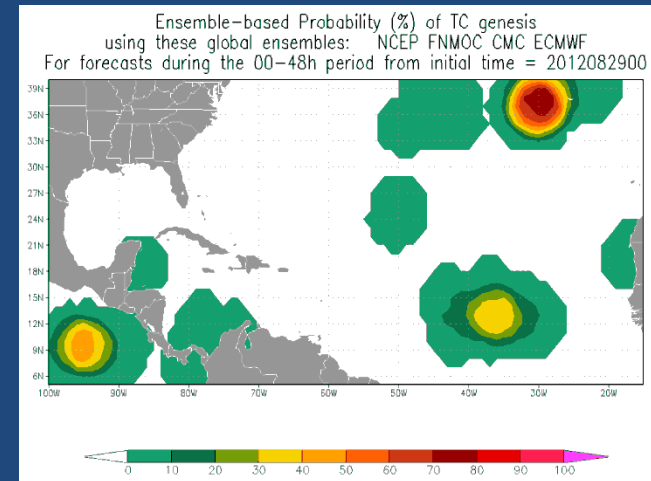
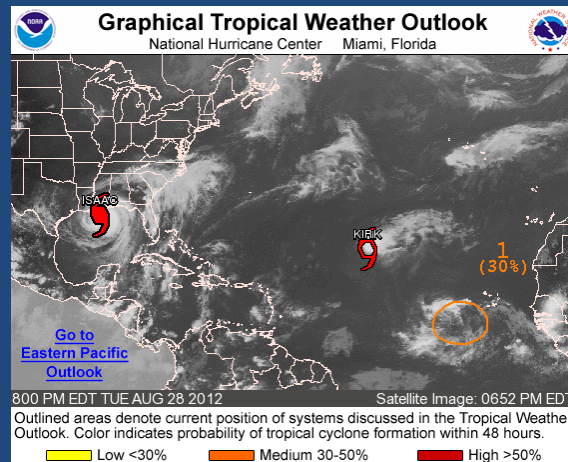
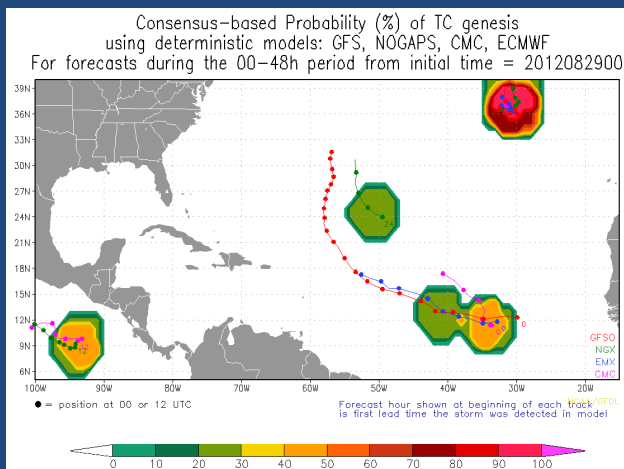


Ensemble-based genesis guidance

Tim Marchok
GFDL

HFIP 9/26/2012 Telecon



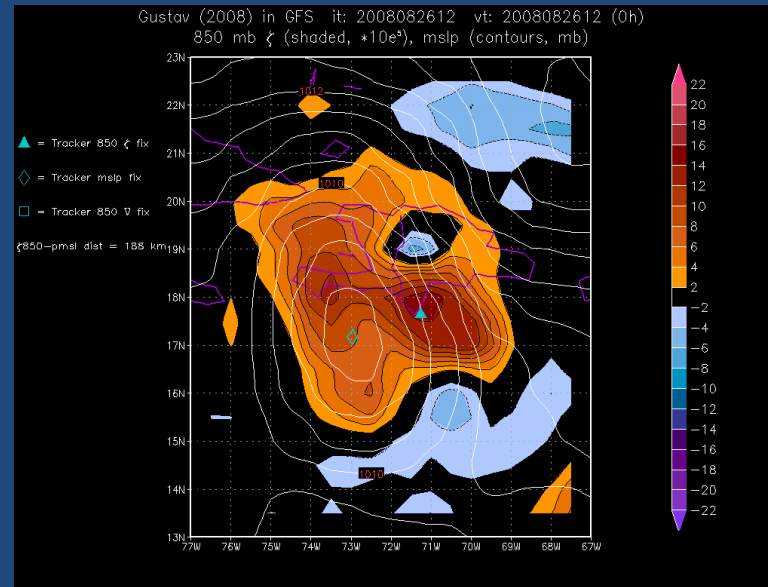
- **Goal**: Provide objective guidance on TC genesis based on dynamical forecast models.
- **Methods**: Create probabilistic guidance based on a consensus of track forecasts from global deterministic models as well as their ensemble forecast systems.

Models included

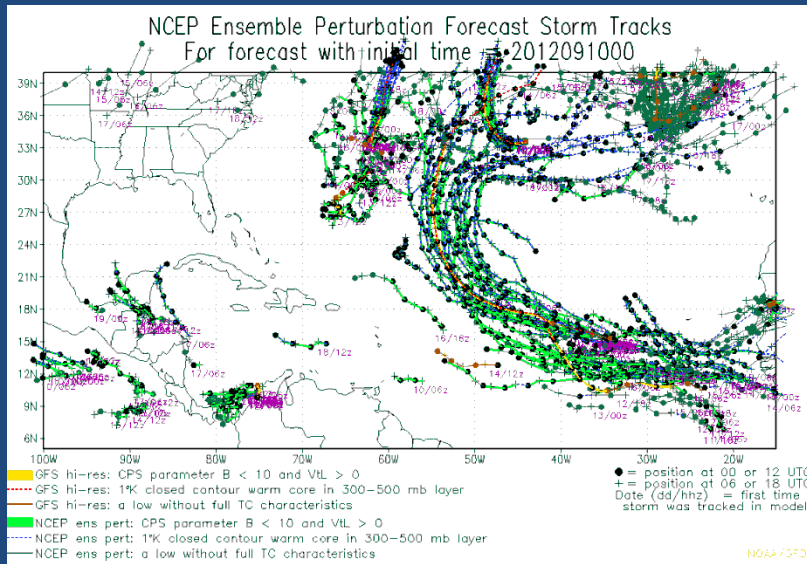
Ensemble System	# Members	Forecast cycle availability (UTC)
NCEP	20	00, 06, 12, 18
FNMOG	20	00, 12
CMC	20	00, 12
ECMWF	50	00, 12
Deterministic models		Forecast cycle availability (UTC)
NCEP / GFS		00, 06, 12, 18
FNMOG / NOGAPS		00, 12
CMC		00, 12
ECMWF		00, 12

Procedure

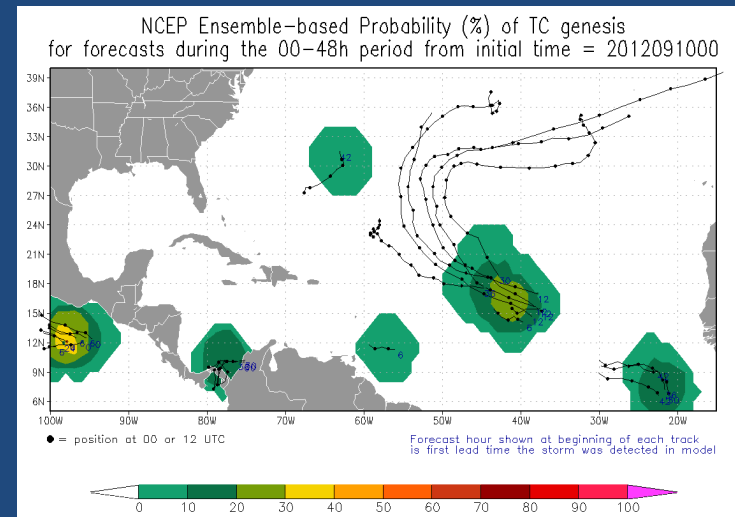
1. Run tracker for each ensemble member



2. Post-process tracker results to filter and categorize storms.



3. Compute genesis probabilities based on track results from all members



Detect & track new storms

1. Initial scan identifies candidate lows, based only on mslp.
2. Second scan is performed to refine the location of lows, using additional parameters:
 - zeta (700 mb, 850 mb, 10-m)
 - gp height (700 mb, 850 mb)
 - minimum in wind speed (700 mb, 850 mb, 10-m)
 - mslp
3. For both scans, checks are performed to ensure each found center resembles a cyclone.

Filter & categorize storms

1. Model forecast storms that do not live for at least 24h are filtered out.
2. Checks are performed at each lead time for a closed mslp contour (1 mb interval) as well as for strength of 850 mb circulation, but results do not need to be 100% continuous.
3. Storms are categorized using two of Hart's cyclone phase space parameters:
 - Parameter B (cyclone tilt / asymmetry): < 10 for TC
 - Lower-level (600-900 mb) warm core: > 0 for TC
4. An additional, simple check of 300-500 mb warm core is shown on track plots, but is not used for genesis probabilities.

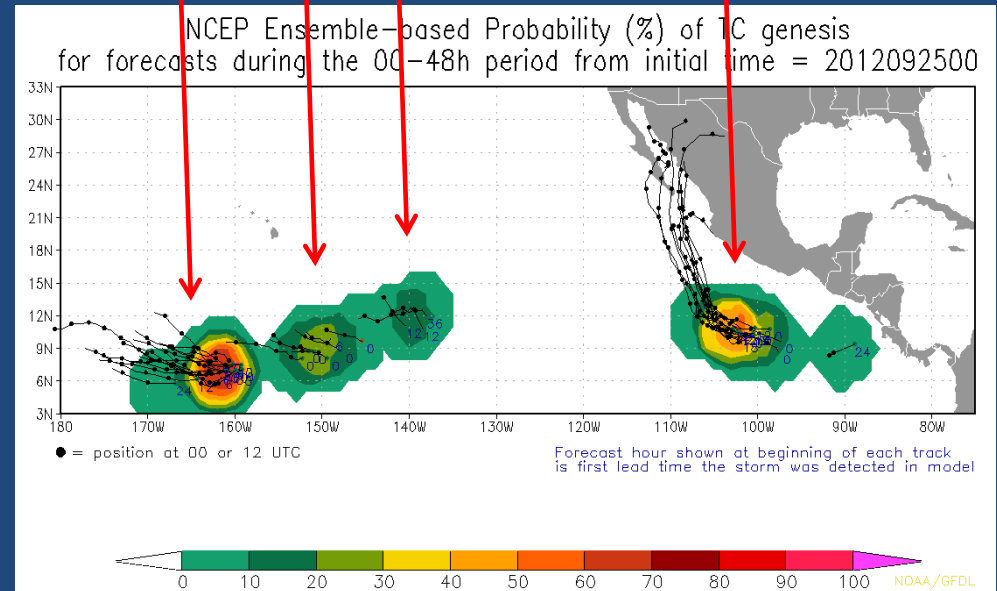
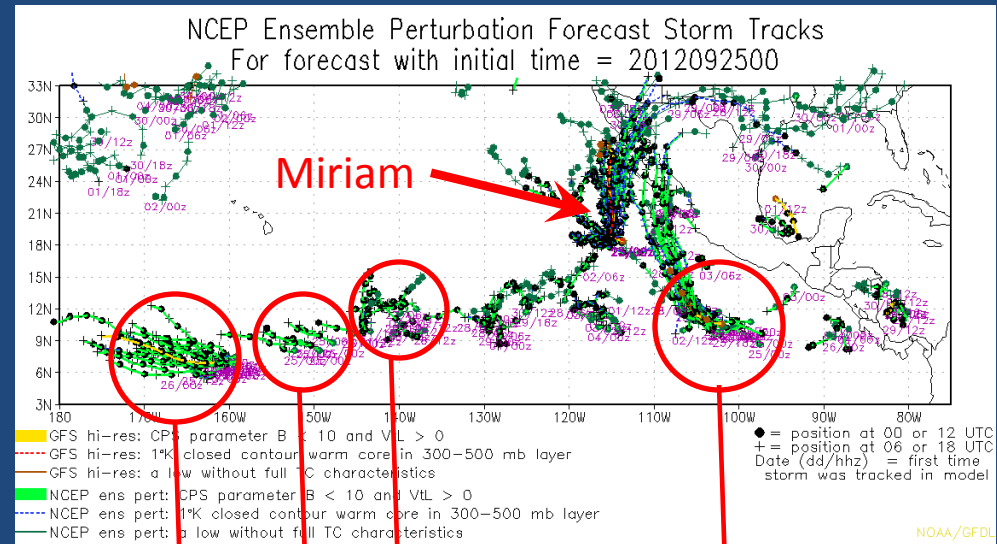
Compute genesis probabilities

Calculate fraction of members indicating genesis within a 350 km radius of each grid point:

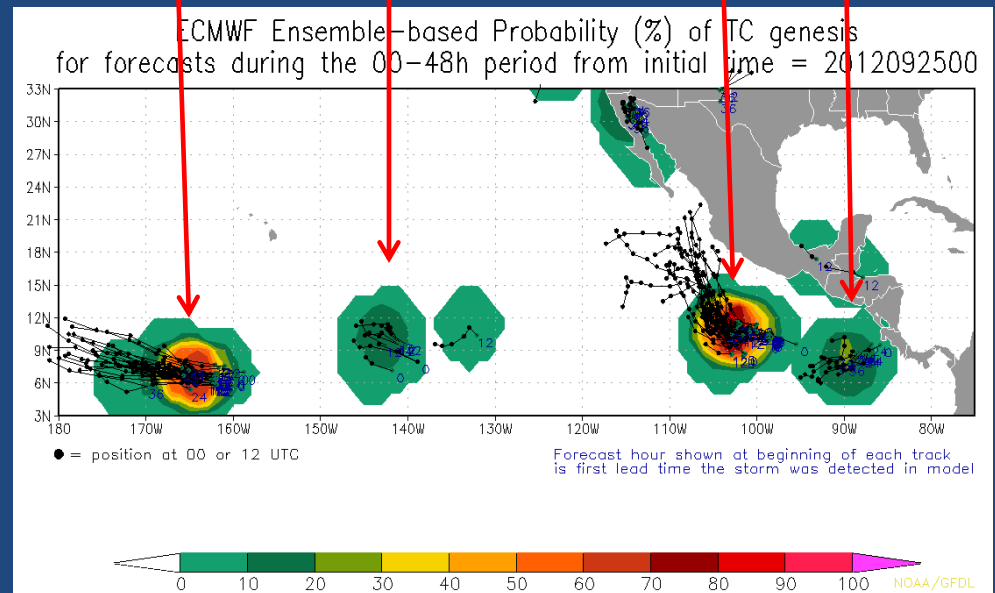
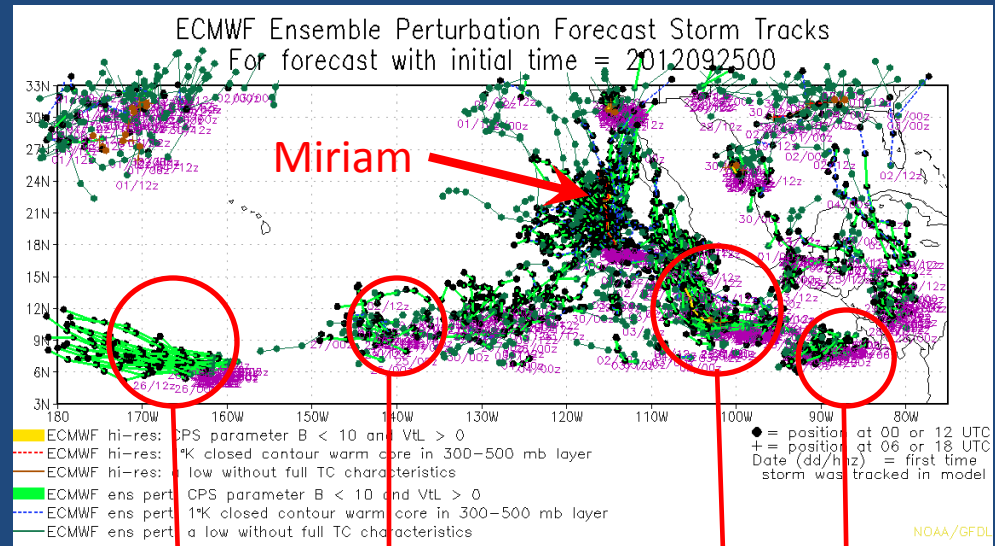
1. For each ensemble
2. For a consensus of the 4 global ensembles (equally weighted)
3. For a consensus of the 4 global deterministic models

Example: 2012092500 NCEP Ensemble

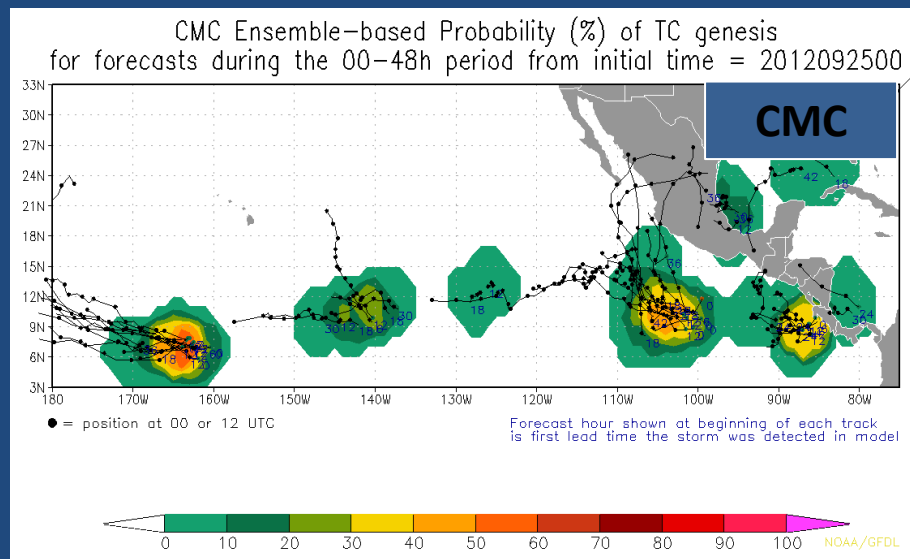
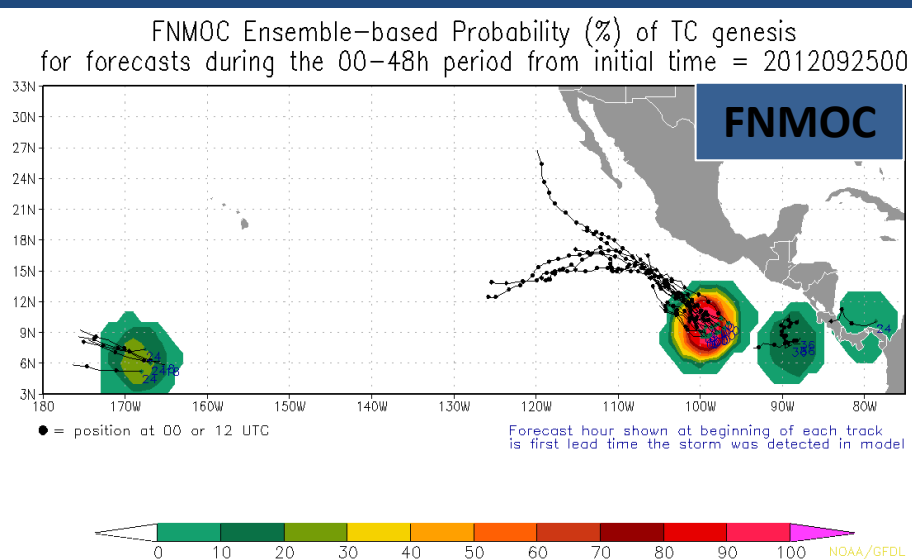
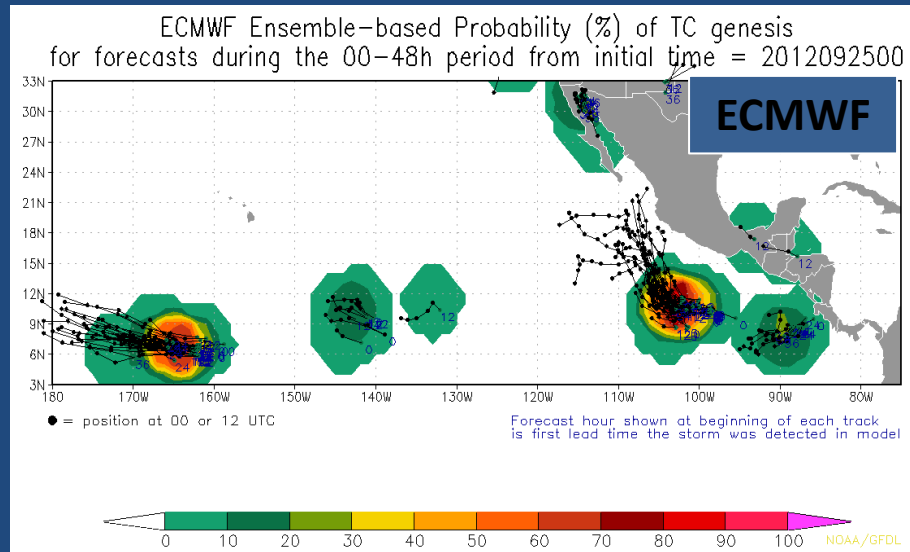
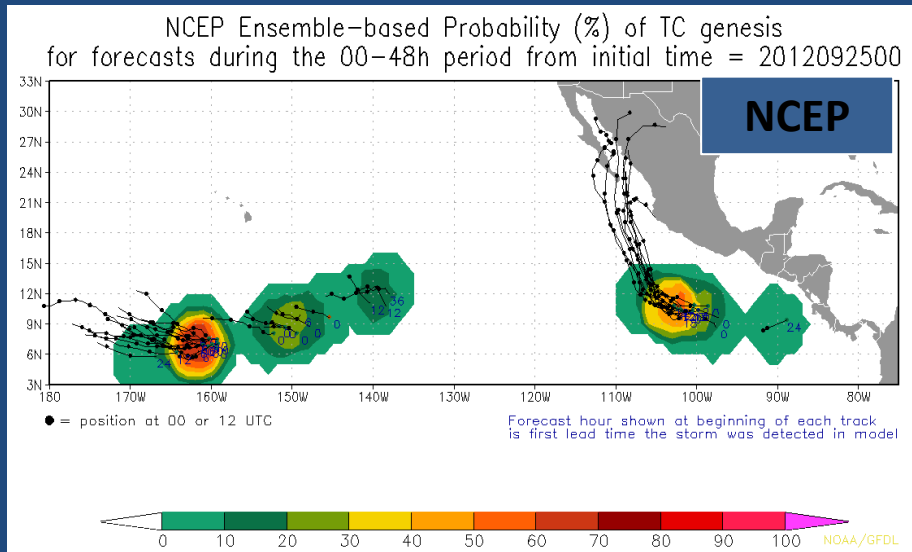
Three different areas in the ITCZ south of Hawaii as well as an area off the coast of Central America lead to probabilities >10%.



Example: 2012092500 ECMWF Ensemble

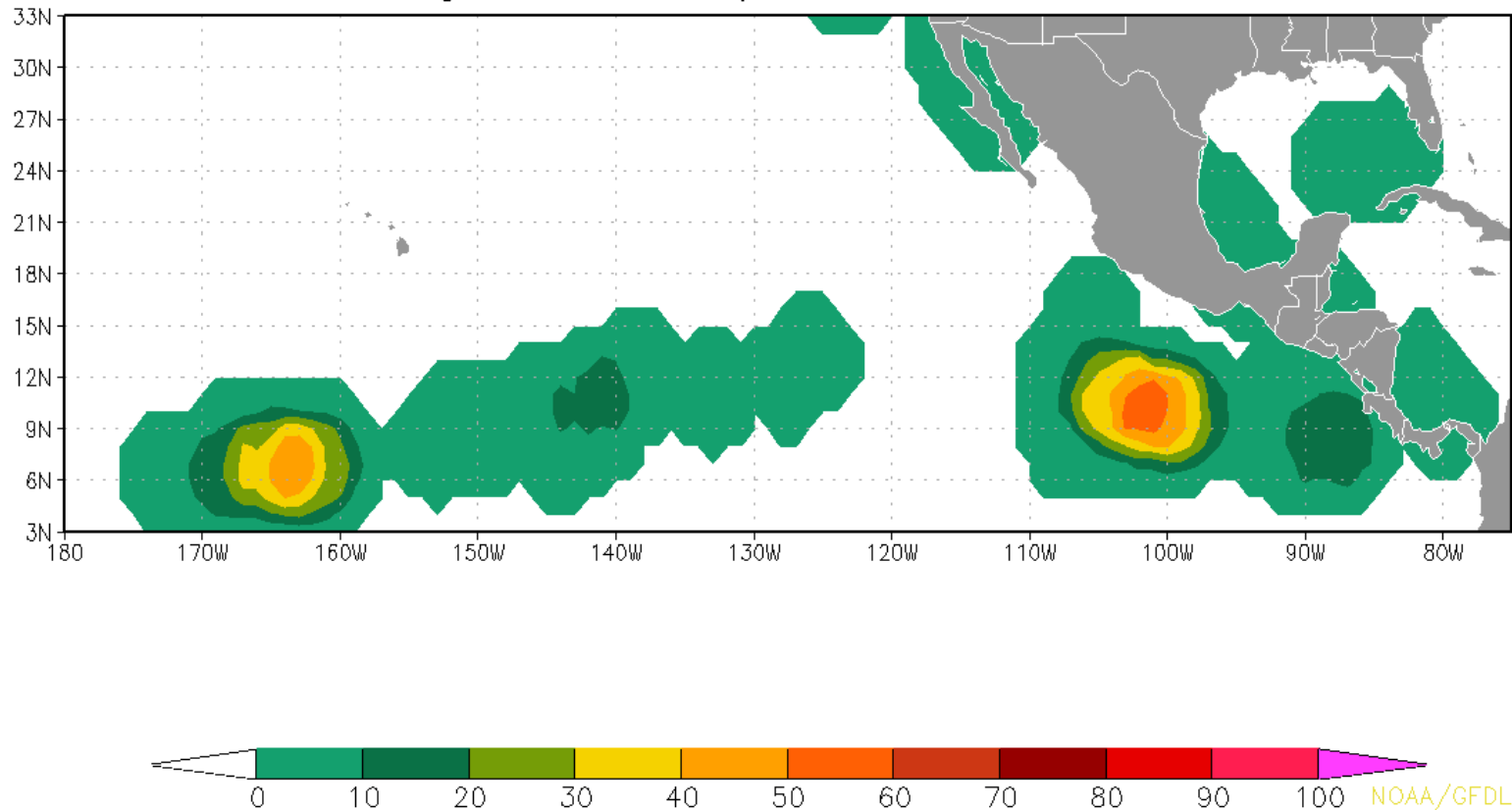


Genesis probabilities for 00-48h from all four global ensembles: 2012092500

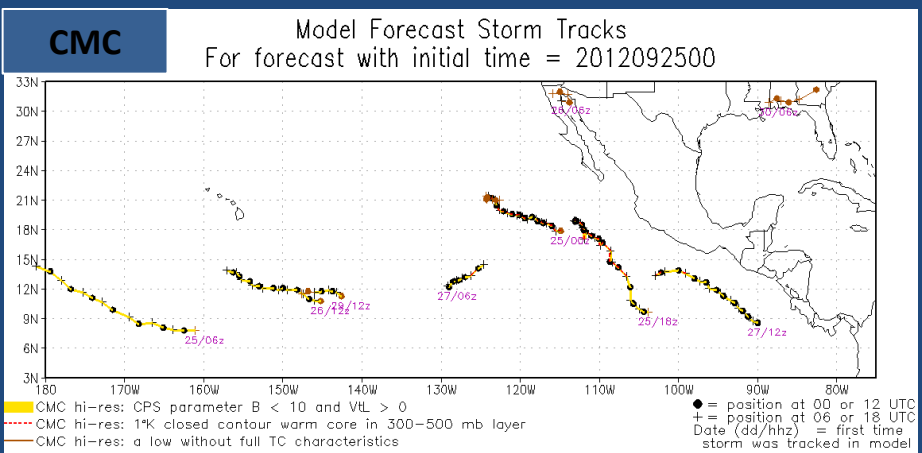
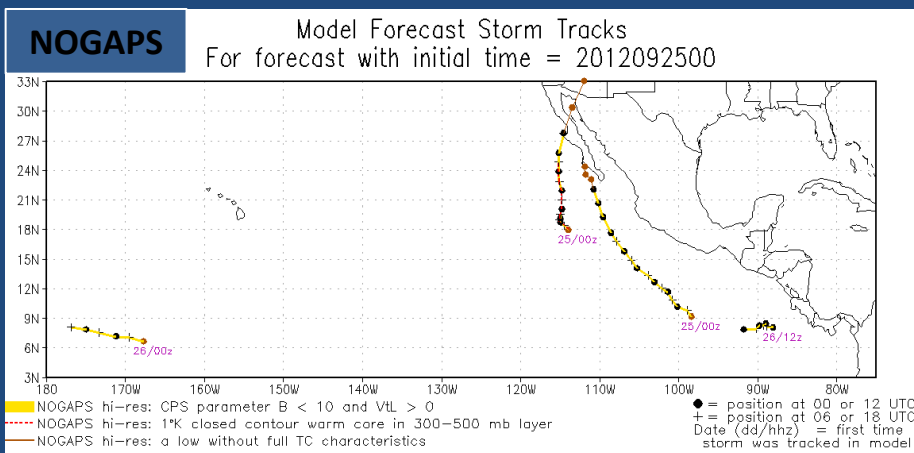
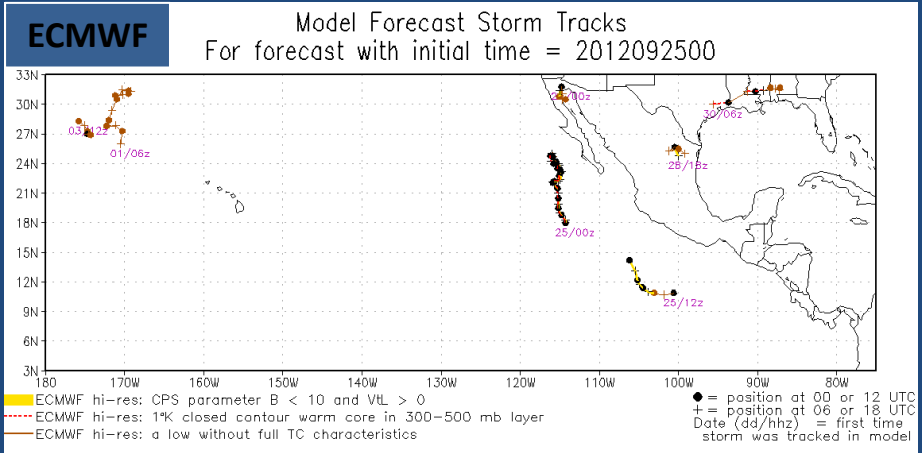
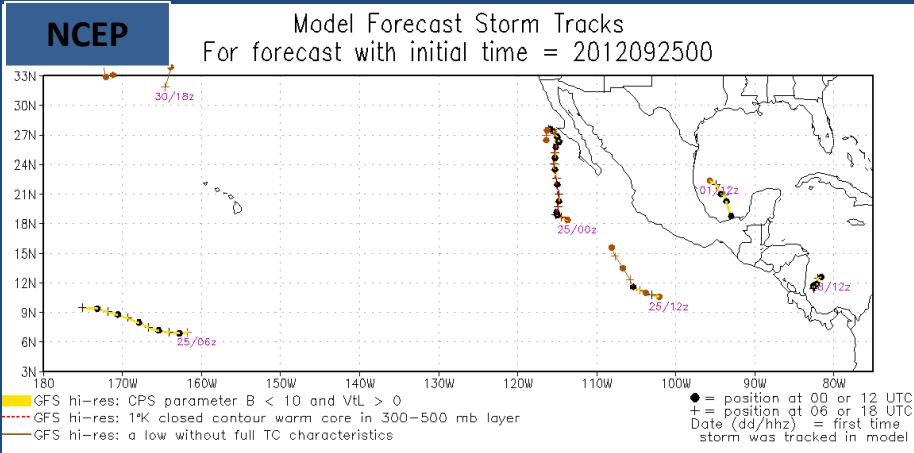


Consensus-based genesis probabilities for 00-48h using all four global ensembles: 2012092500

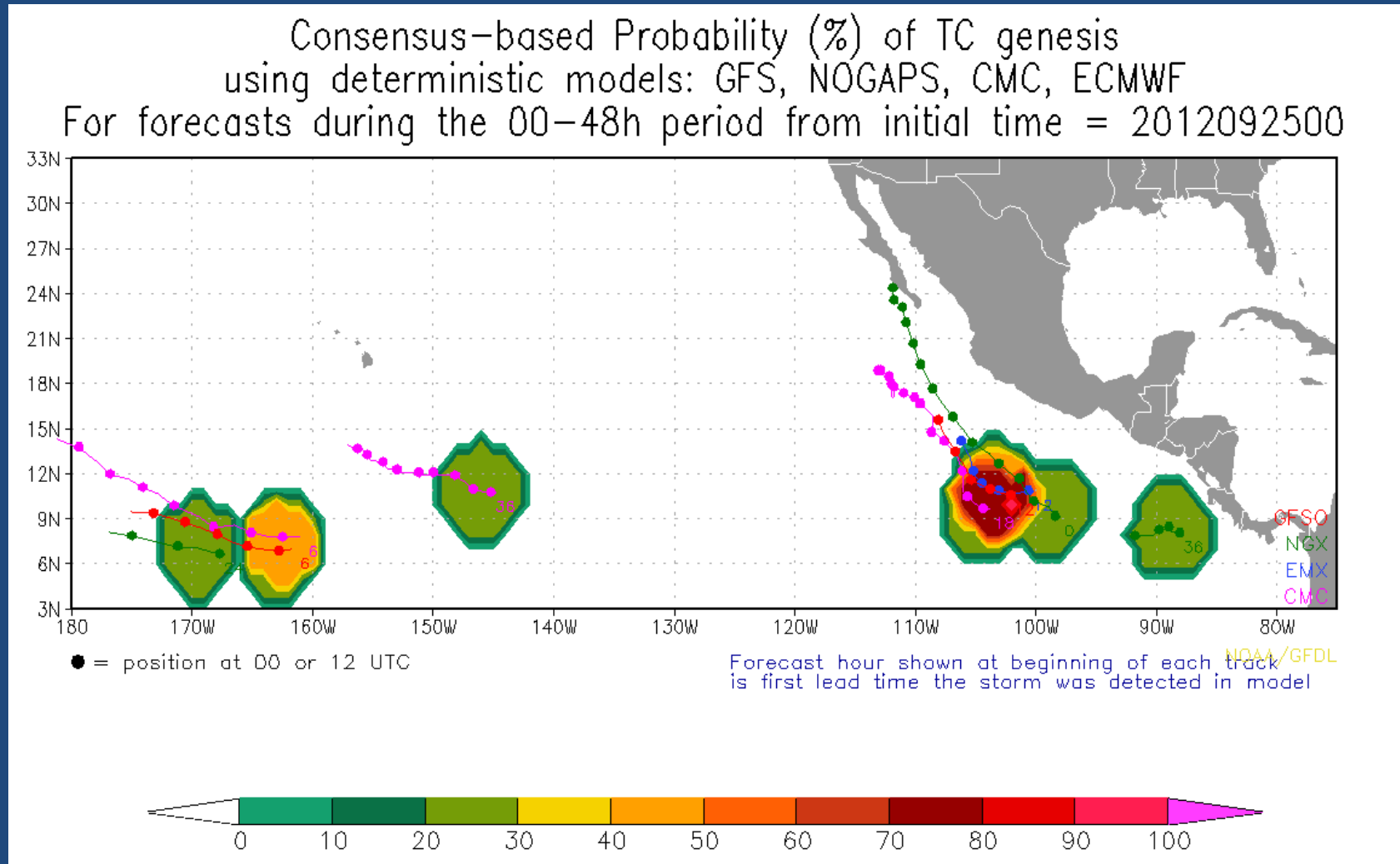
Ensemble-based Probability (%) of TC genesis
using these global ensembles: NCEP FNMOC CMC ECMWF
For forecasts during the 00-48h period from initial time = 2012092500



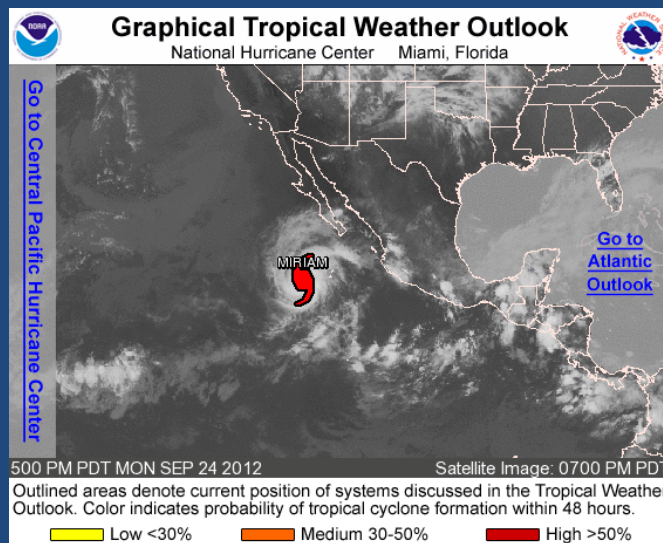
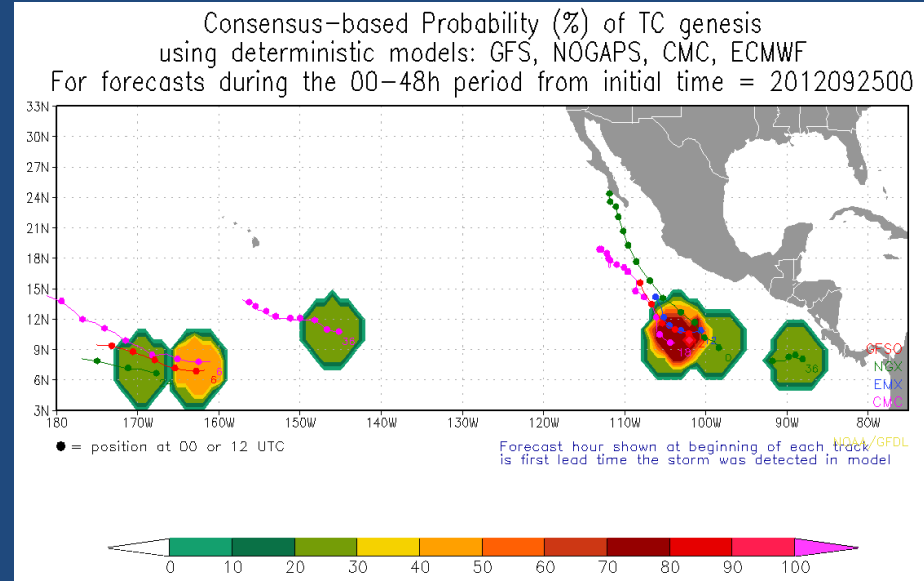
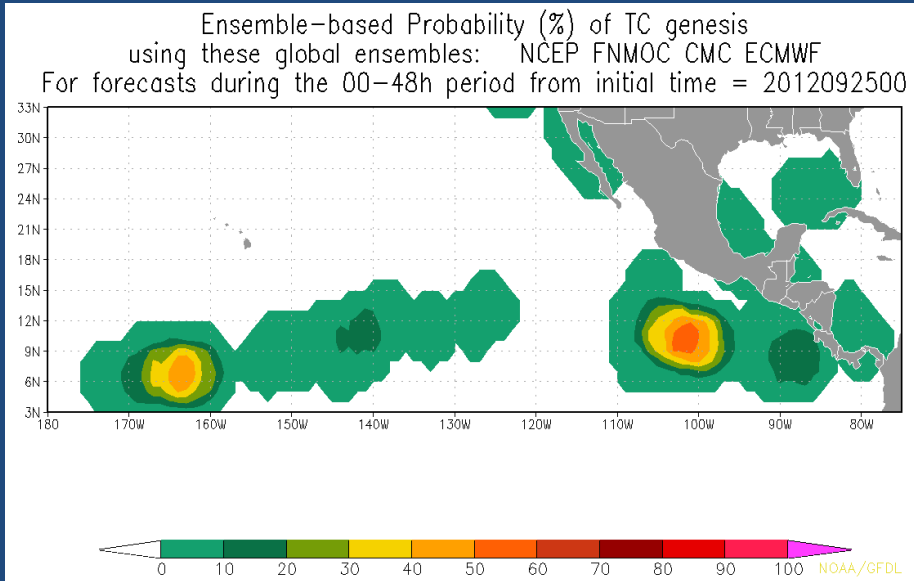
Forecast storm tracks from all four deterministic global models: 2012092500



Consensus-based genesis probabilities for 00-48h using all four global deterministic models: 2012092500



Ensemble-based and Consensus-based genesis probabilities for 2012092500: 00-48h



Website 1: <http://www.emc.ncep.noaa.gov/gmb/tpm/emchurr/tcgen>

Hurricane MIRIAM 7-Day Forecast for ... NCEP/EMC Cyclone ... NCEP/EMC Cyclone

NCEP/EMC Cyclogenesis Tracking Page

Text track file: ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓

Atlantic Ocean Basin: Model Storm Tracks and Genesis Probabilities

Region	Model Guidance													
	Multi Model (Determ)	Multi Model (Ens)	GFS	NCEP Ens	NAM	SREF Ens	Ukmet	NOGAPS	FNMOC Ens	CMC	CMC Ens	ECMWF (restricted)	ECMWF Ensemble (restricted)	Multi Model w/ECMWF (restricted)
Atlantic Basin tracks	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Atlantic Basin tracks (last 4 cycles)	X	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	X
Genesis Probs (00-48h)	X	✓	X	✓	X	✓	X	X	✓	X	✓	X	✓	✓
Genesis Probs (00-120h)	X	✓	X	✓	X	X	X	X	✓	X	✓	X	✓	✓
Genesis Probs (120-240h)	X	✓	X	✓	X	X	X	X	✓	X	✓	X	✓	✓
Text track file	✓	X	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Eastern Pacific Ocean Basin: Model Storm Tracks and Genesis Probabilities

Region	Model Guidance													
	Multi Model (Determ)	Multi Model (Ens)	GFS	NCEP Ens	NAM	SREF Ens	Ukmet	NOGAPS	FNMOC Ens	CMC	CMC Ens	ECMWF (restricted)	ECMWF Ensemble (restricted)	Multi Model w/ECMWF (restricted)
Eastern														

Genesis probabilities based on each ensemble forecast system

Genesis probabilities based on consensus of ensemble forecasts

Genesis probabilities based on consensus of deterministic forecasts

Website 2: http://www.hfip.org/data_prob

The screenshot shows a web browser window with several tabs open. The active tab is titled "HFIP Experimental Products" and displays the following content:

- Header: "HFIP Products | HFIP Hurricane Forecast Improvement Program | NOAA"
- Section: "HFIP Experimental Products" with a link to "Guide to Product Descriptions".
- Warning: "WARNING: This webpage contains experimental analysis and forecast guidance of unknown accuracy and reliability. For official forecasts consult the National Hurricane Center".
- Data Browser section with three dropdown menus:
 - Select model: "NCEP Ens-based Probability"
 - Select date: "25 Sep 2012 - 12Z"
 - Select area: "Atlantic"
- Model summary: "Model: NCEP Ens-based Probability Date: 25 Sep 2012 - 12Z Area: Atlantic" with a "Go" button.
- Navigation controls: "Forward", "Reverse", "Bounce" buttons and a sequence of numbers "1 2 3".
- Map: A map of the Atlantic Ocean showing "NCEP Ensemble-based Probability (%) of TC genesis for forecasts during the 00-120h period from initial time = 2012092512". The map displays green and yellow shaded regions indicating probability, with a black line showing a storm track.

Paula McCaslin built a very nice interface for looping through images based on model or lead time.

Summary

1. Consensus-based approach to provide genesis probability guidance using global deterministic and ensemble forecast systems.
2. Cyclones are detected with the tracker and categorized using parameters from cyclone phase space.
 - May need to adjust use of cyclone phase space depending on results
3. Bug fix necessary in order to include genesis probabilities for Invest systems.