Evaluation of the NCEP CFSv2 45-day Forecasts for Predictability of Intraseasonal Tropical Storm Activities

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Outline

- CFSv2 45-day hindcast suite for 1999-2010
- To provide basis for subseasonal tropical storm (TS) activity prediction to be used for CPC Global Tropics Hazards and Benefits Outlooks (GTHBO)
- Analysis of TS statistics
- Summary

Subseasonal Tropical Storm Prediction with the CFSv2 45-Day Forecasts

- CFSv2 operationally implemented in April, 2011

- AGCM - 2009 operational NCEP GFS in T126/L64 resolution
  LSM - Noah LSM
  OGCM - GFDL MOM4

- Hindcast runs for 1999-2010 with initial conditions every 6 hours at 00Z, 06Z, 12Z, and 18Z everyday. Output every 6 hours.

- Operational runs with ICs at 00Z, 06Z, 12Z, and 18Z everyday, 4 ensemble members each

Detection & Tracking Method

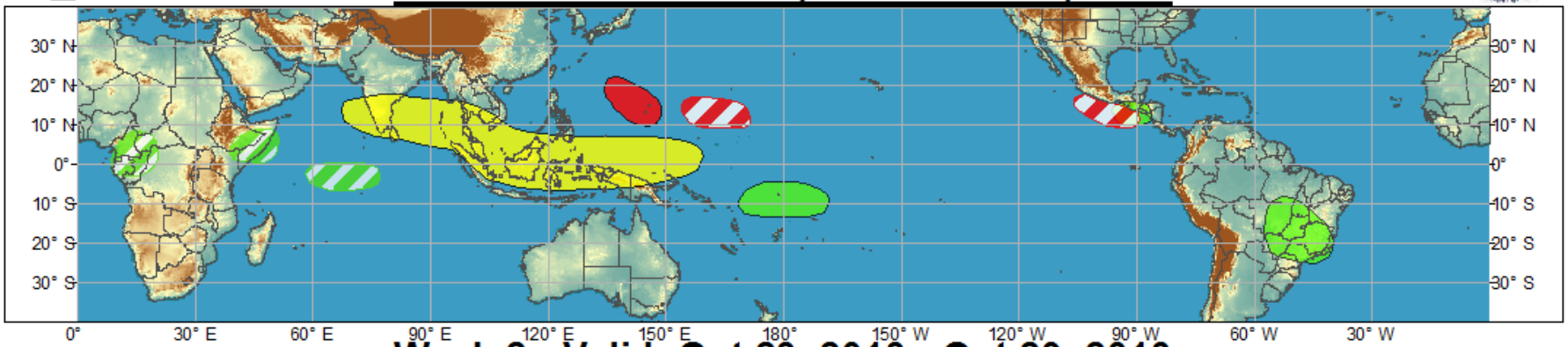
- Method based on Camargo & Zebiak (2002)
  - Point must meet 7 criteria to be considered a storm
  - Tracked forward and backward in time following vorticity maxima
- Detection thresholds unique to CFSv2, created using seasonal hindcast runs for 1982-2010
- Observations from the HURDAT and JTWC Best Track Datasets for verification
- Tropical depressions and subtropical storms are not included in storm counts.

CPC Global Tropics Hazards and Benefits Outlook

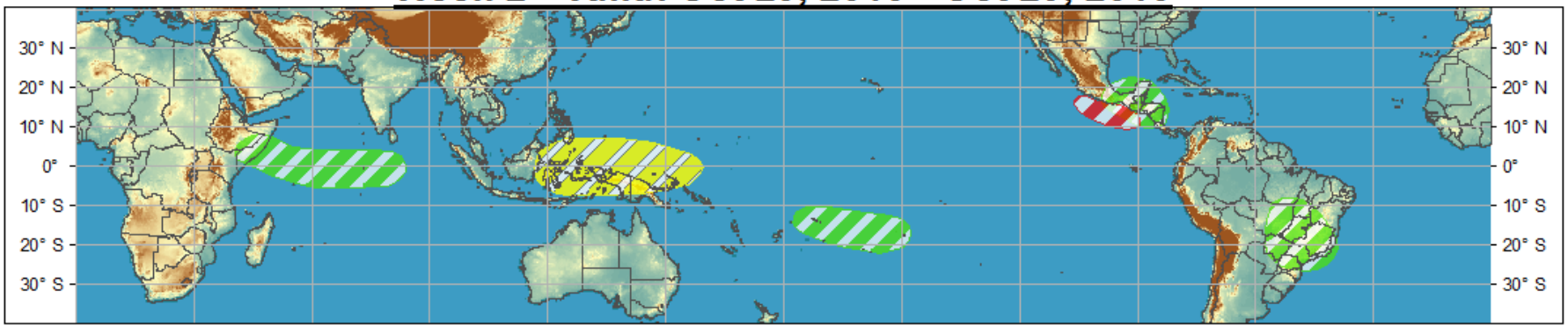
- Forecast for moderate or high confidence of:
  - TC Formation
  - Above/Below Average Rainfall
- Issue forecast for Week 1 and Week 2
- Includes graphic and a detailed discussion
- Outlooks are updated each Tuesday
  - Includes live briefing (via webinar), soon to be open to public
- Currently mostly subjective in nature with only a few objective forecasting tools
- Collaborators include
  - NHC, CPHC, JTWC, NPS, Australian Bureau of Meteorology, Taiwan Central Weather Bureau, SUNY, CICS

Global Tropics Hazards and Benefits Outlook - Climate Prediction Center

Week 1 - Valid: Oct 16, 2013 - Oct 22, 2013



Week 2 - Valid: Oct 23, 2013 - Oct 29, 2013



Produced: 10/15/2013

Forecaster: Pugh

	Confidence: High	Confidence: Moderate	
Tropical Cyclone Formation			Development of a tropical cyclone that eventually reaches tropical storm/cyclone strength.
Above-average rainfall			Weekly total rainfall in the upper third of the historical range.
Below-average rainfall			Weekly total rainfall in the lower third of the historical range.
Above-normal temperatures			7-day mean temperatures in the upper third of the historical range.
Below-normal temperatures			7-day mean temperatures in the lower third of the historical range.

Product is updated once per week. The product targets broad scale conditions integrated over a 7-day period for US interests only. Consult your local responsible forecast agency.

中央氣象局 Central Weather Bureau

UNIVERSITY AT ALBANY State University of New York

ESSIC UNIVERSITY OF MARYLAND

Australian Government Bureau of Meteorology

CICS-NC

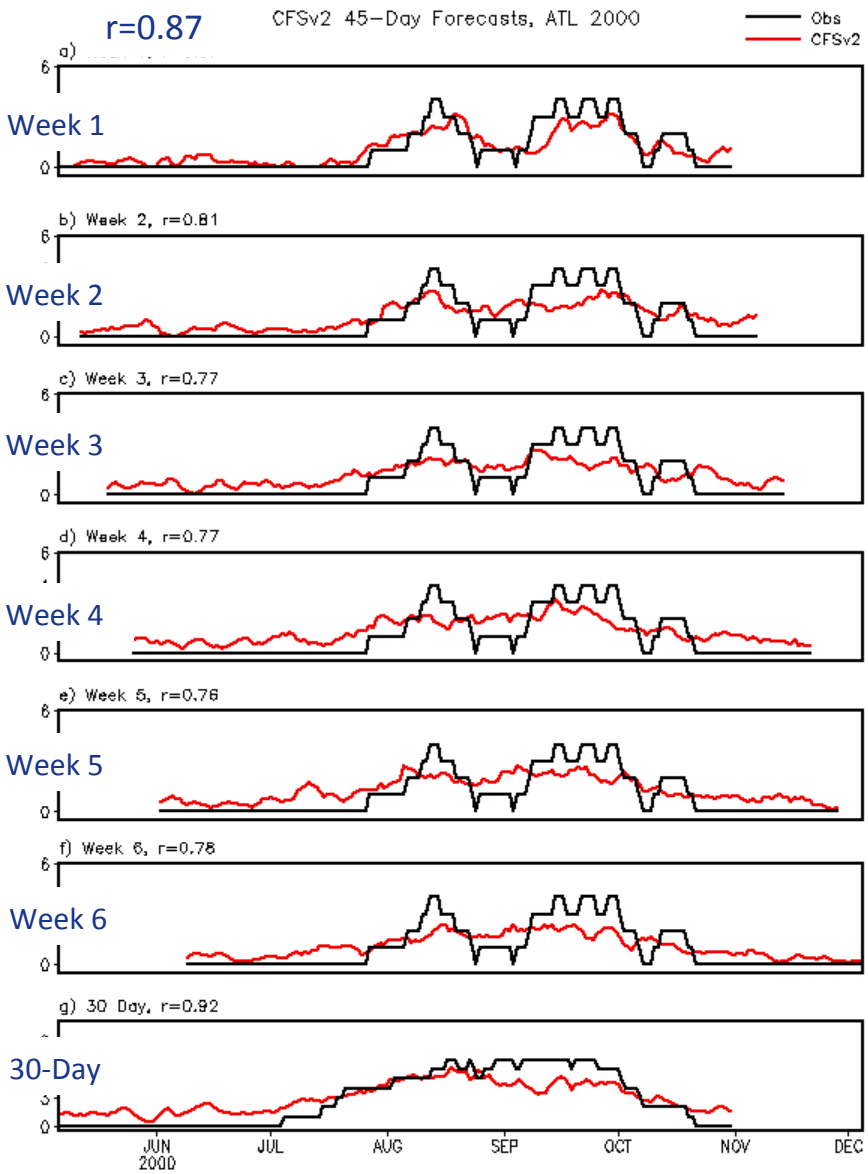
NPS

CFSv2 Hindcast TS Analysis

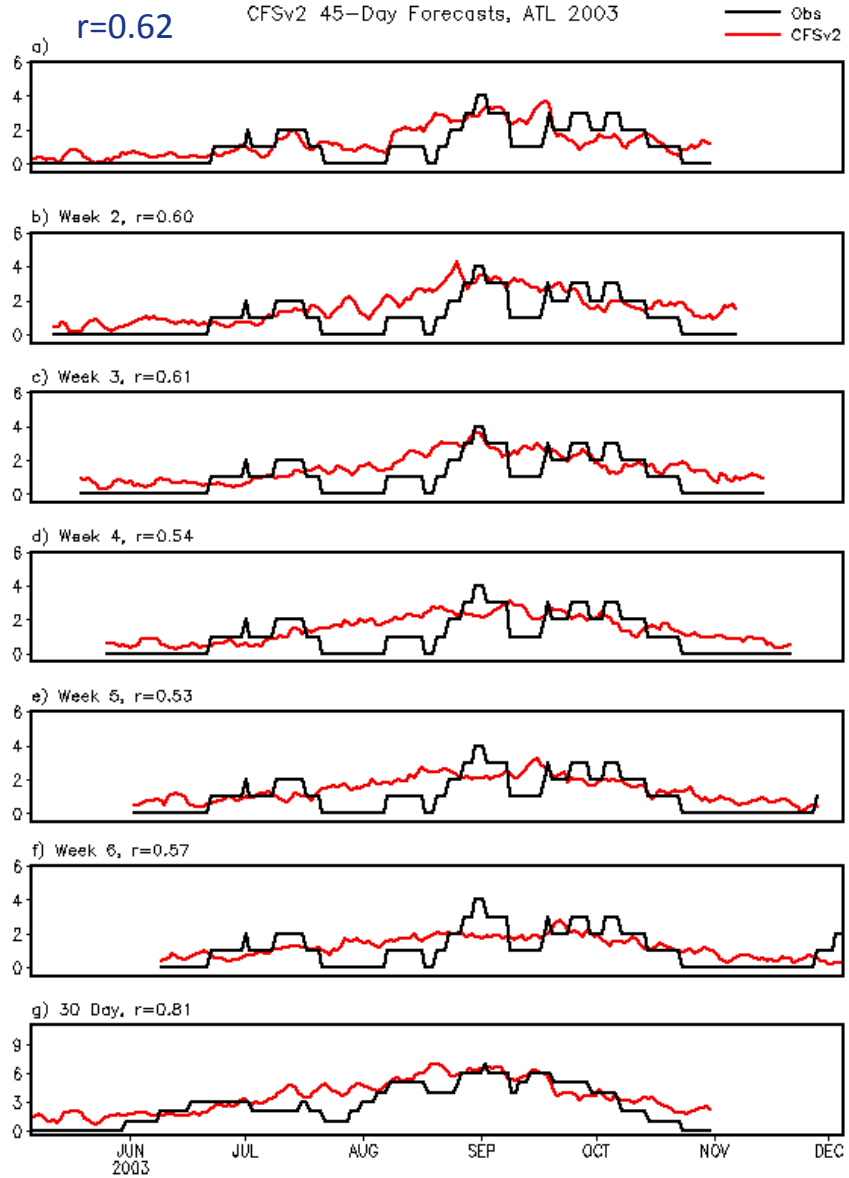
- Currently working on two products
  - Storm count
  - Storm track location
- These products are prepared for Week 1 through Week 4 and monthly (30-day).
- Based on a 20-member ensemble comprised of the 5 days prior to the forecast day (4 times per day)
- TS analysis performed for global ocean basins through out the year
- Hope to provide an objective tool for forecasters

Storm Counts for Atlantic, May-Oct IC

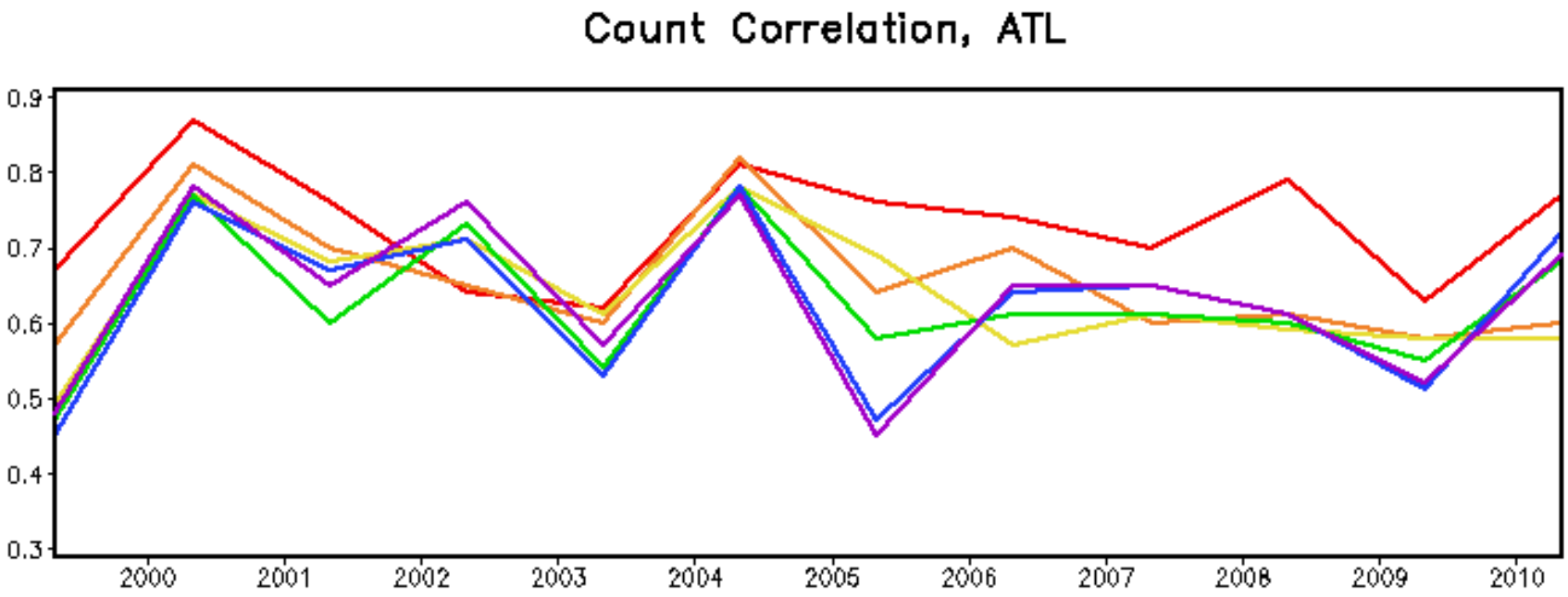
2000



2003



Storm Count Correlations for Atlantic



Average Means per Week

Week1 = 0.73 Week2 = 0.66 Week3 = 0.64

Week4 = 0.63 Week5 = 0.63 Week6 = 0.63

Example of Storm Count Table

Bias-Corrected Table of Storm Counts by Week:

PERIOD	START	END	ATL	ENP	WNP	NI	SI	AUS	SP
Week 1	19990801	19990807	0.7	2.3	2.5	0.0	0.0	0.0	0.0
Week 2	19990808	19990814	0.8	1.9	2.4	0.0	0.0	0.0	0.0
Week 3	19990815	19990821	1.2	1.6	1.5	0.0	0.0	0.0	0.0
Week 4	19990822	19990828	2.4	2.0	1.3	0.0	0.1	0.0	0.0
Week 5	19990829	19990904	2.8	2.0	1.2	0.0	0.3	0.0	0.0
Week 6	19990905	19990911	2.7	1.6	1.1	0.0	0.3	0.0	0.0
30 Day	19990801	19990830	3.5	5.7	5.8	0.0	0.1	0.0	0.0

Period Forecast is Valid

Storm Count by Basin

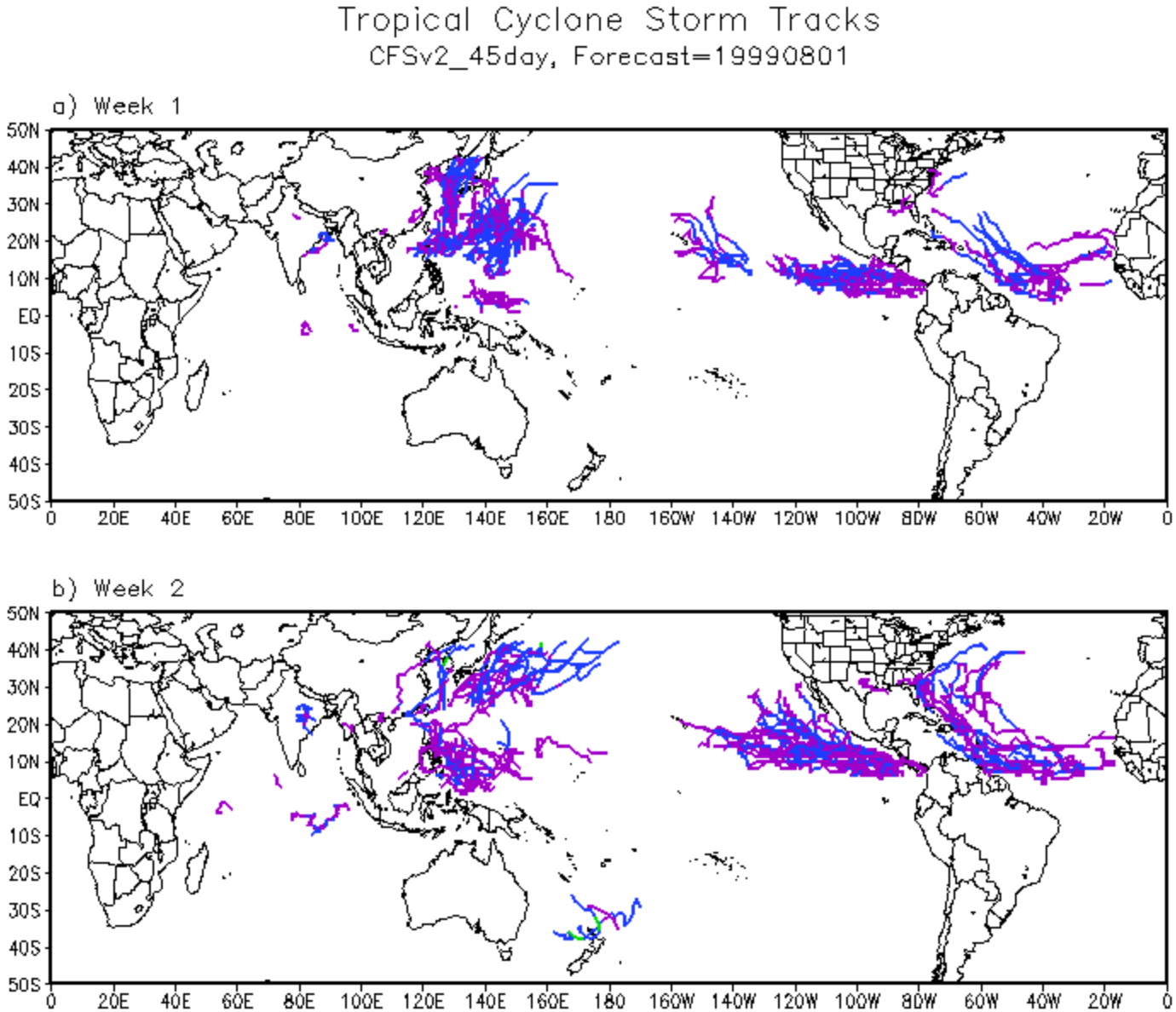
Example of Storm Count Table

Verification:

PERIOD	START	END	ATL/OBS	ENP/OBS	WNP/OBS
Week 1	19990801	19990807	0.7/0	2.3/2	2.5/3
Week 2	19990808	19990814	0.8/0	1.9/2	2.4/1
Week 3	19990815	19990821	1.2/2	1.6/3	1.5/2
Week 4	19990822	19990828	2.4/4	2.0/2	1.3/3
Week 5	19990829	19990904	2.8/2	2.0/0	1.2/1
Week 6	19990905	19990911	2.7/3	1.6/1	1.1/0
30 Day	19990801	19990830	3.5/4	5.7/3	5.8/6

Period Forecast is Valid

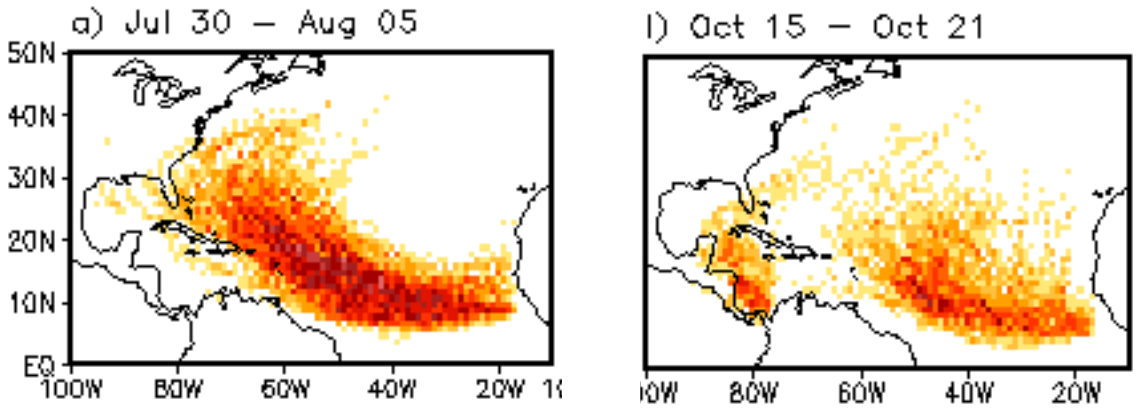
Example of Storm Track Location



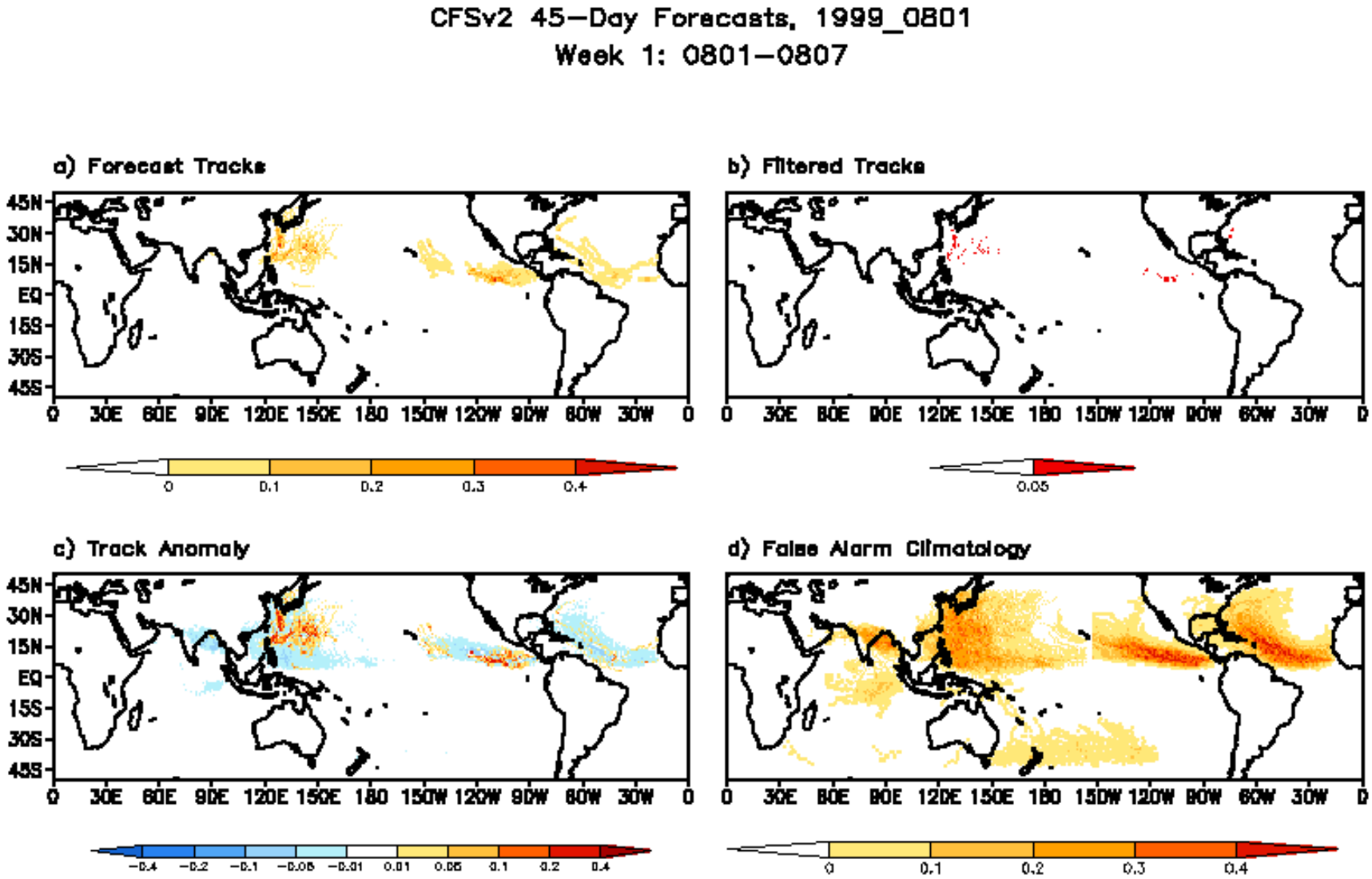
Storm Tracks in the CFSv2

- The CFSv2 tends to produce a high number of False Alarms (storms which do not occur in observations).
- To account for these in the tracks, we have created storm density tracks that we then filter to remove the weekly False Alarm climatology.
- Filtering removes the weekly climatology and False Alarm rate
- We then plot those points which are above the threshold of 0.05 (1/20 members) as a point that is likely to be an actual TS.

Weekly False Alarms Examples



Final Products to Forecasters - Storm Track Density



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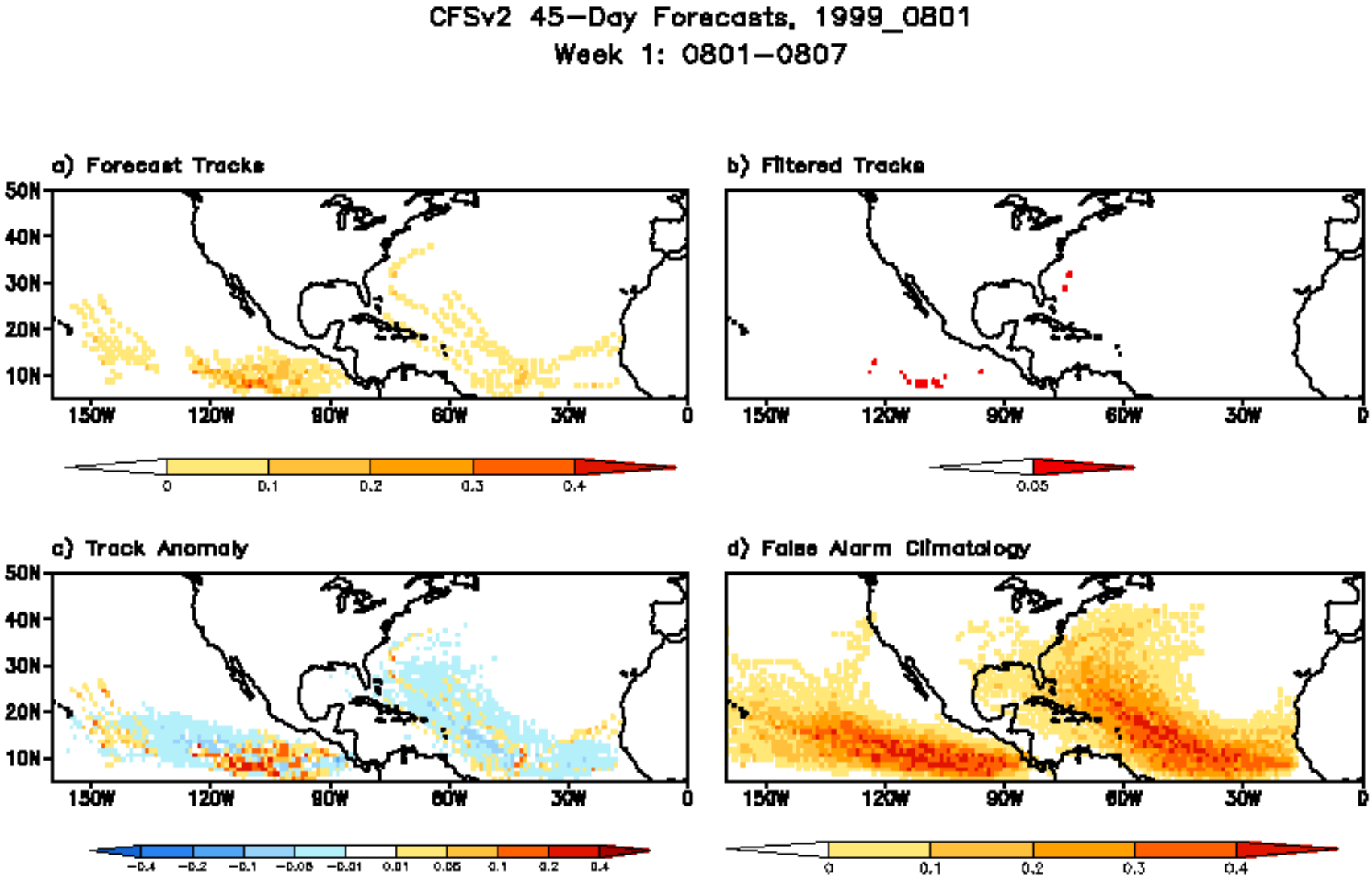
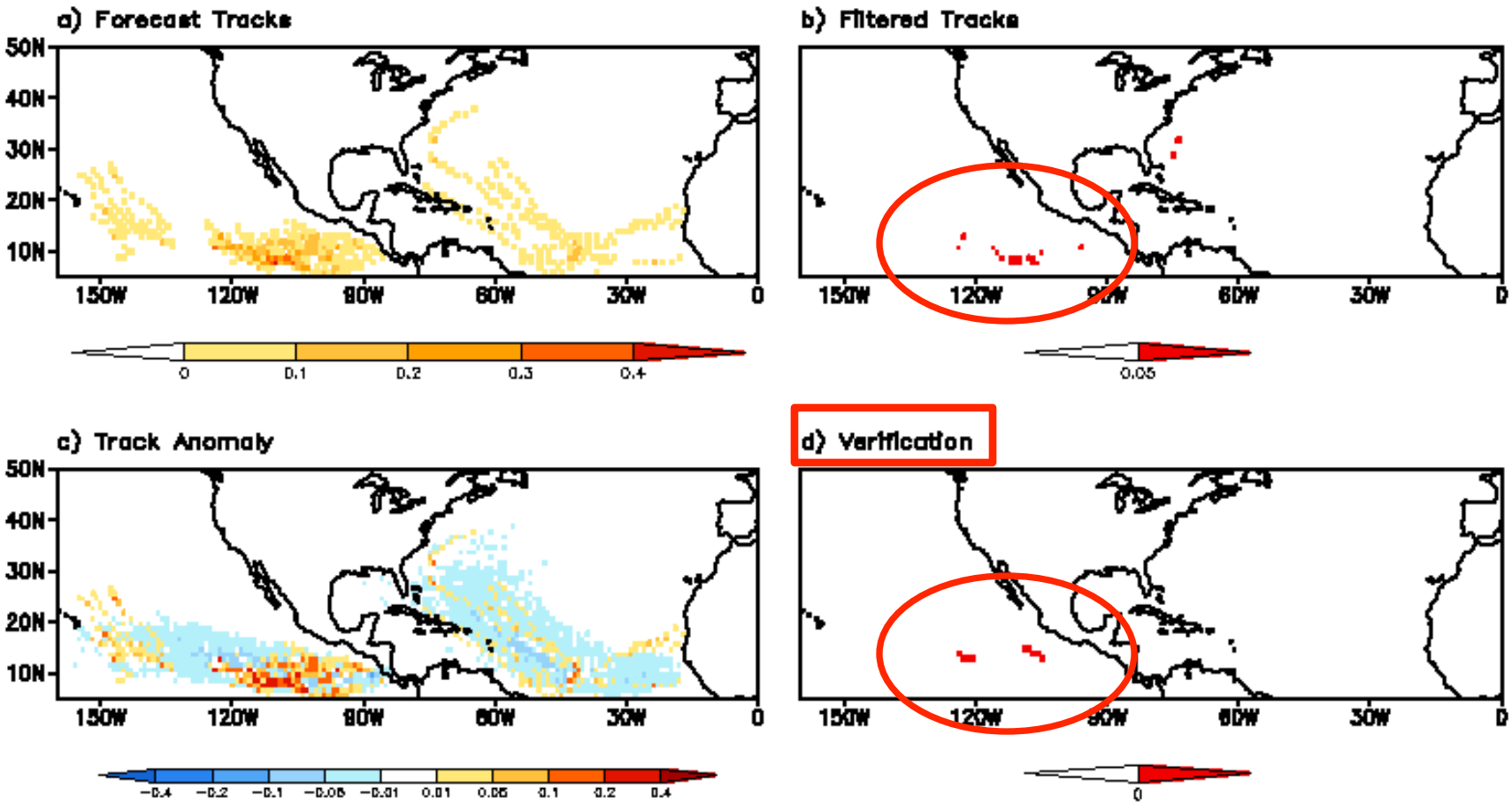


Storm Track Density - Verification

CFSv2 45–Day Forecasts, 1999_0801
Week 1: 0801–0807



The filtered track forecast does well forecasting for the ENP. The ATL does contain FAs.

Monthly Heidke Skill Scores – Storm Track

a) June

JUN	ATL	ENP	WNP
Wk1	0.30	0.50	0.51
Wk2	0.07	0.29	0.18
Wk3	0.05	0.03	0.11
Wk4	0.00	0.01	0.00

b) July

JUL	ATL	ENP	WNP
Wk1	0.44	0.46	0.49
Wk2	0.21	0.28	0.17
Wk3	0.03	0.27	0.21
Wk4	0.00	0.00	0.00

c) August

AUG	ATL	ENP	WNP
Wk1	0.45	0.49	0.47
Wk2	0.13	0.27	0.20
Wk3	0.09	0.26	0.21
Wk4	0.00	0.01	0.01

d) September

SEP	ATL	ENP	WNP
Wk1	0.50	0.46	0.48
Wk2	0.20	0.28	0.20
Wk3	0.11	0.23	0.23
Wk4	0.00	0.00	0.00

e) October

OCT	ATL	ENP	WNP
Wk1	0.40	0.47	0.49
0.19	0.16	0.21	0.19
Wk3	0.08	0.27	0.18
Wk4	0.00	0.00	0.01

f) November

NOV	ATL	ENP	WNP
Wk1	0.55	0.65	0.53
Wk2	0.11	0.09	0.16
Wk3	0.02	0.00	0.16
Wk4	0.00	0.00	0.03

Summary

- New products on TS activity prediction being developed for CPC forecasters
  - Experimental real time prediction to be initiated soon
  - Still evaluating best way to remove False Alarms in CFS
- Will provide guidance on both storm count and location
  - Storm counts show skill throughout the period
  - Storm locations show skill for weeks 1-3
- Operational product will be based on 16-member daily ensemble (00Z, 06Z, 12Z, and 18Z with 4 members each)