

HFIP Topics

NOAA FAB

Paula McCaslin

Zoltan Toth

Nov 8-9, 2011

- 9th International THORPEX Meeting of the GIFS-TIGGE Working Group
 - (THORPEX Interactive Grand Global Ensemble–Global Interactive Forecast System)
 - August 31 to September 2, 2011 – Geneva
- 50% of Presentations were on topics of TC
 - JMA, ECMWF, WMO, South Pacific, Others
 - Quick tour....

GIFS TIGGE

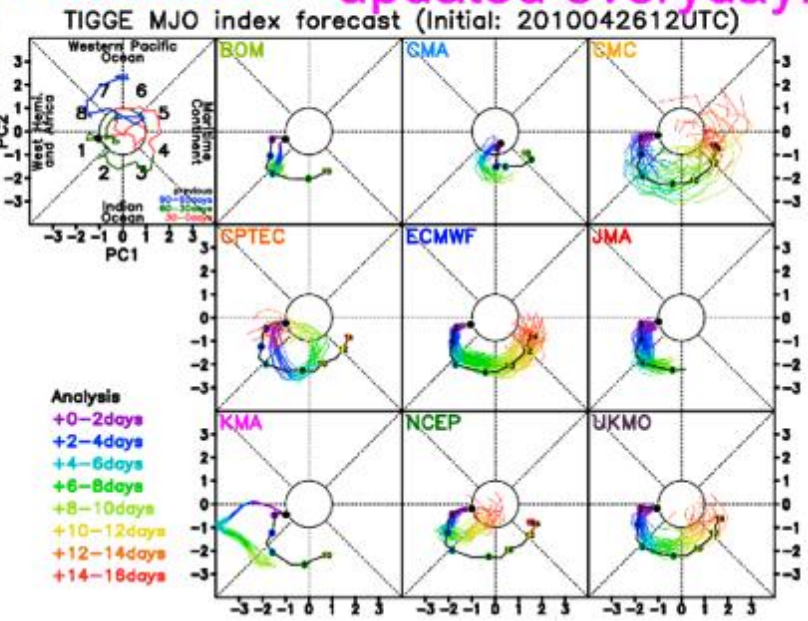
GIFS TIGGE – JMA

- Monitoring and verification website
 - <http://tparc.mri-jma.go.jp/TIGGE>
 - Or, search web for “mjo tigge”

GIFS TIGGE – JMA

TIGGE monitoring and verification website

Automatically updated everyday!



TIGGE Medium-Range Ensemble

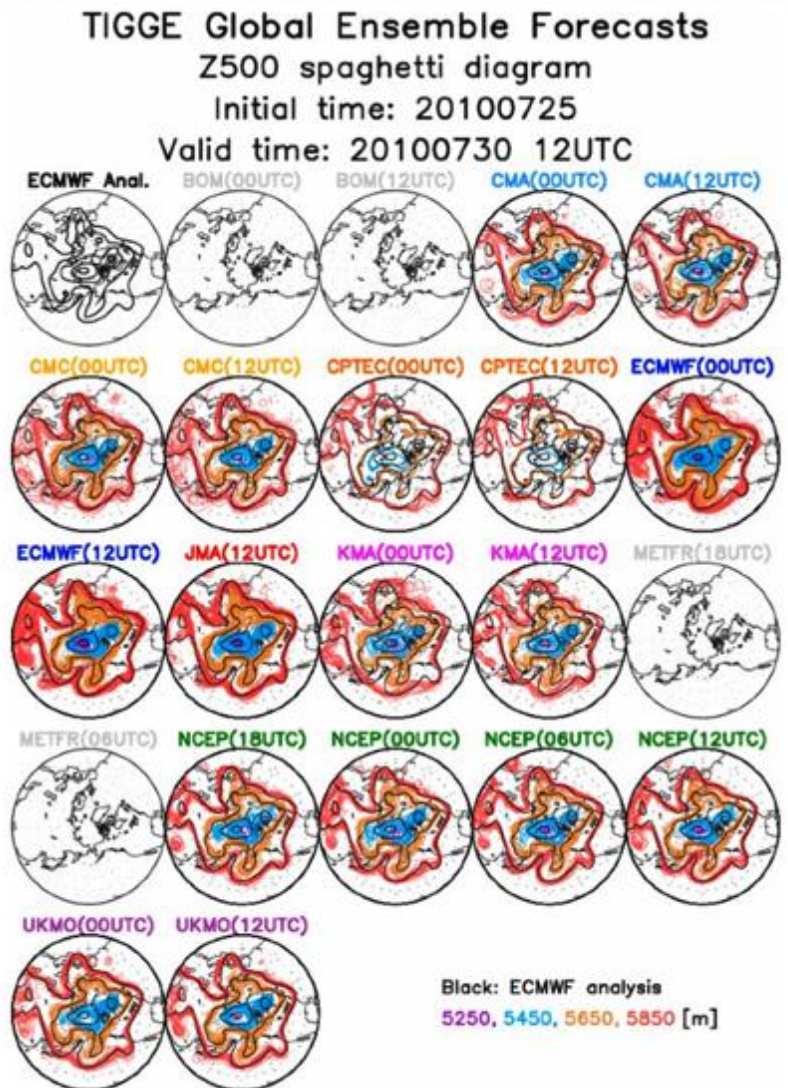
- Spaghetti (5550m)
- Spaghetti (5600m)
- Spaghetti (5650m)
- Spaghetti (5700m)
- Spaghetti stamp (NH)
- Spaghetti stamp (SH)
- Ensemble Mean (NH)
- Ensemble Mean (SH)
- Ensemble Spread (NH)
- Ensemble Spread (SH)

Initiated time:
 Year: Month: Day: 2010 07 25

[-1 Day] [+1 Day] [latest]

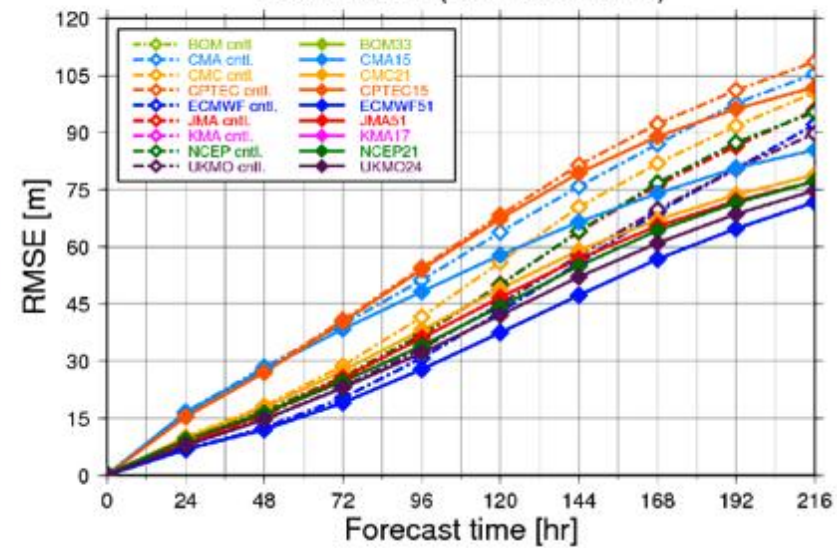
- FT:
- 000 0C3 024
 - 036 0C3 060
 - 072 0C4 096
 - 108 103 132
 - 144 1C5 168
 - 180 1C2 204
 - 216 aTime

[Go to main page](#)



TIGGE medium-range ensemble forecasts

Z500 RMSE (2011MAM: NH)



TIGGE monitoring and verification website

Automatically
updated everyday!

THORPEX
A World Weather Research Programme

Welcome to a gallery of THORPEX Interactive Grand Global Ensemble (TIGGE)!

The TIGGE is a key component of the THORPEX project, which provides operational global ensemble forecast data quasi-operationally (2 days behind). The TIGGE portals provide the TIGGE data freely for research and education purposes. For details, see [WMO THORPEX website](#) or [TIGGE website](#). This page is operated for an advertisement of TIGGE by [Dr. Mio Matsuueda](#) (JAMSTEC, Japan) in cooperation with Dr. Tetsuo Nakazawa (WMO). **This page is updated every day** (4 days behind).

Enjoy the TIGGE data!

LastUpdate:07/26/2011 18:42:17

About TIGGE data

- [Latest details of operational global ensemble prediction system in TIGGE portals as of December 2010 \[pdf\]](#)

Real-time TIGGE forecast monitor Updated every day!

- [Spaghetti diagram, ensemble mean, and ensemble spread for Z500](#)
- [MJO forecast](#)
- [Ensemble-based warnings for extreme weather events](#) **New!**
- [Ensemble-based occurrence probability of extreme events](#) **New!**
- [Ensemble-based occurrence probability of blocking over the NH](#)
- [EPS meteogram \(around Japan\)](#)

Verifications of TIGGE ensemble forecasts

<http://tparc.mri-jma.go.jp/TIGGE>
or
Google "mjo tigde"



GIFS TIGGE – ECMWF

- Tropical cyclones
 - Tracking of tropical cyclones developing during forecast
 - Operational tracks – deterministic up to 1 hour early
 - Under testing: replacement of operational tracker (beyond 5 days)

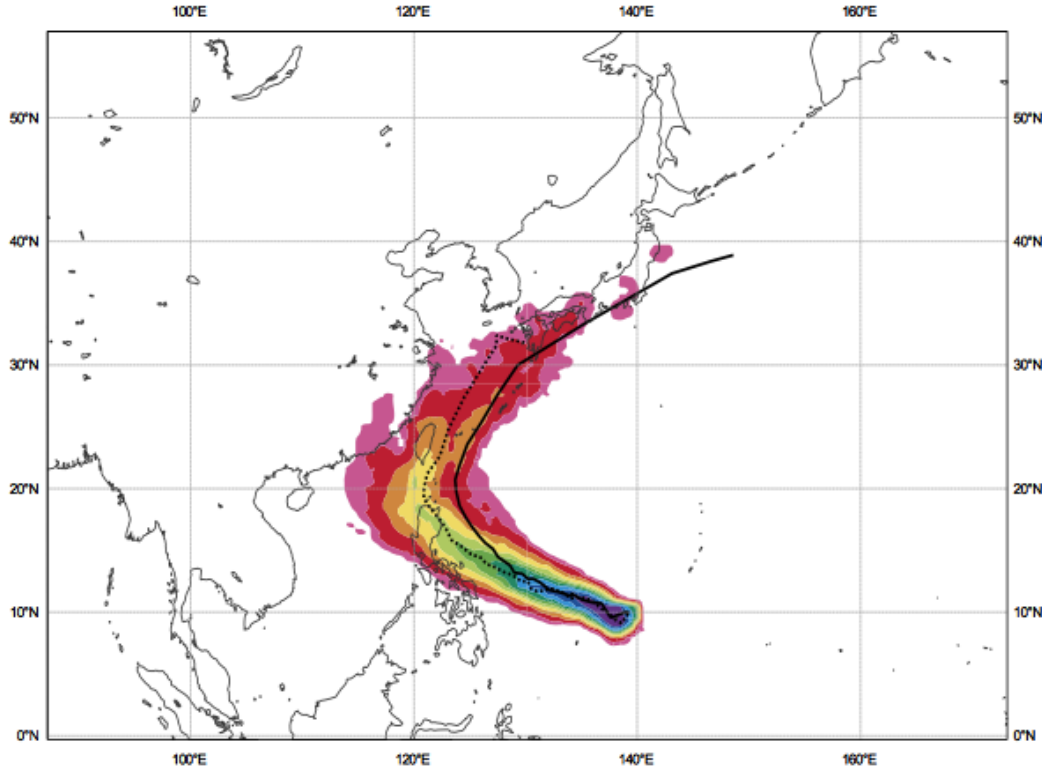
GIFS TIGGE – ECMWF

Tropical cyclones

Date 20110520 12 UTC @ ECMWF

Probability that **04W** will pass within 120 km radius during the next **240** hours
tracks: **solid**=OPER; **dot**=CTRL

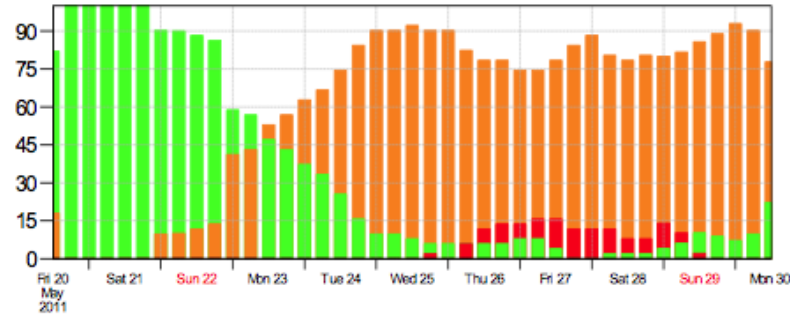
5-10 10-20 20-30 30-40 40-50 50-60 60-70 70-80 80-90 > 90 %



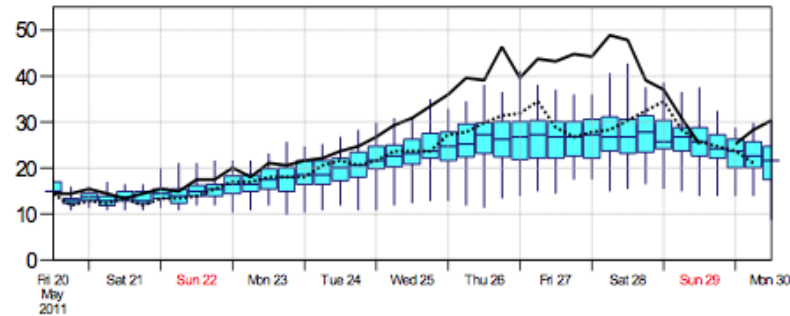
List of ensemble members numbers forecast Tropical Cyclone
Intensity category in colours: **TD**(up to 16) **TS**[17-32] **HR1** [33-42] **HR2** [43-48] **HR3** [>48 m/s]

+024 h: hr ct 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
 +048 h: hr ct 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
 +072 h: hr ct 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
 +096 h: hr ct 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
 +120 h: hr ct 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
 +144 h: hr ct 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
 +168 h: hr ct 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
 +192 h: hr ct 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
 +216 h: hr ct 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
 +240 h: hr 01 03 04 05 06 07 08 10 11 13 14 15 16 17 18 19 20 21 22 23 27 28 29 32 33 34 35 36 37 40 43 44 47 48 49 50

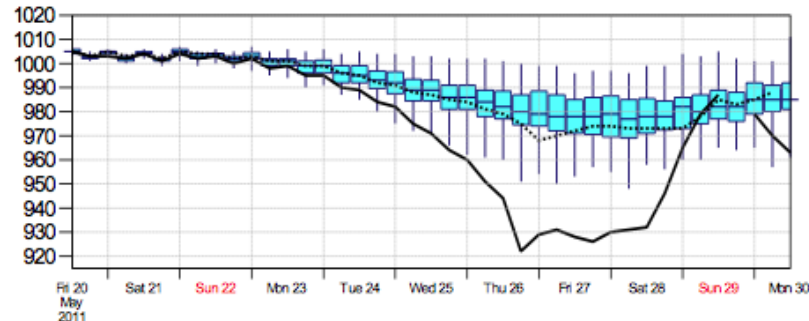
Probability (%) of Tropical Cyclone Intensity falling in each category
TD[up to 16] **TS** [17-32] **HR1**[33-42] **HR2** [43-48] **HR3** [> 48 m/s]



10m Wind Speed (m/s)



Mean Sea Level Pressure in Tropical Cyclone Centre (hPa)

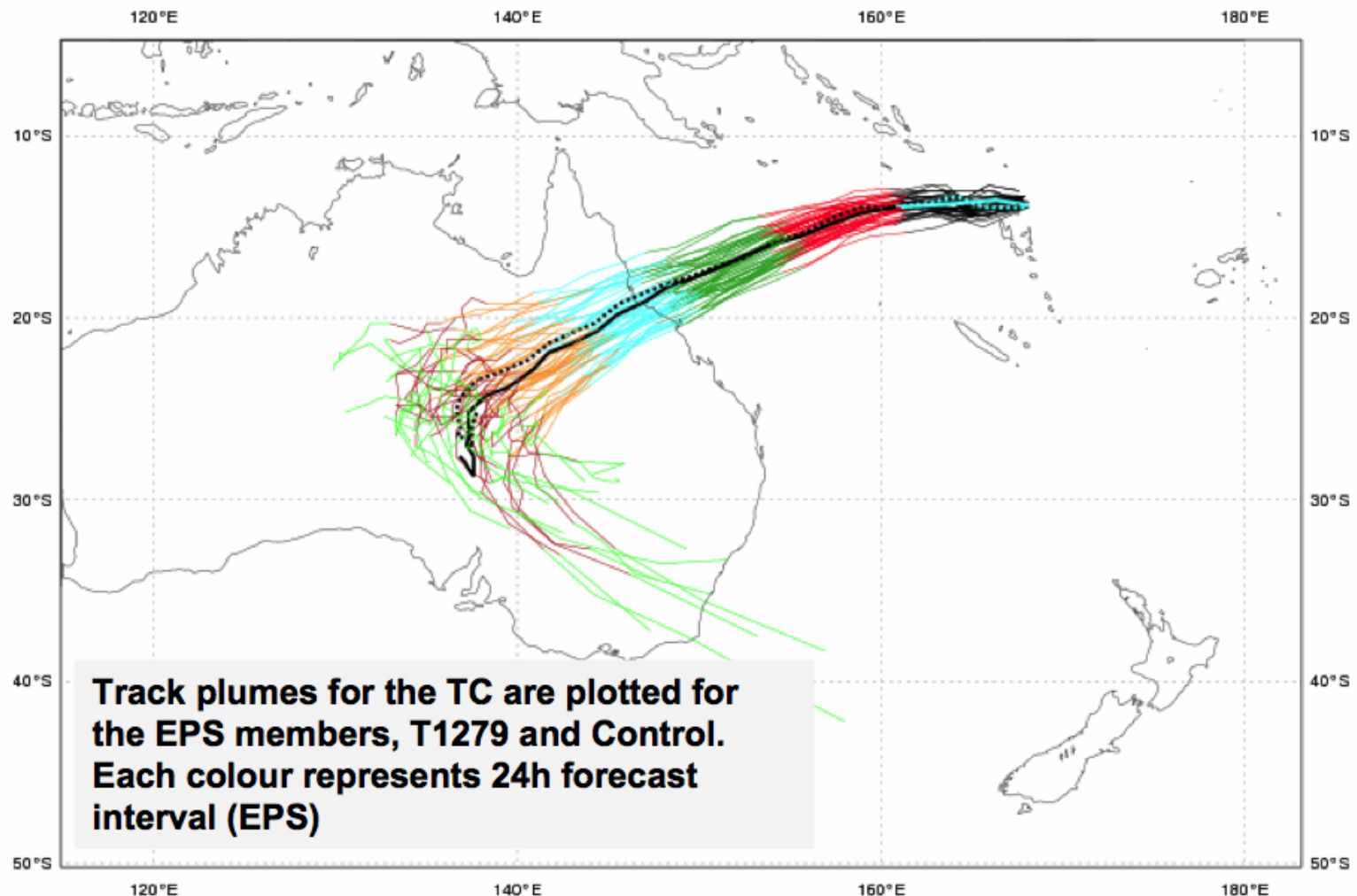


Date 20110130 12 UTC @ECMWF

Probability that **YASI** will pass within 120 km radius during the next **168** hours

tracks: **thick solid**=OPER; **thick dot**=CTRL; **thin solid**=EPS members

0-24h **24-48h** **48-72h** **72-96h** **96-120h** **120-144h** **144-168h**

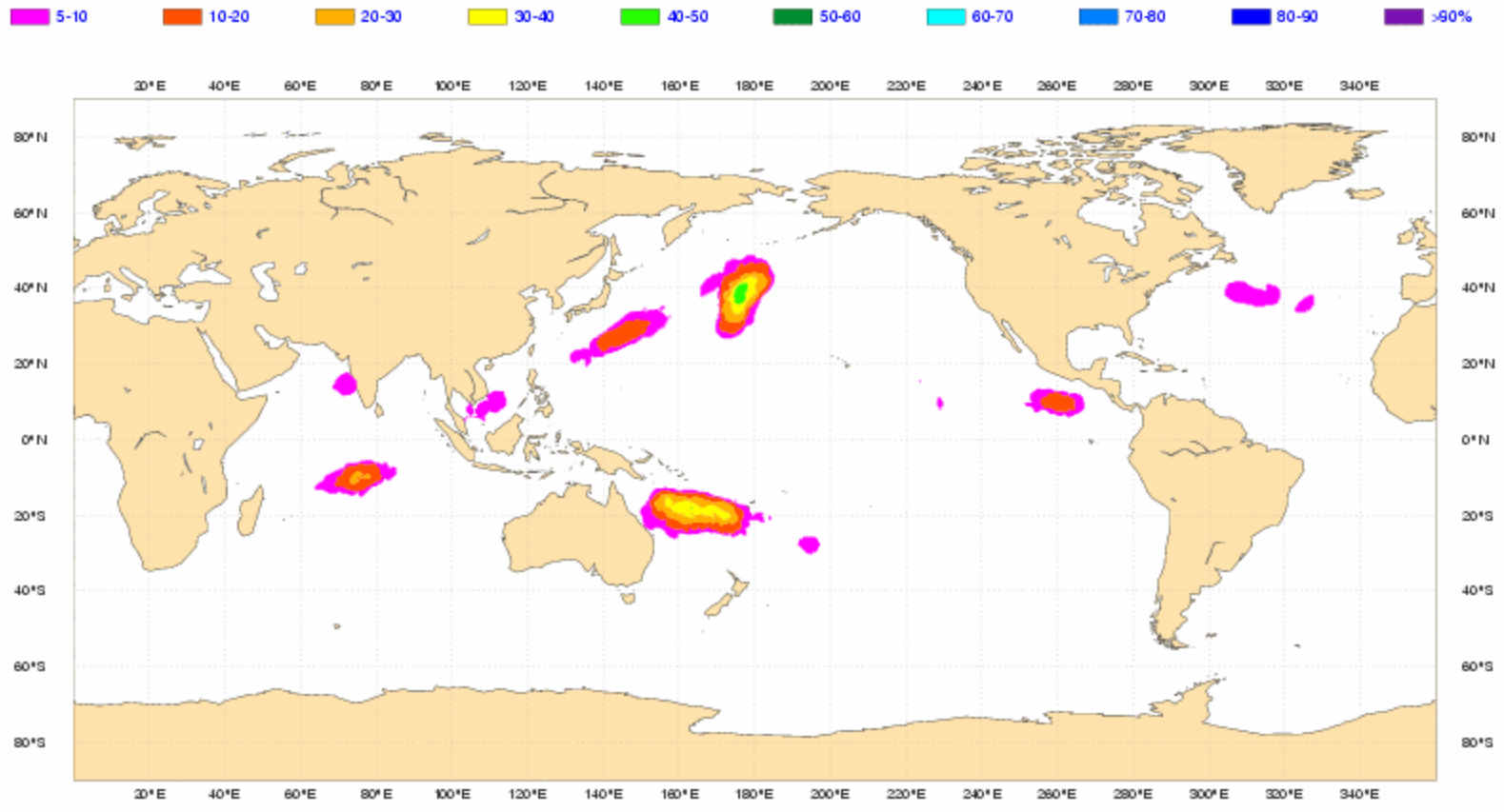


GIFS TIGGE – THORPEX

- Tropical cyclones
 - TC Genesis
 - Analysis of weak and strong storms differ
 - Global view
 - Contradictions
- The archive is a tremendous resource for the research community

GIFS TIGGE – THORPEX

Tropical Storm Strike Probability Start date Sunday 21 November 2010 at 12 UTC
valid for 48hours from Friday 26 November 2010 at 12 UTC to Sunday 28 November 2010 at 12 UTC
Probability of a Tropical Storm passing within 300km radius



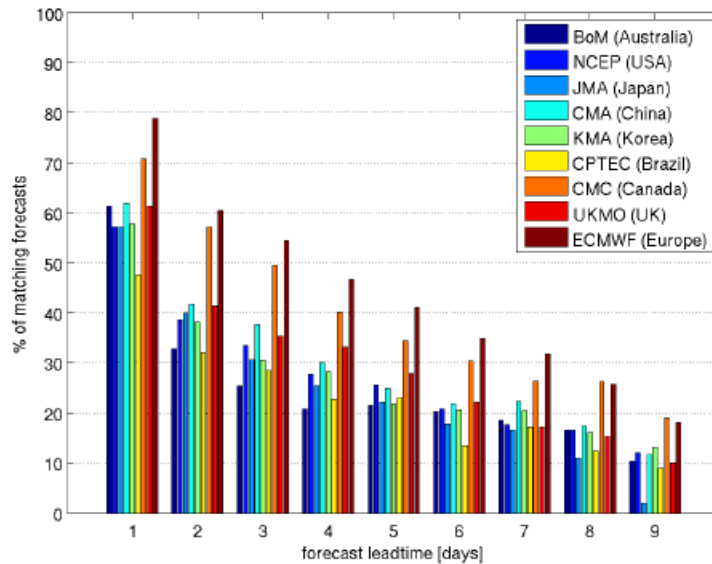
**Forecasting TC genesis
strike probability 5-7 days ahead**

David Richardson / ECMWF

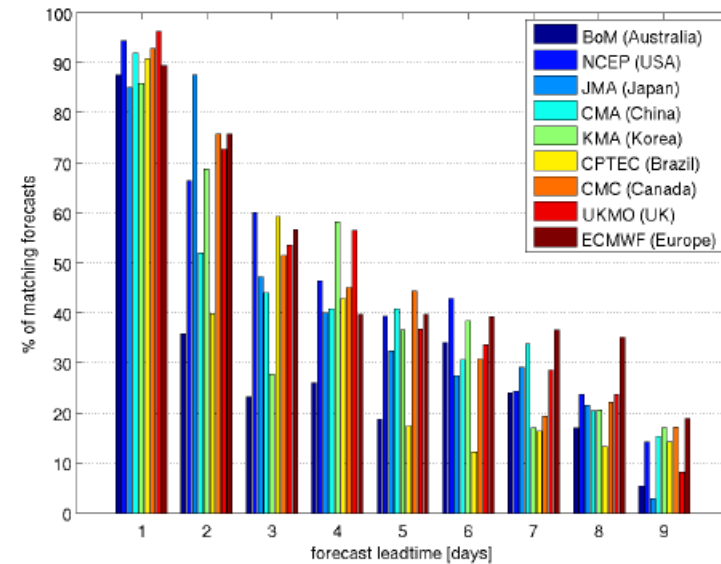
Results

Number of tracks

990 hPa < min SLP < 1000 hPa



930 hPa < min SLP < 950 hPa



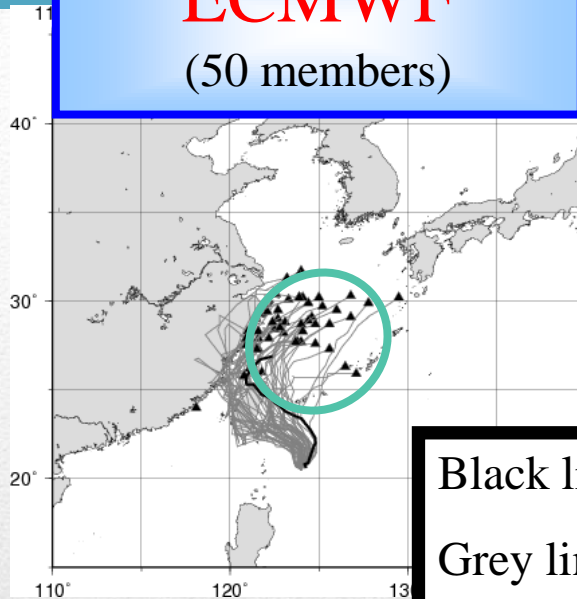
Importance of analysis – especially for weak cyclones

Forecasts of cyclone tracks

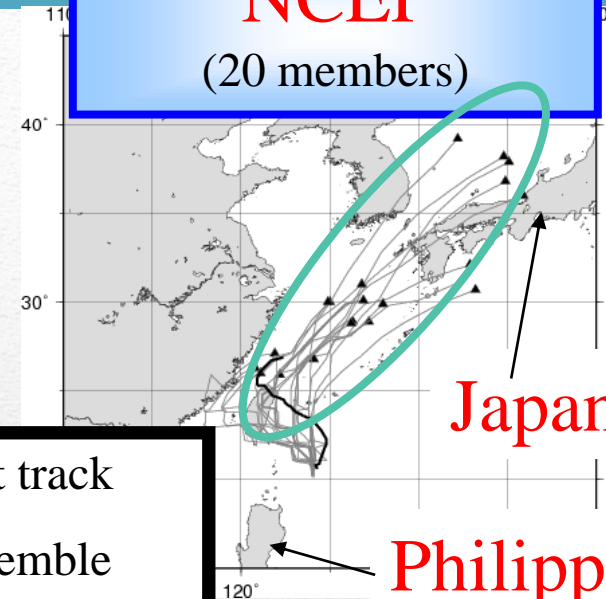
Sinlaku

initiated at 12UTC 10
Sep. 2008

ECMWF
(50 members)



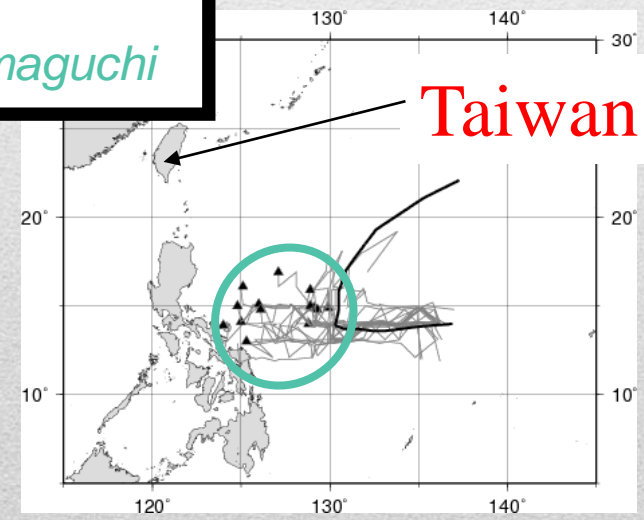
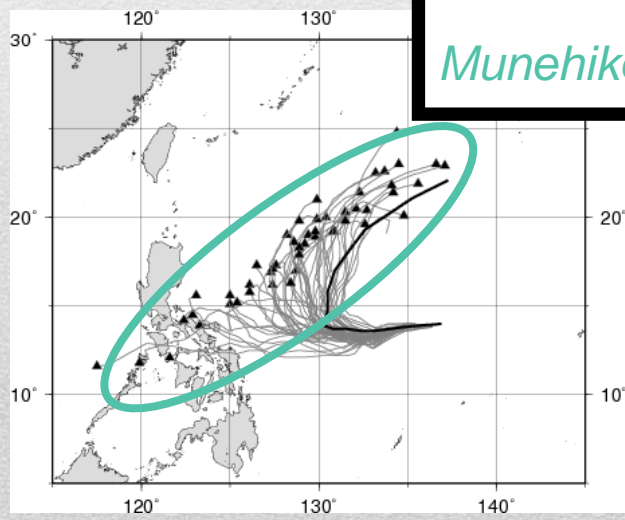
NCEP
(20 members)



Black line: Best track
Grey lines: Ensemble member
Munehiko Yamaguchi

Dolphin

initiated
at 00UTC 13 Dec.
2008



TC forecasts – ensemble spread contradictions

- Major Article in BAMS
- New leaflet to publicise TIGGE to researchers
- Contribution to GEO book “Crafting Geoinformation”
- Tropical cyclone case study in WMO Bulletin
- Update of TIGGE website

Publicising TIGGE

THE THORPEX INTERACTIVE GRAND GLOBAL ENSEMBLE

THORPEX
A World Weather Research Programme

WWRP-THORPEX

TIGGE

The THORPEX Interactive Grand Global Ensemble

Database of their operational ensemble to accelerate the development of high-impact weather.

THORPEX is a global system that is not a total responsibility.

THORPEX is a global system that is not a total responsibility.

GEO GROUP ON EARTH OBSERVATIONS

Crafting geoinformation
The art and science of Earth observation

CECMWF

TIGGE

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TIGGE >

TIGGE - the THORPEX Interactive Grand Global Ensemble

TIGGE, the THORPEX Interactive Grand Global Ensemble, is a World Weather Research Programme (WWRP) project. It is a global system that is not a total responsibility.

The TIGGE archive consists of ensemble forecast data from ten global WWP centres, starting from October 2006, which has been made available for scientific research. TIGGE has become a focal point for a range of research projects, including research on ensemble forecasting, predictability and the development of products to improve the prediction of severe weather. The TIGGE project is overseen by the GFS-TIGGE working group, which includes representative TIGGE data providers and the TIGGE archive centres. Further information is available from [this leaflet](#) and on other pages of this website. We encourage researchers using TIGGE to inform the GFS-TIGGE working group of their research progress, particularly when papers are published.

Working Group

- TIGGE data portals

Improving cyclone warning

Case study: Philippines

by Paula McCaslin¹, Tetsuo Nakazawa², Richard Swinbank³ and Zoltan Totfi¹

Better cyclone prediction is a focus of international weather research. This case study of a 2000 typhoon that narrowly missed the Philippines gives a portrait of the scope for ensemble forecasting.

A key challenge for meteorologists of the 21st century is to improve prediction of severe weather events like Typhoon Parma, so that people can protect themselves through timely warnings.

When Typhoon Parma struck in September 2000, it was the worst storm in four decades in the Philippines, affecting more than 3 million people, killing 288 and causing over US\$ 600 million of damage.

Tropical cyclones, also known as hurricanes and typhoons, are the most powerful and destructive weather systems on the planet. While success achieved with numerical weather prediction is one of the most significant scientific achievements of the 20th century, there is room to improve forecasting for rare but severe events that cause catastrophic damage.

Building on the foundations of numerical weather prediction and ensemble forecasting, TIGGE is an example of the world's leading weather forecast centres, collaborating together with the global meteorological community.

The aim is to develop Global Interactive Forecast System to provide the best possible forecasts for tropical cyclones and other high-impact weather events.

This project is part of the international research programme since 2003. The Observing and Prediction programme is part of the Weather Research and Disaster Risk Reduction programme.

To illustrate how to help with tropical cyclones, Typhoon Parma is used as a case study. Just Typhoon Parma was a typhoon that struck the Philippines in 2000.

1 Global Systems Division, Earth Systems Research Laboratory, National Oceanic and Atmospheric Administration, USA
2 Typhoon Research Department, Meteorological Research Institute, Japan
3 Stormwise Forecasting Group, UK Met Office

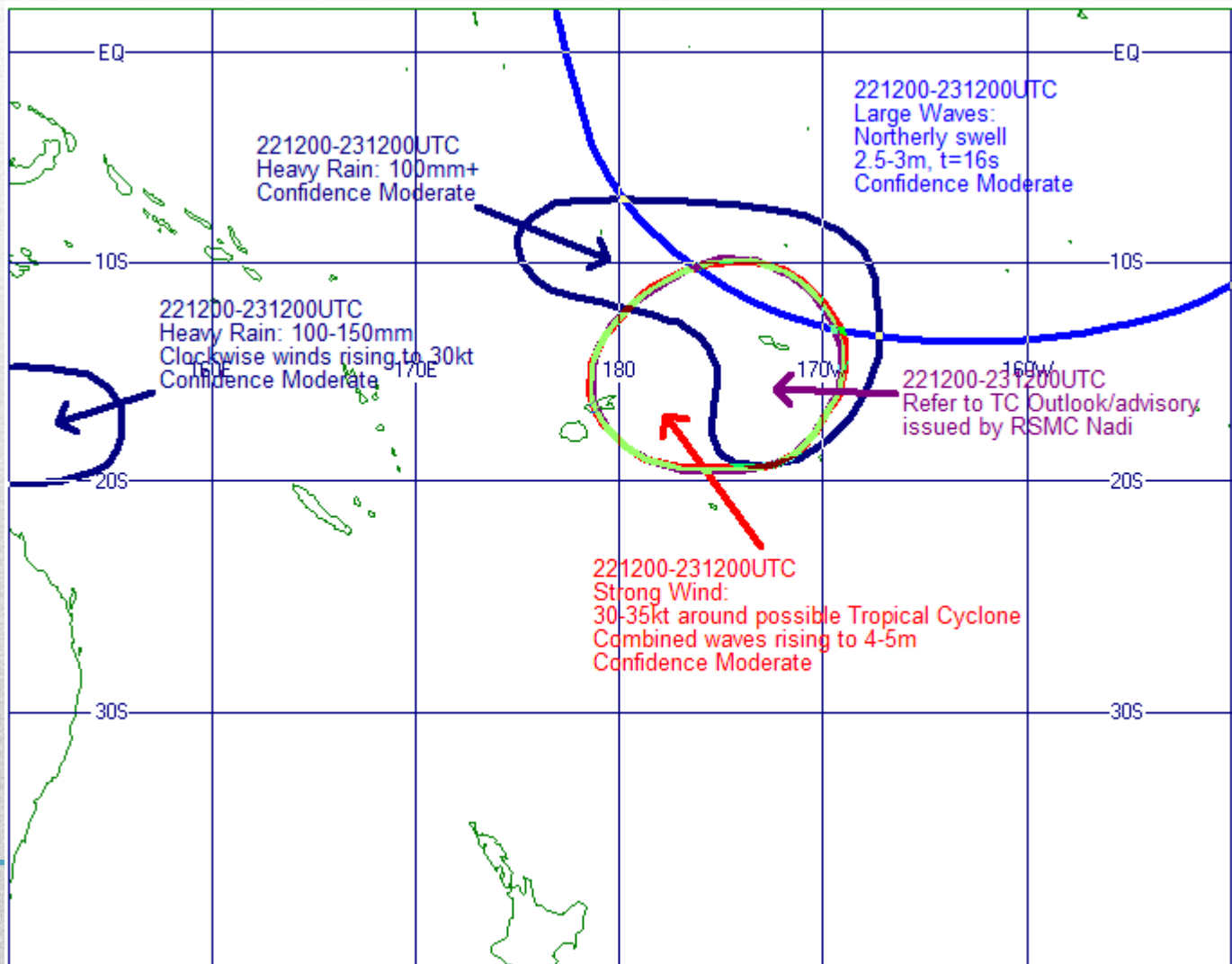


GIFS TIGGE – South Pacific

- Severe Weather Forecasting and Disaster risk reduction Demonstration Project (SWFDDP)
- Informing small island communities

GIFS TIGGE – South Pacific

South Pacific Guidance chart during TC Wilma Jan 2011





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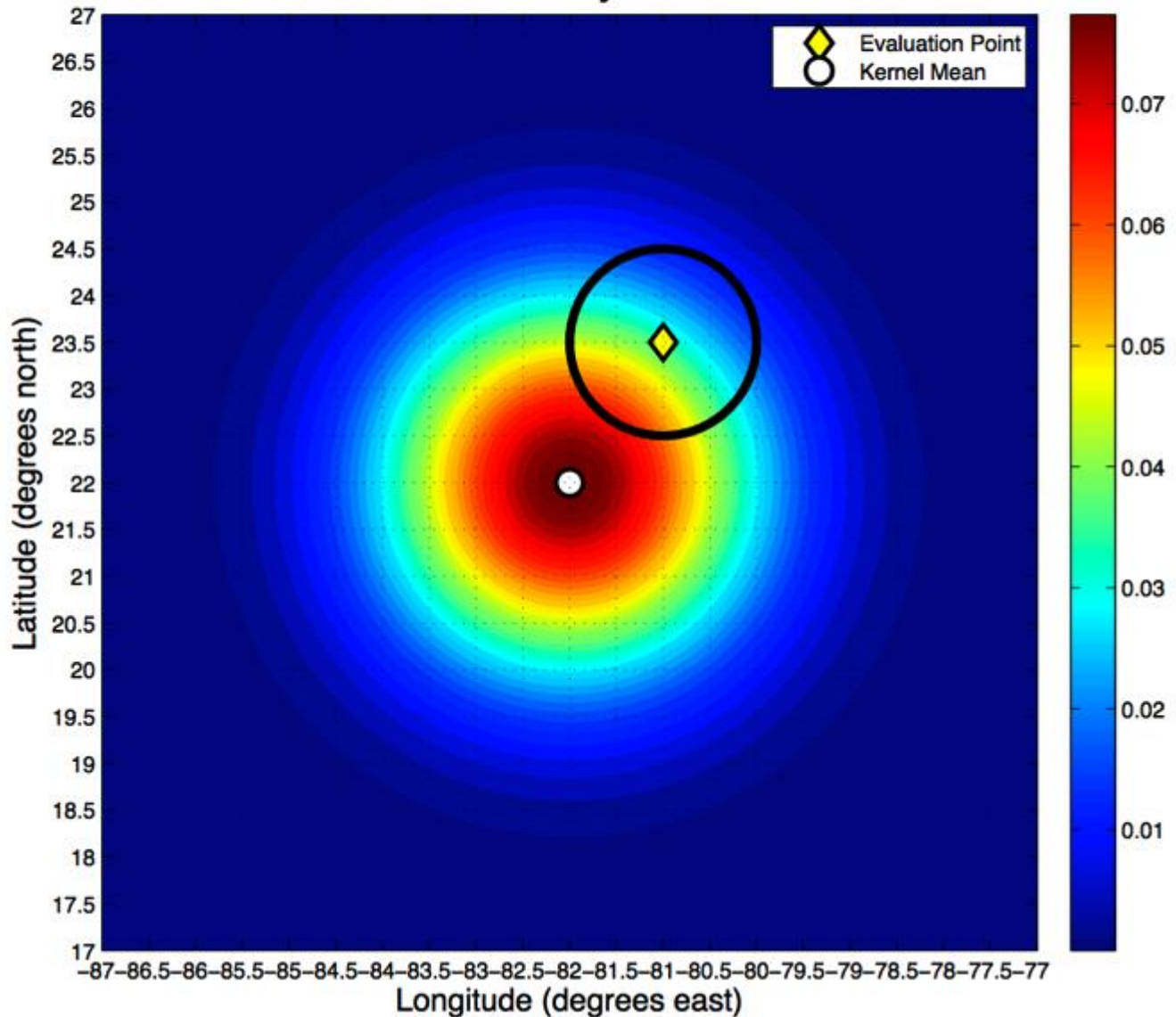
HFIP – FAB Statistical Post-Processing

- Strike probability and track forecast cones each describe the probability of a single event (storm will be located within a 60 n mi radius)
- A storm position pdf (SPPDF) forecast is a more general approach describing the probability of all events related to storm position.
- Users may be interested in the probability of storm passing within their state or county. They can obtain this information if they have access to a storm position pdf.

HFIP – FAB Statistical Post-Processing

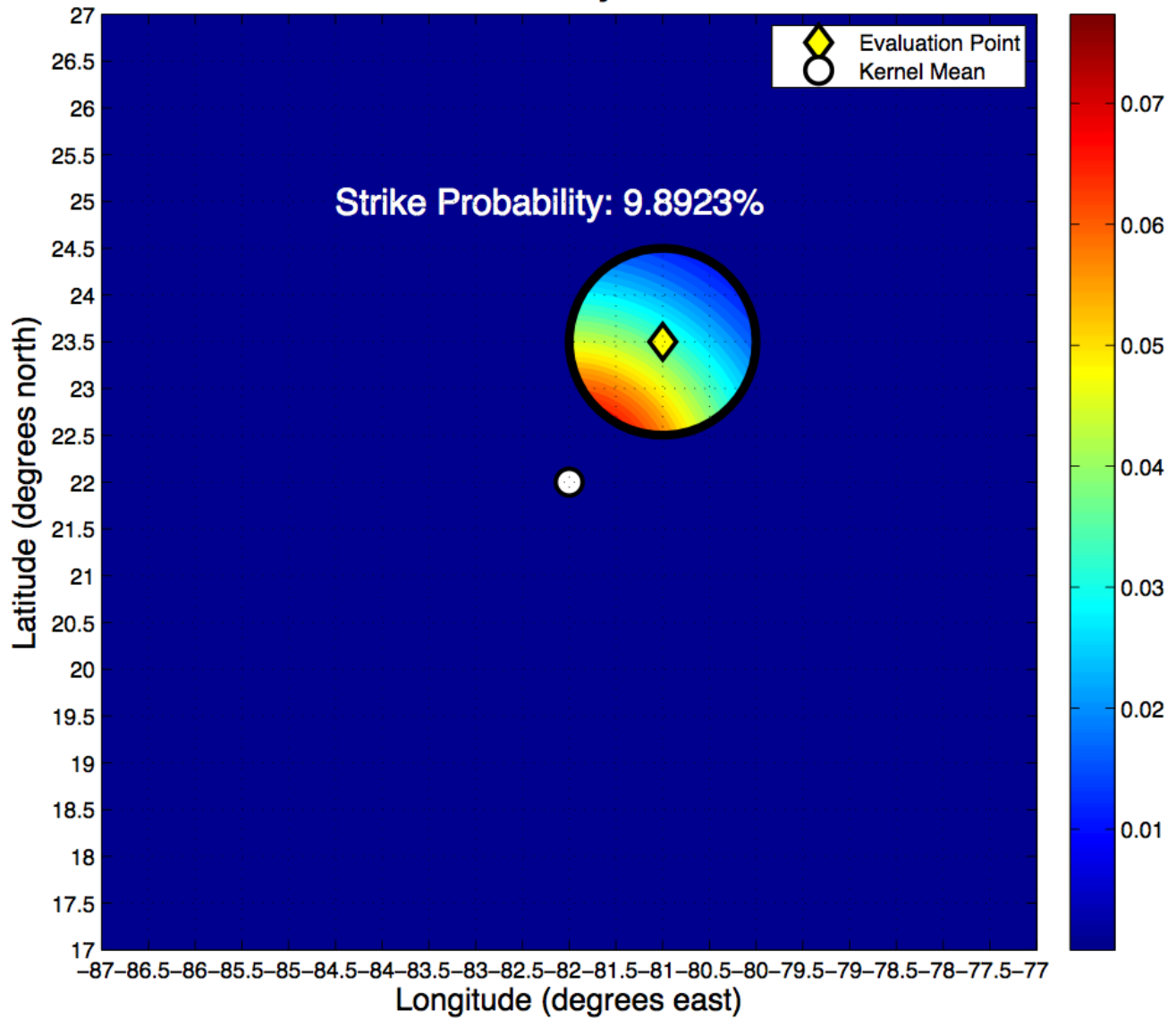
Example: 2D PDF

Strike Probability Calculation



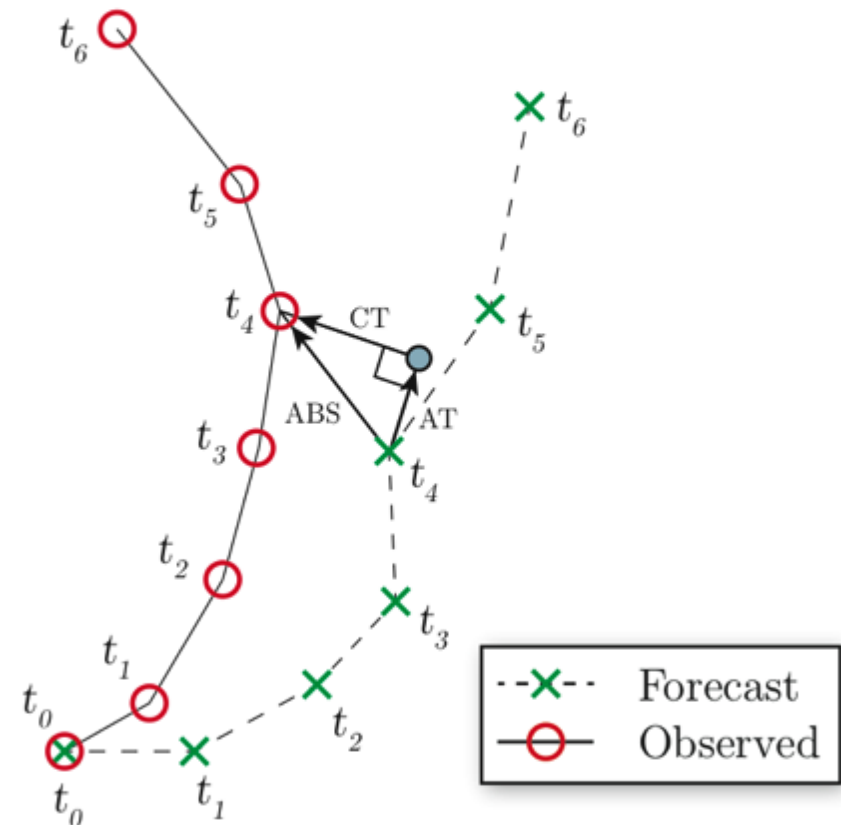
Example: 2D PDF

Strike Probability Calculation



Proposed Method: Track Errors

- An SPPDF is constructed from an ensemble forecast and is based on historical error statistics.
- These historical errors are separated into **along-track** (timing) and **cross-track** (position) components.
- All errors are great circle distances, accounting for the curvature of the Earth's surface.



Proposed Method: Best Members

- For a given forecast case, we can determine a **best member**, which is closest to the observed track *in that case*.

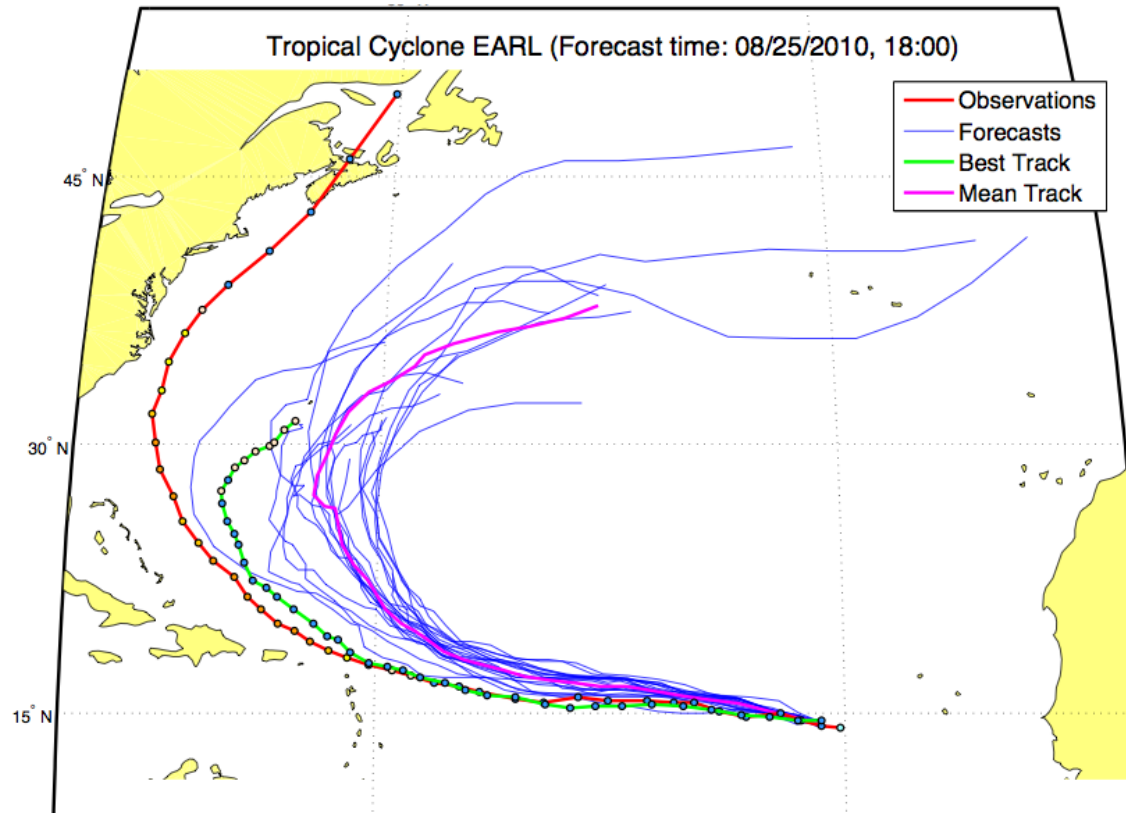
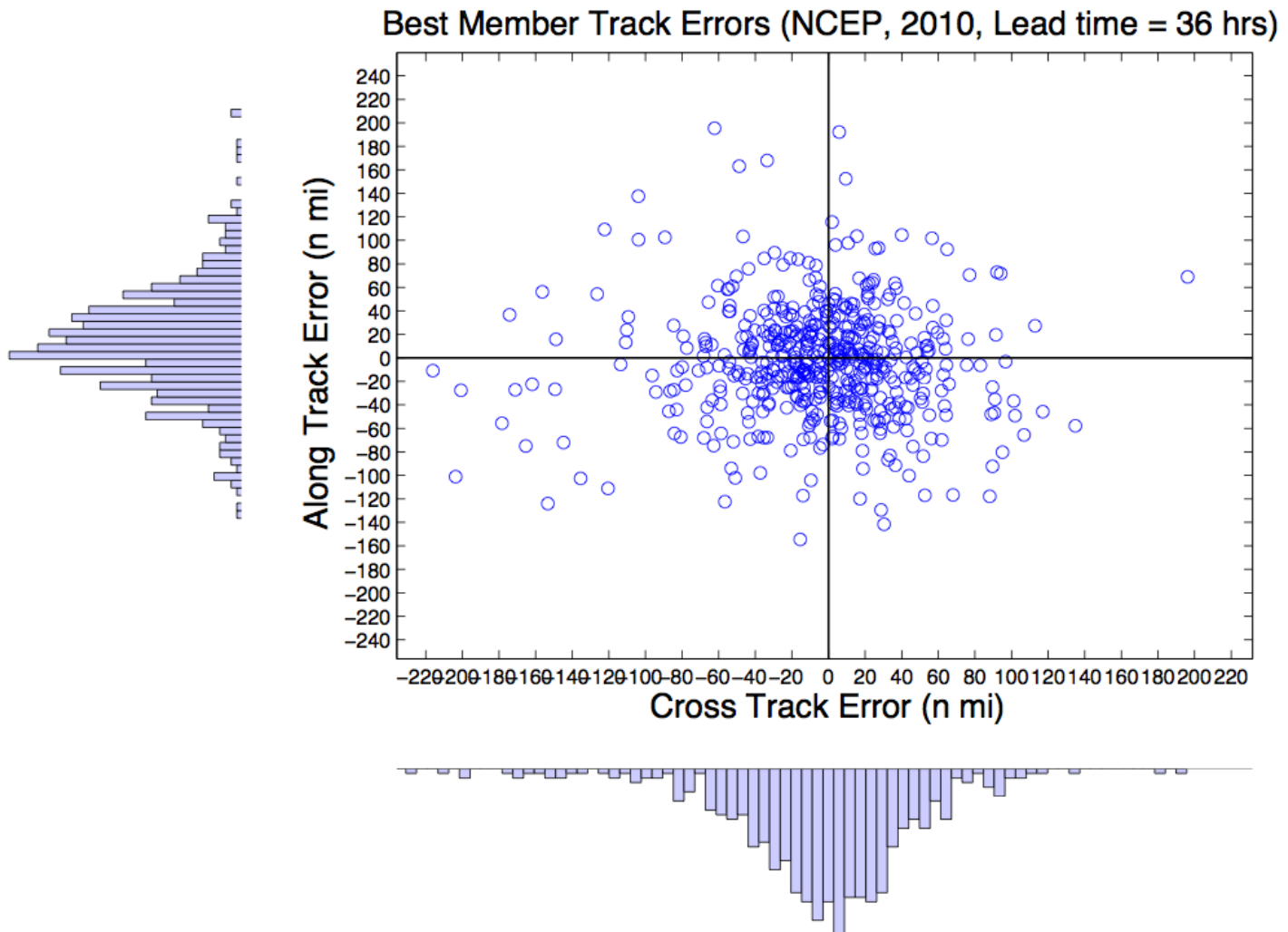


Figure: Forecast case for Hurricane Earl at 08/25/2010, 6:00 pm.

Example: Aggregated Errors

- 2-dimensional normal distributions can be fit to error statistics of best members aggregated over a period of time.



Example: Hurricane Irene (Initial time)

Hurricane Irene (08/26/2011 12:00 AM)

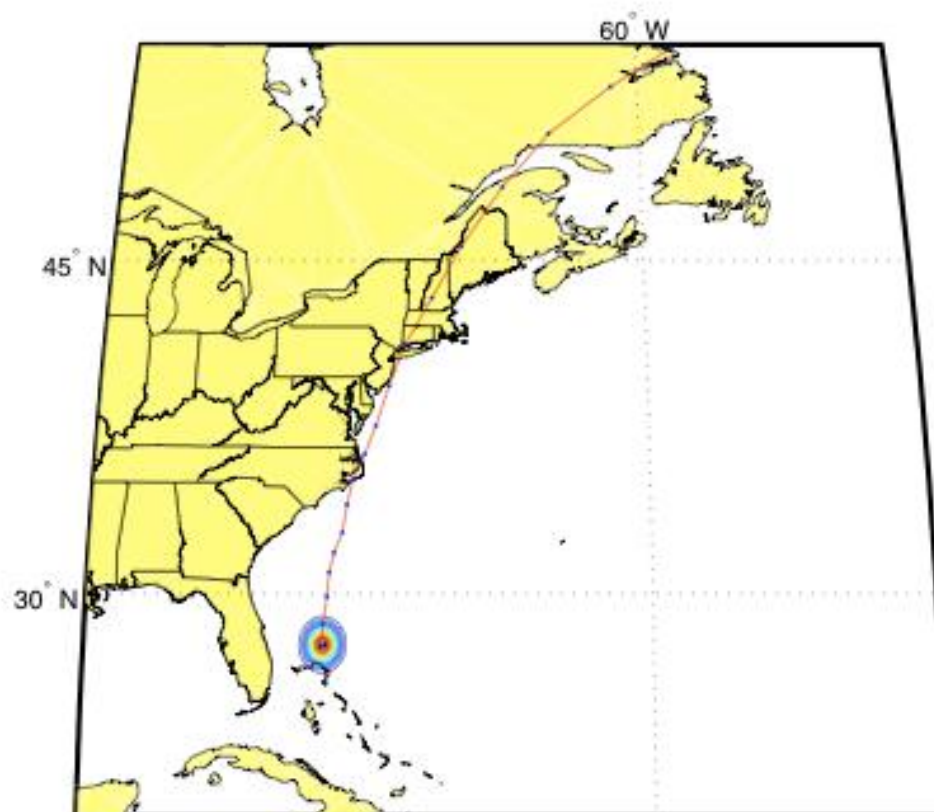


Figure: GEFS 20-member ensemble mean and storm position probability distribution at the initial time.

Example: Hurricane Irene SPPD (12 hrs)

Hurricane Irene (08/26/2011 12:00 AM)

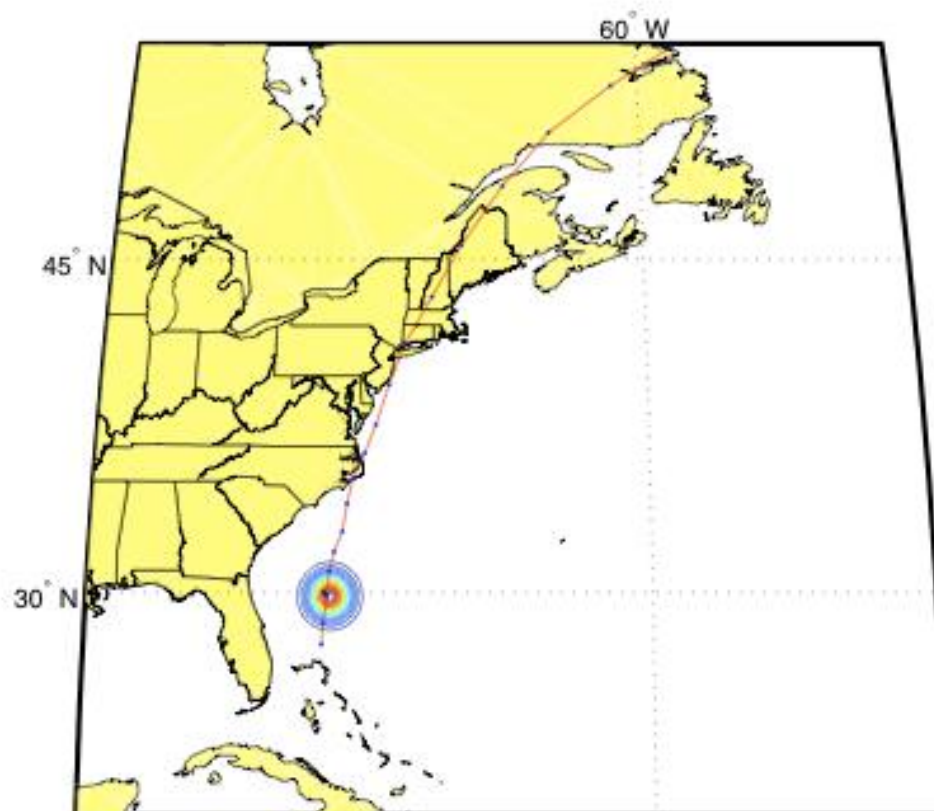


Figure: GEFS 20-member ensemble mean and storm position probability distribution at 12 hours of lead time.

Example: Hurricane Irene SPPD (24 hrs)

Hurricane Irene (08/26/2011 12:00 AM)

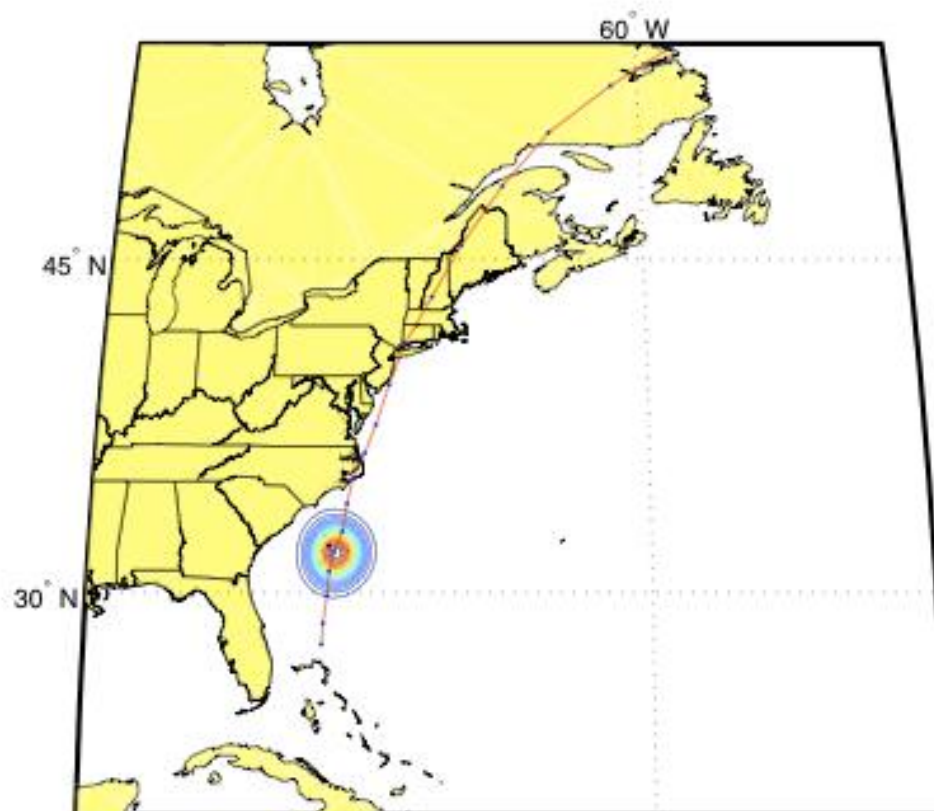


Figure: GEFS 20-member ensemble mean and storm position probability distribution at 24 hours of lead time.

Example: Hurricane Irene SPPD (36 hrs)

Hurricane Irene (08/26/2011 12:00 AM)

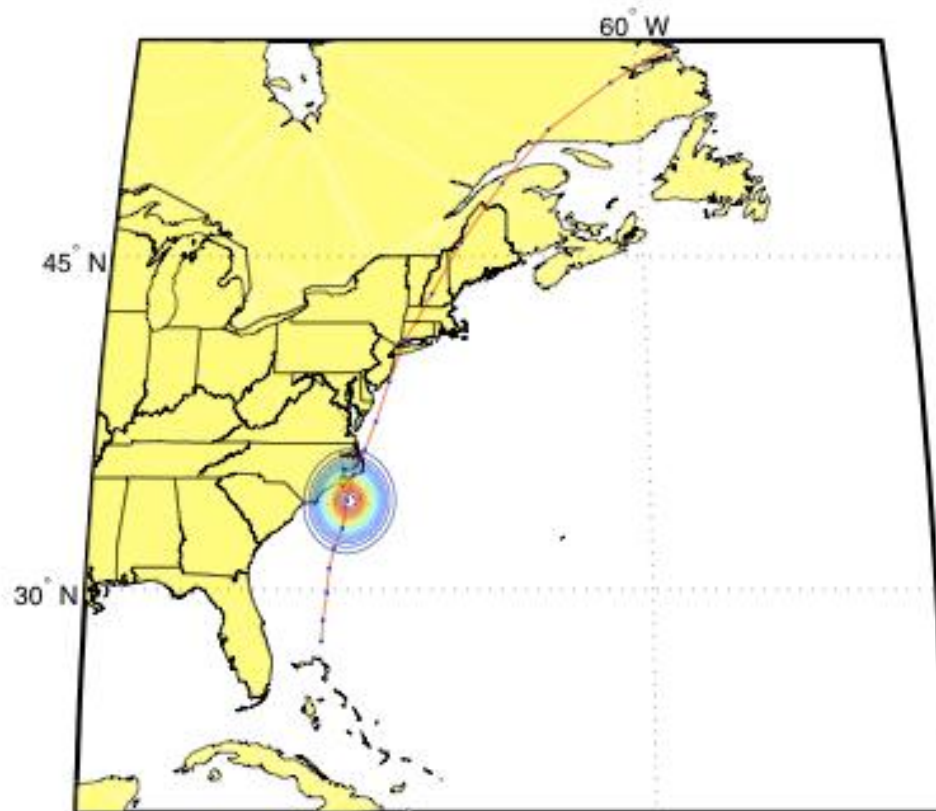


Figure: GEFS 20-member ensemble mean and storm position probability distribution at 36 hours of lead time.

Example: Hurricane Irene SPPD (48 hrs)

Hurricane Irene (08/26/2011 12:00 AM)

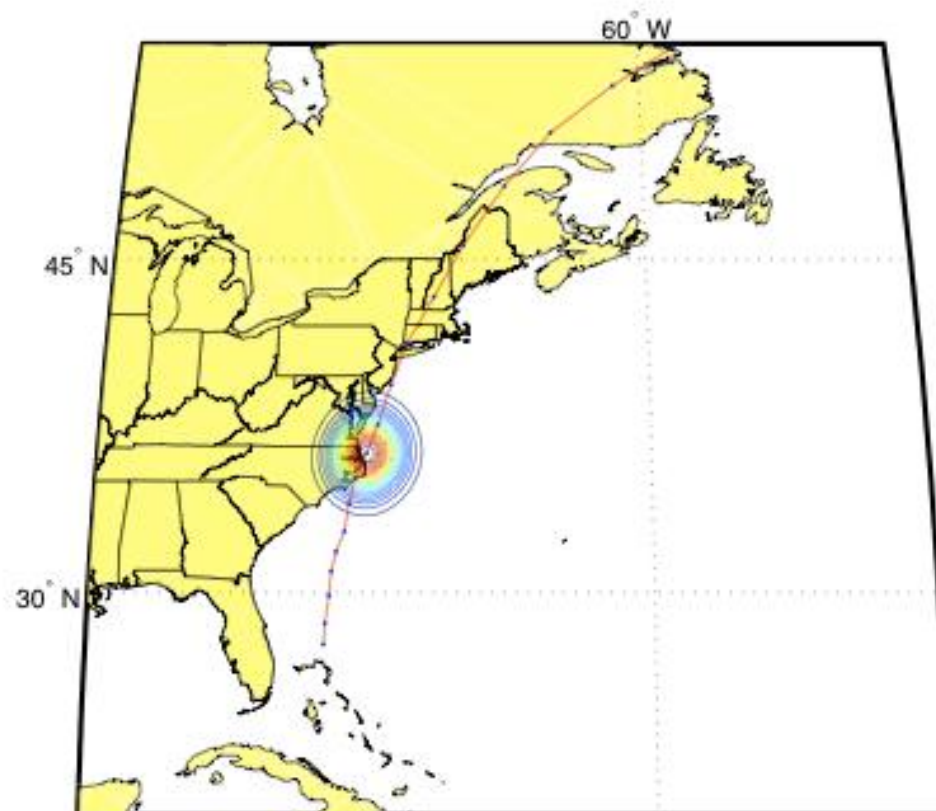


Figure: GEFS 20-member ensemble mean and storm position probability distribution at 48 hours of lead time.

Example: Hurricane Irene SPPD (60 hrs)

Hurricane Irene (08/26/2011 12:00 AM)

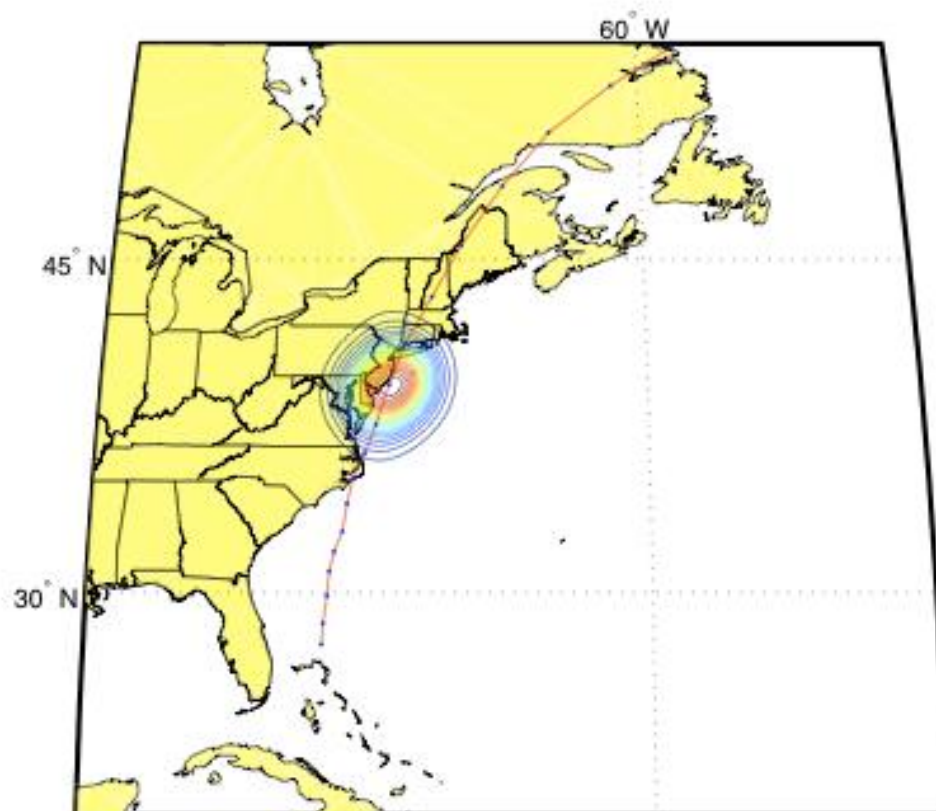


Figure: GEFS 20-member ensemble mean and storm position probability distribution at 60 hours of lead time.

Example: Hurricane Irene SPPD (72 hrs)

Hurricane Irene (08/26/2011 12:00 AM)

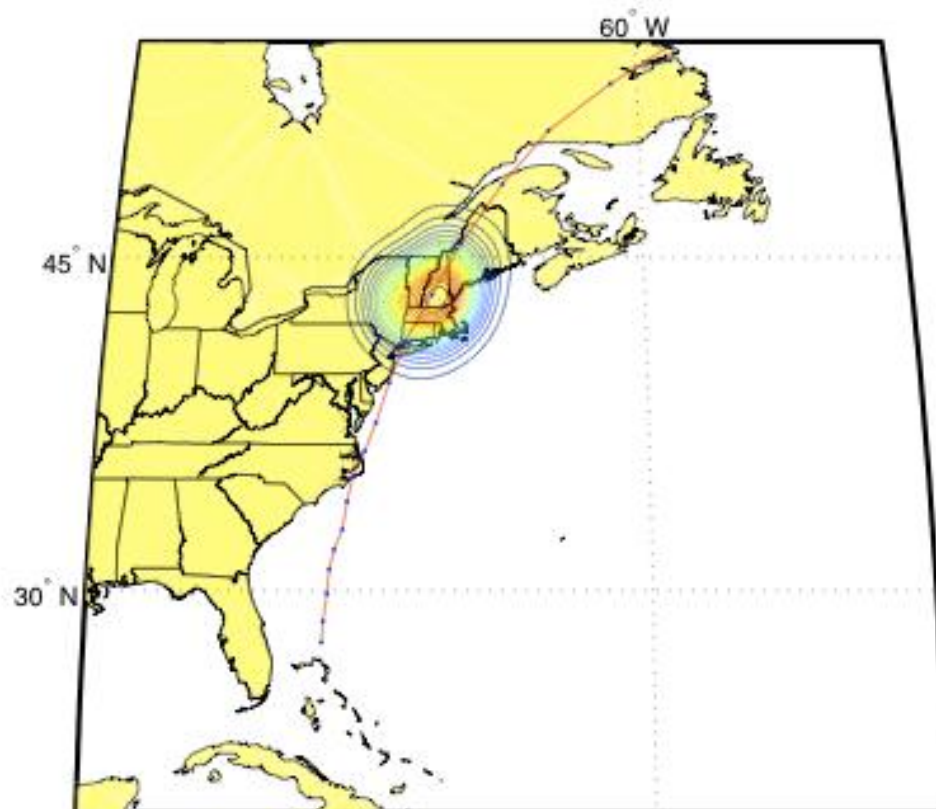


Figure: GEFS 20-member ensemble mean and storm position probability distribution at 72 hours of lead time.

Example: Hurricane Irene SPPD (84 hrs)

Hurricane Irene (08/26/2011 12:00 AM)

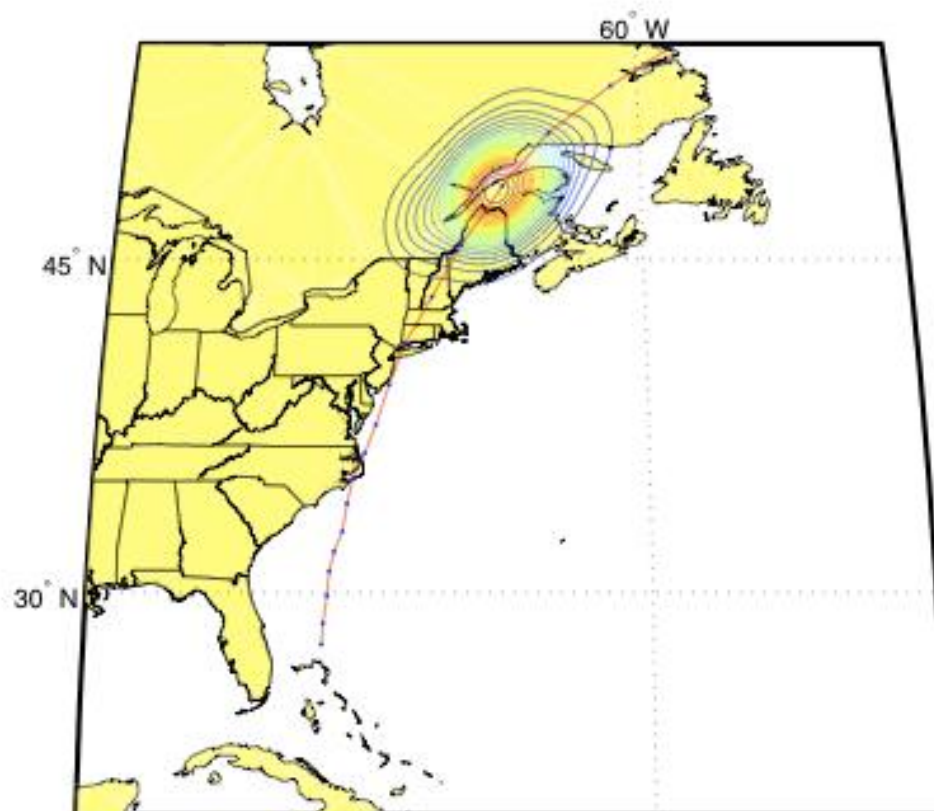


Figure: GEFS 20-member ensemble mean and storm position probability distribution at 84 hours of lead time.

- FAB Ongoing SPPDF Work
 - Verification, 2-D continuous rank probability scores
 - Application to multi-model ensembles
 - Comparison with NHC track forecast cones
- GSD & DTC to host 10th International THORPEX GIFS TIGGE Workshop
 - Boulder, July 2012
 - Please consider attending, engaging on the international level

SUMMARY
