observed
Time



2. Create a normal distribution from the predicted value and its uncertainty
3. Calculate the probability that prediction is above event definition
Event Definition Intensity threshold, I [equivalent to M-class boundary]
1. Each and every predicted value is required to have an uncertainty (error) associated
Probability of Exceedence, P(pred > I) = 34 %
Uncertainty in prediction σ = 4 nT
PDF
0.1
0.06
0.02
0
2
4
6
8
10
12
14
|B| field
Predicted
Observed
Time

1. So, we have a fixed probability that our prediction is above Event Definition, I (which is equivalent to the M-class intensity boundary)

P(pred>I) = 34%



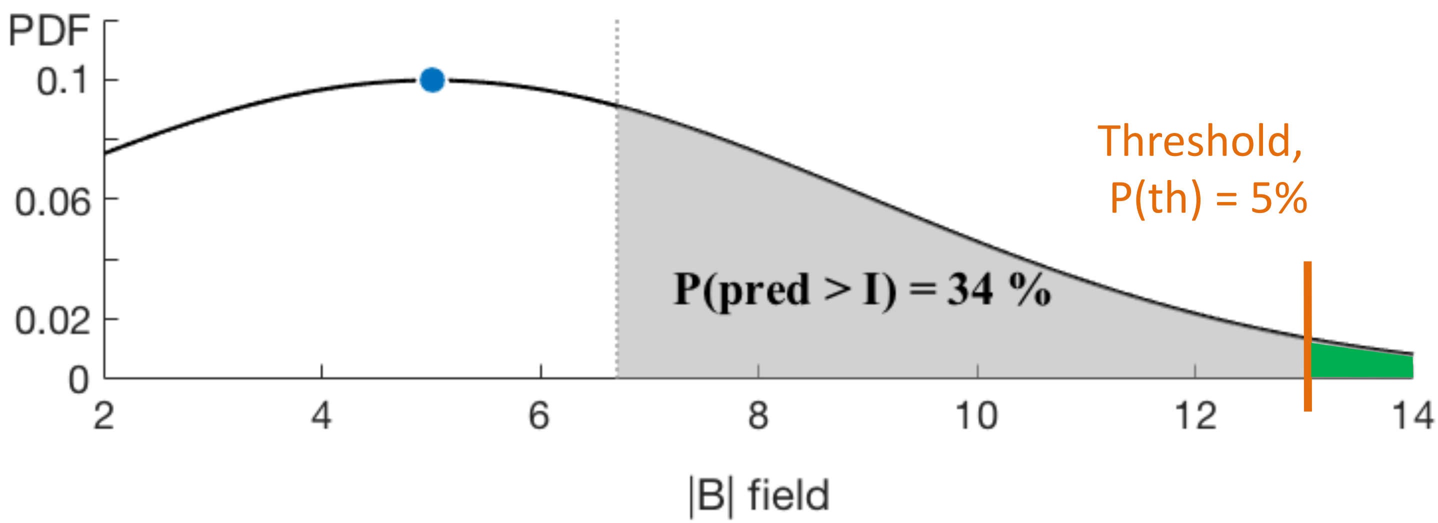
1. So, we have a fixed probability that our prediction is above Event Definition, I (which is equivalent to the M-class intensity boundary)

P(pred>I) = 34%

2. Lets define a threshold, P(th), for which we require the prediction probability to exceed, in order to qualify as a 'Yes' predicted event.

P(pred>I) > P(th) → Prediction = Y

P(pred>I) < P(th) → Prediction = N



1. So, we have a fixed probability that our prediction is above Event Definition, I (which is equivalent to the M-class intensity boundary)

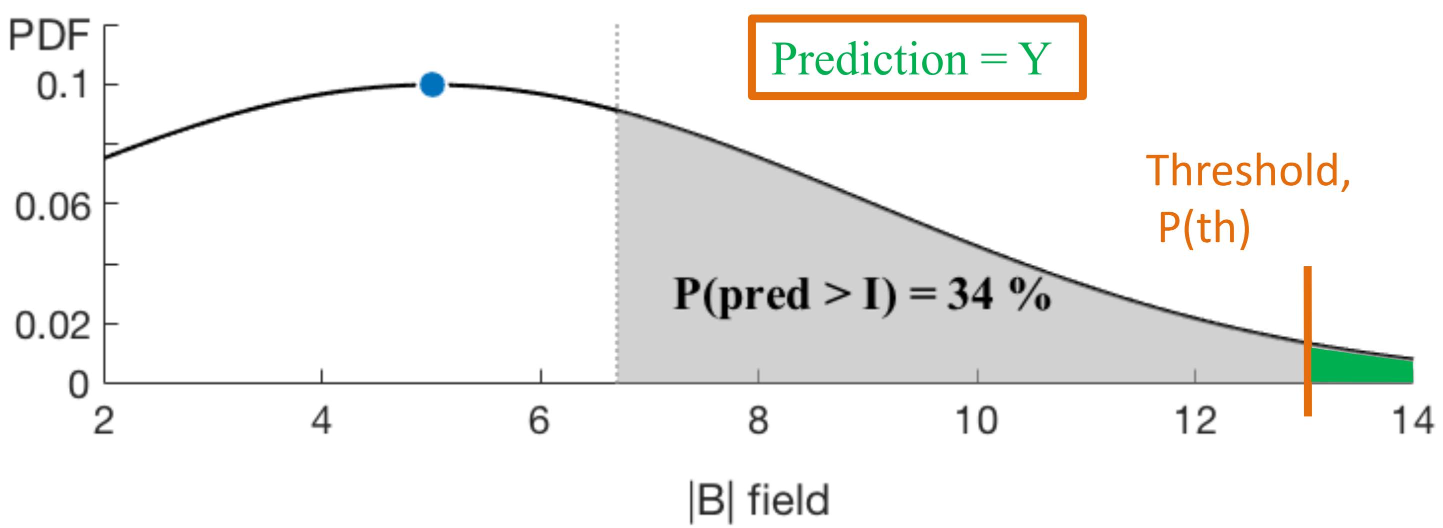
P(pred>I) = 34%

2. Lets define a threshold, P(th), for which we require the prediction probability to exceed, in order to qualify as a 'Yes' predicted event.

P(pred>I) > P(th) → Prediction = Y

P(pred>I) < P(th) → Prediction = N

3. We can now manually change this threshold to vary across 0-100%. [This is equivalent to varying probability threshold for Flare forecasting].



1. So, we have a fixed probability that our prediction is above Event Definition, I (which is equivalent to the M-class intensity boundary)

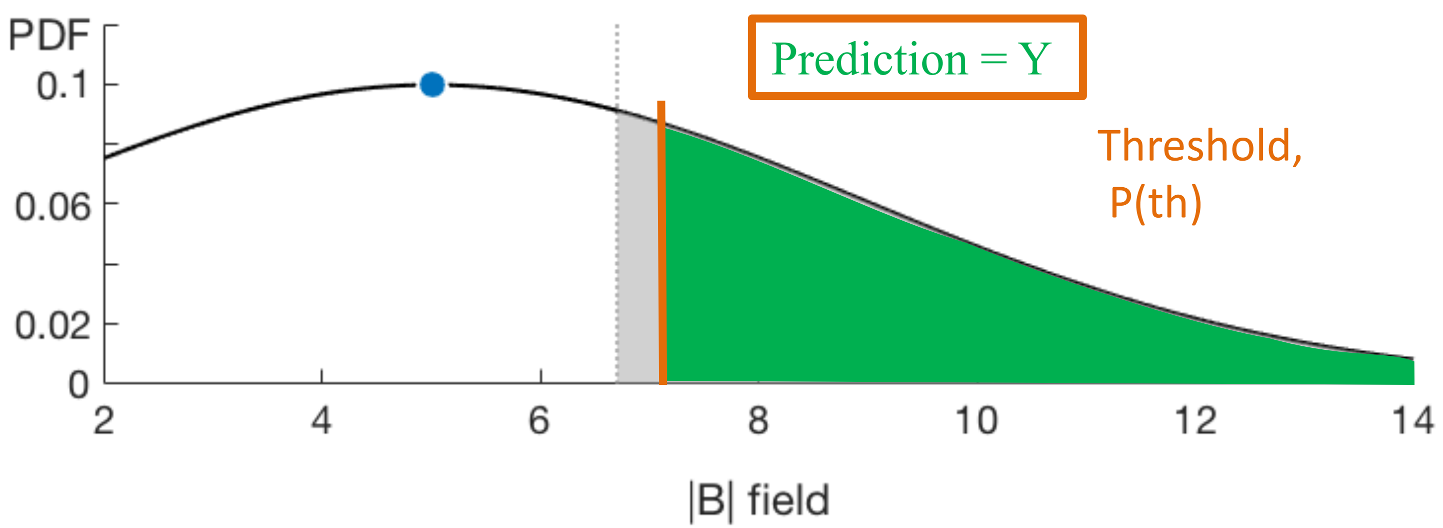
P(pred>I) = 34%

2. Lets define a threshold, P(th), for which we require the prediction probability to exceed, in order to qualify as a 'Yes' predicted event.

P(pred>I) > P(th) → Prediction = Y

P(pred>I) < P(th) → Prediction = N

3. We can now manually change this threshold to vary across 0-100%. [This is equivalent to varying probability threshold for Flare forecasting].



1. So, we have a fixed probability that our prediction is above Event Definition, I (which is equivalent to the M-class intensity boundary)

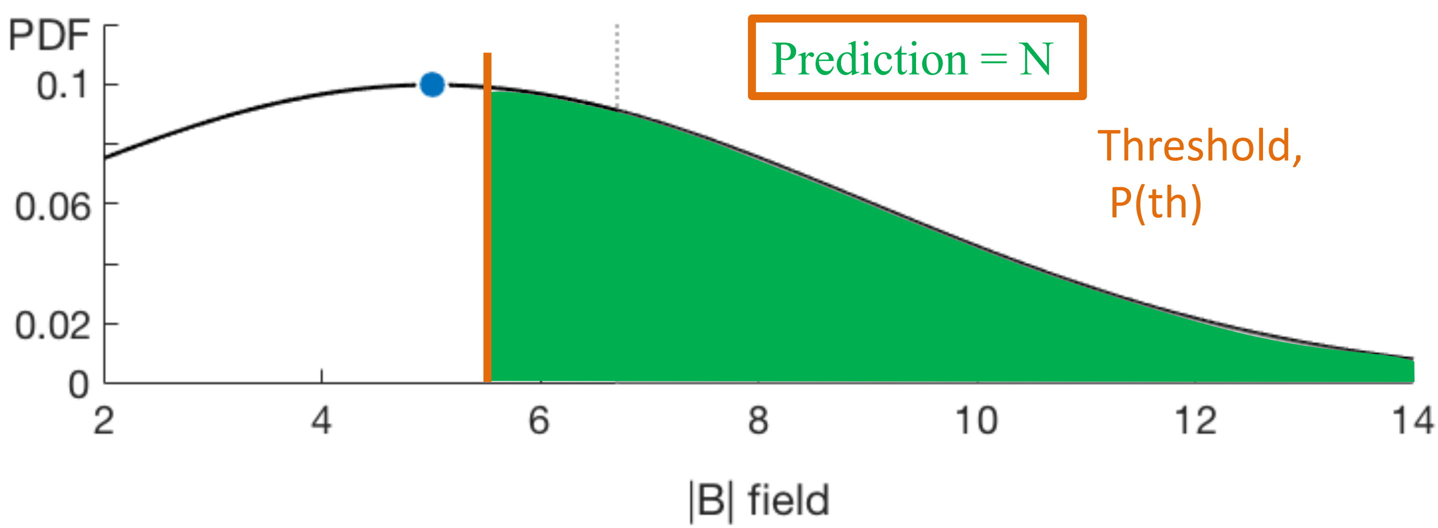
P(pred>I) = 34%

2. Lets define a threshold, P(th), for which we require the prediction probability to exceed, in order to qualify as a 'Yes' predicted event.

P(pred>I) > P(th) → Prediction = Y

P(pred>I) < P(th) → Prediction = N

3. We can now manually change this threshold to vary across 0-100%. [This is equivalent to varying probability threshold for Flare forecasting].



1. So, we have a fixed probability that our prediction is above Event Definition, I (which is equivalent to the M-class intensity boundary)

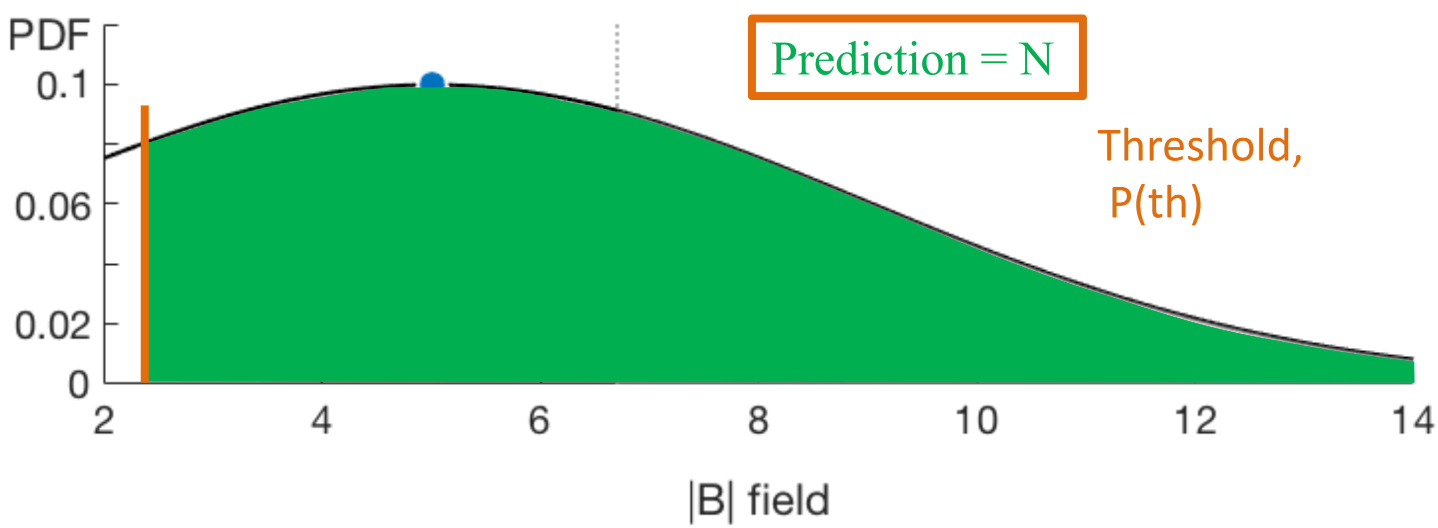
P(pred>I) = 34%

2. Lets define a threshold, P(th), for which we require the prediction probability to exceed, in order to qualify as a 'Yes' predicted event.

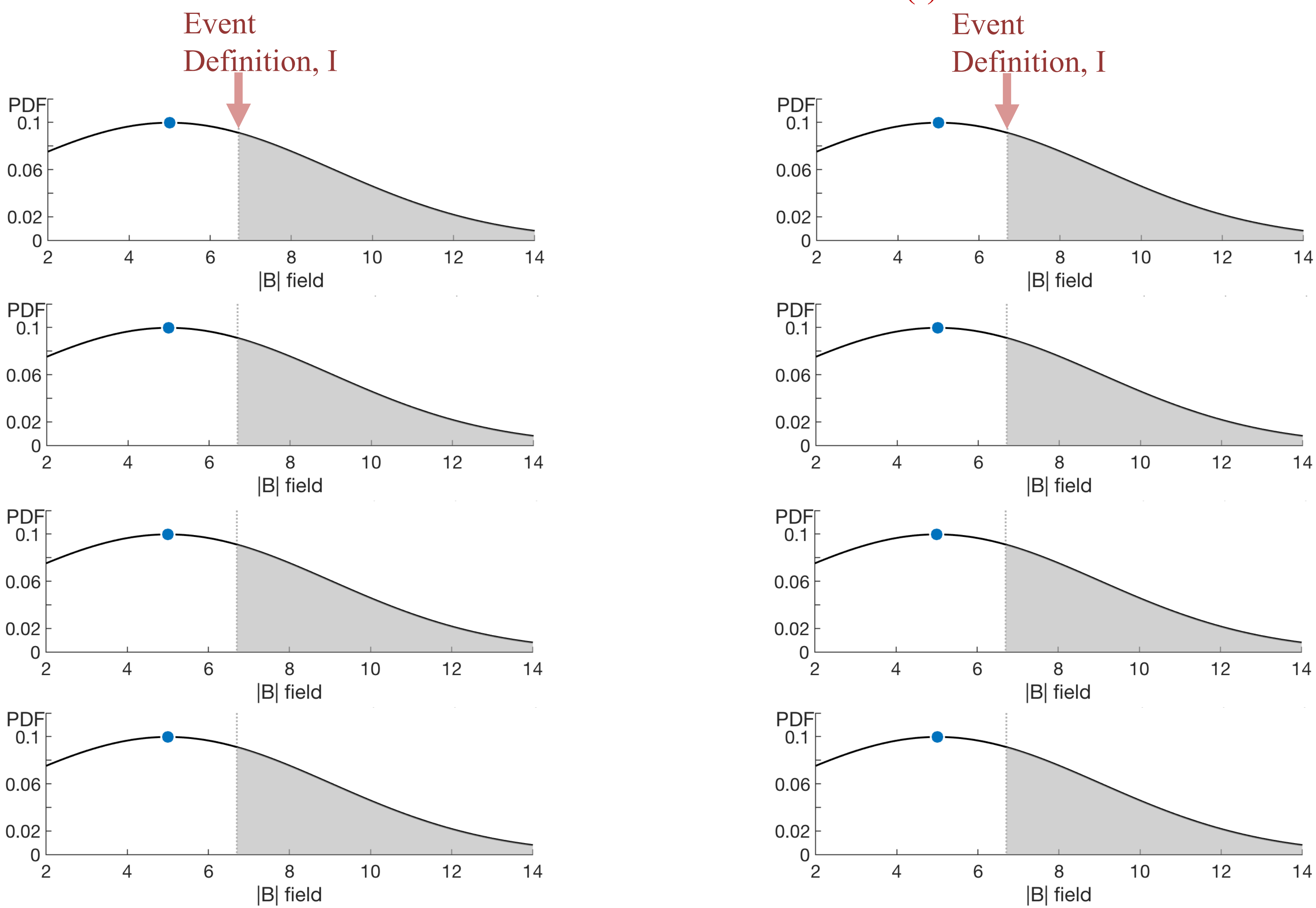
P(pred>I) > P(th) → Prediction = Y

P(pred>I) < P(th) → Prediction = N

3. We can now manually change this threshold to vary across 0-100%. [This is equivalent to varying probability threshold for Flare forecasting].



# 1. Now consider if the Observation was measured above/below Event Definition (I).

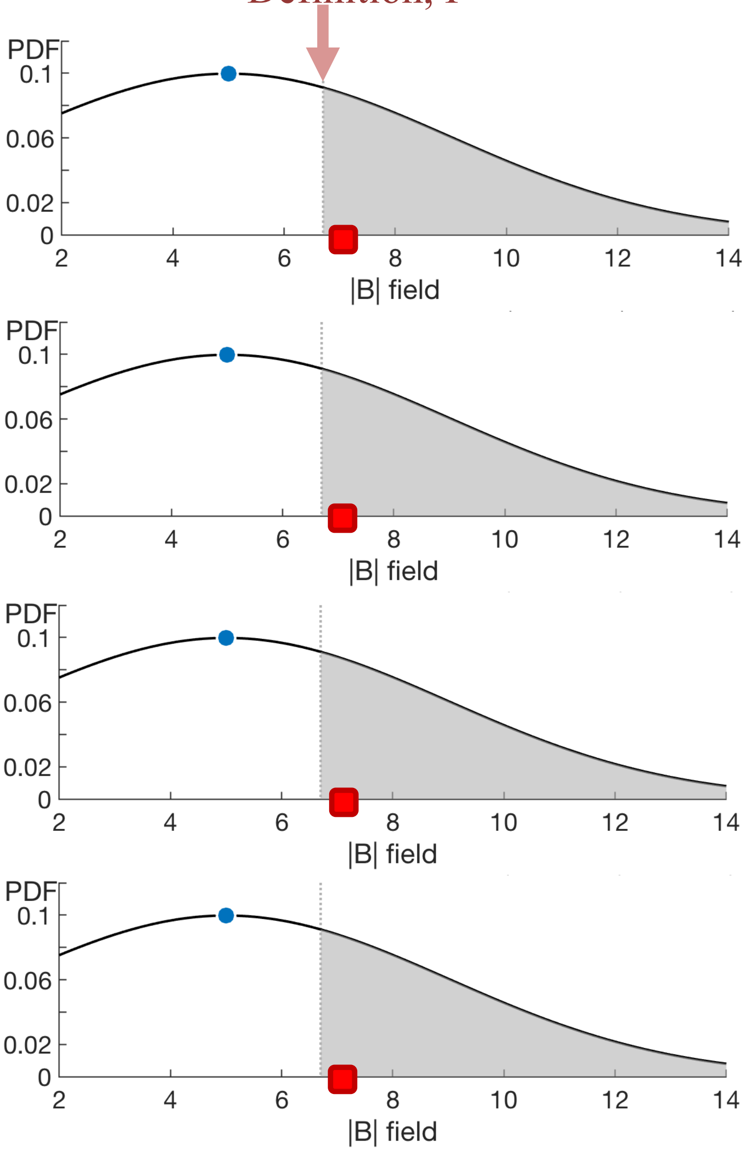


obs = Yes

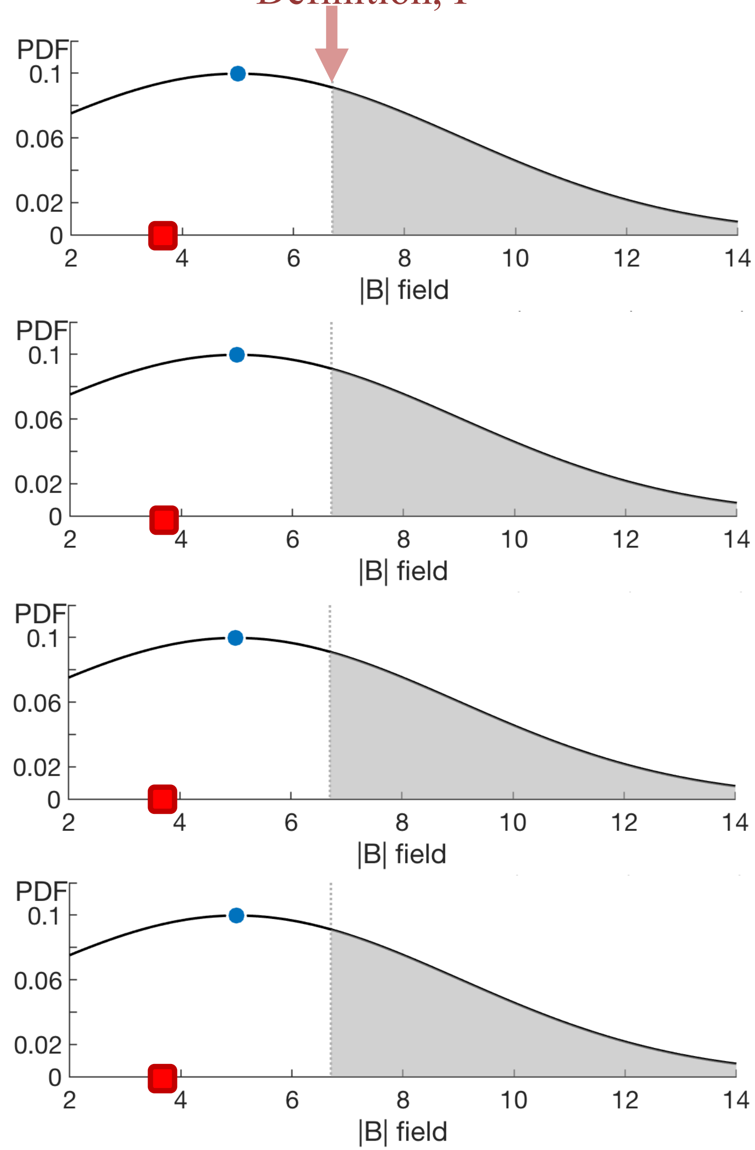
1. Now consider if the Observation was measured above/below Event Definition (I).

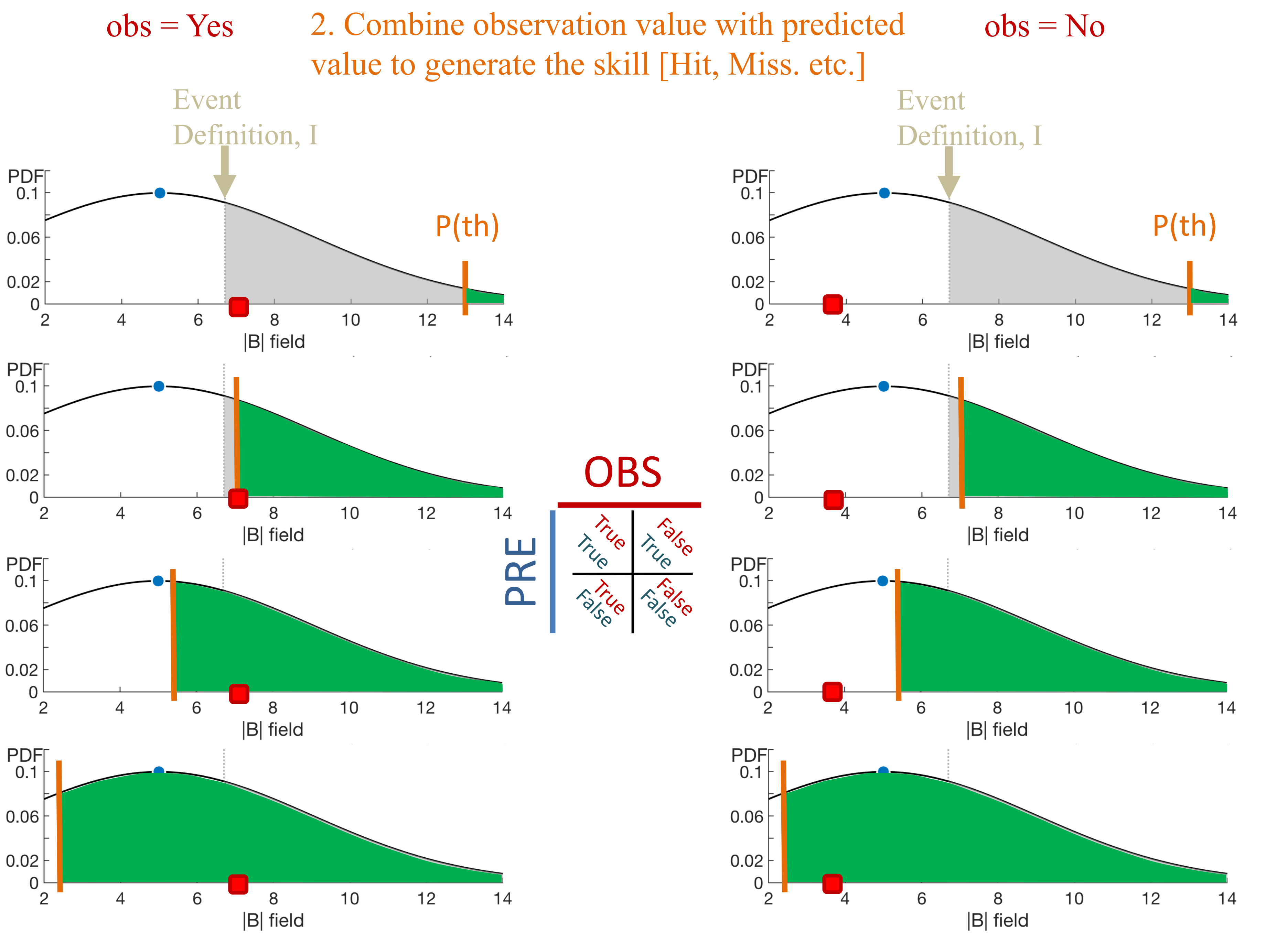
obs = No

Event Definition, I




Event Definition, I




obs = Yes
2. Combine observation value with predicted value to generate the skill [Hit, Miss. etc.]
obs = No
Event Definition, I
P(th)
PDF
|B| field
OBS
PRE
True True
False True
True False
False False

obs = Yes

## 2. Combine observation value with predicted value to generate the skill [Hit, Miss. etc.]

obs = No