

Towards closing the gap in NOAA's seamless suite of Forecast products. Prospects of "useful" Predictions for Weeks 3 & 4?

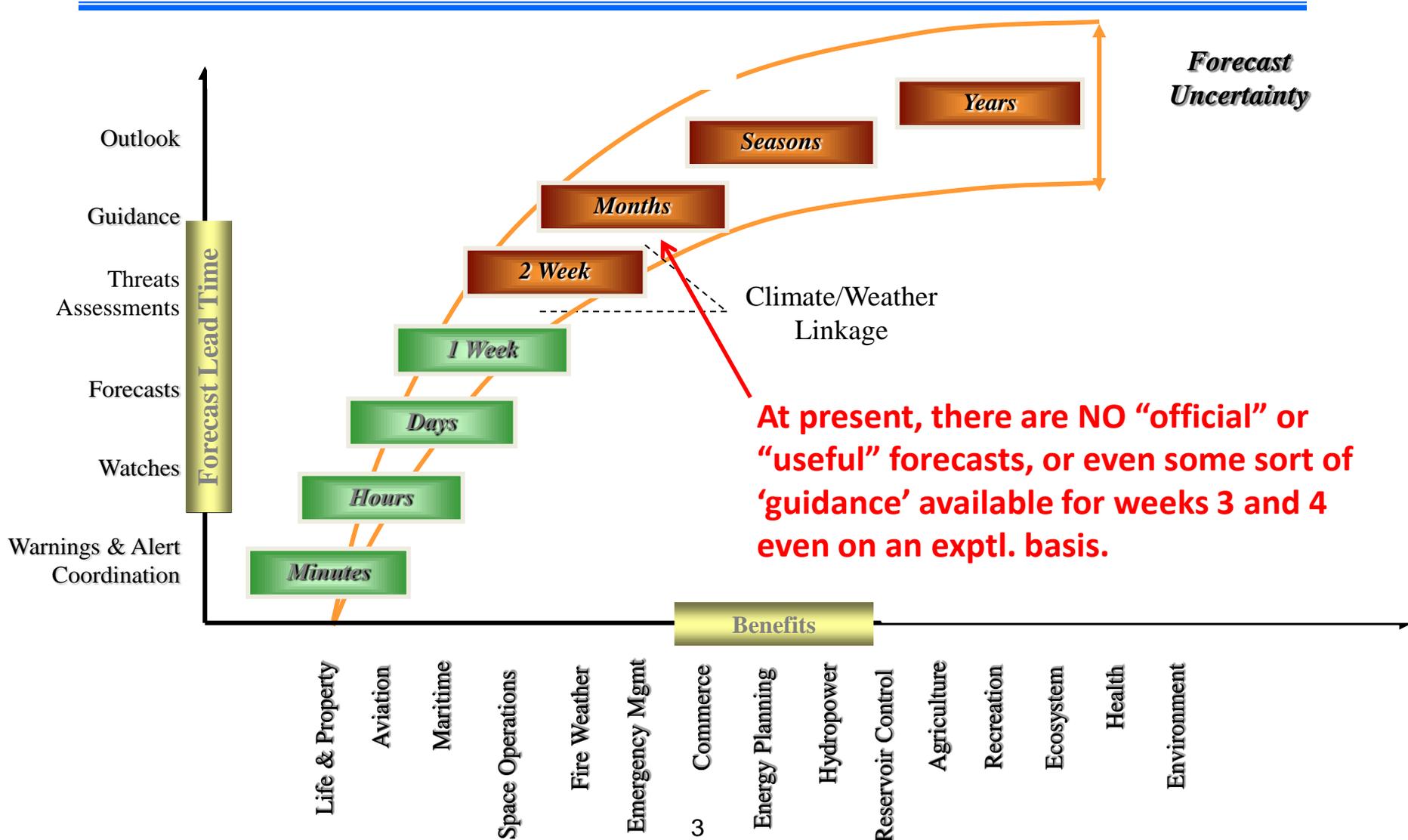
Muthuvel Chelliah
CPC/NCEP

October 23, 2013

* Want to thank the Forecast Operations Branch Staff of CPC as well as Arun Kumar & Huug Van den Dool for the discussions I had with them as I was working on this.



NOAA Seamless Suite of Forecast Products Spanning Climate and Weather





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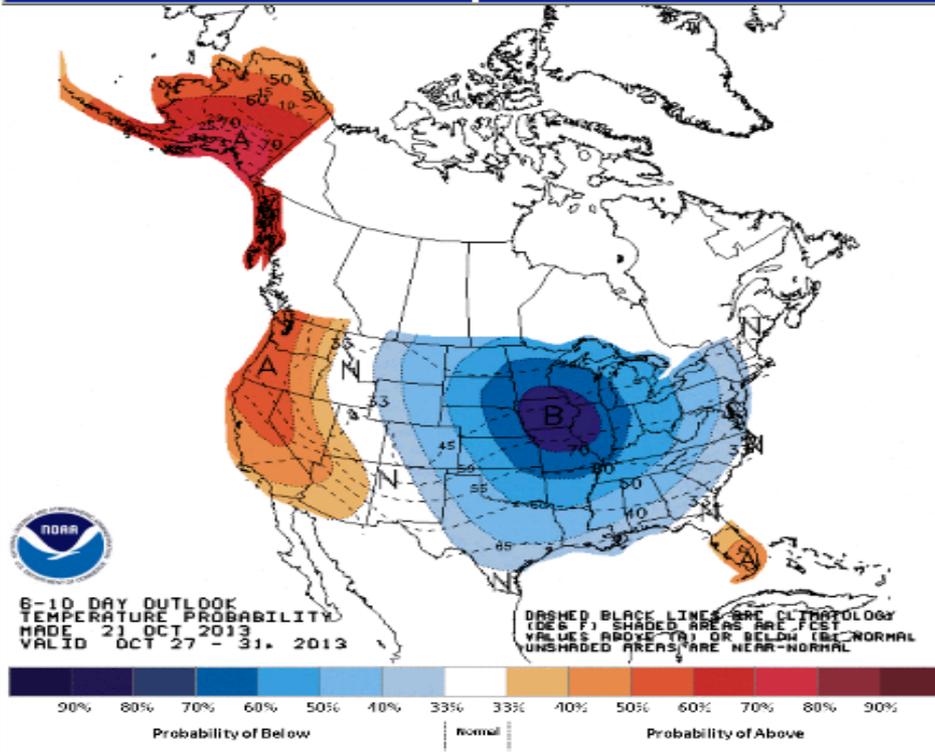
CPC Web Team

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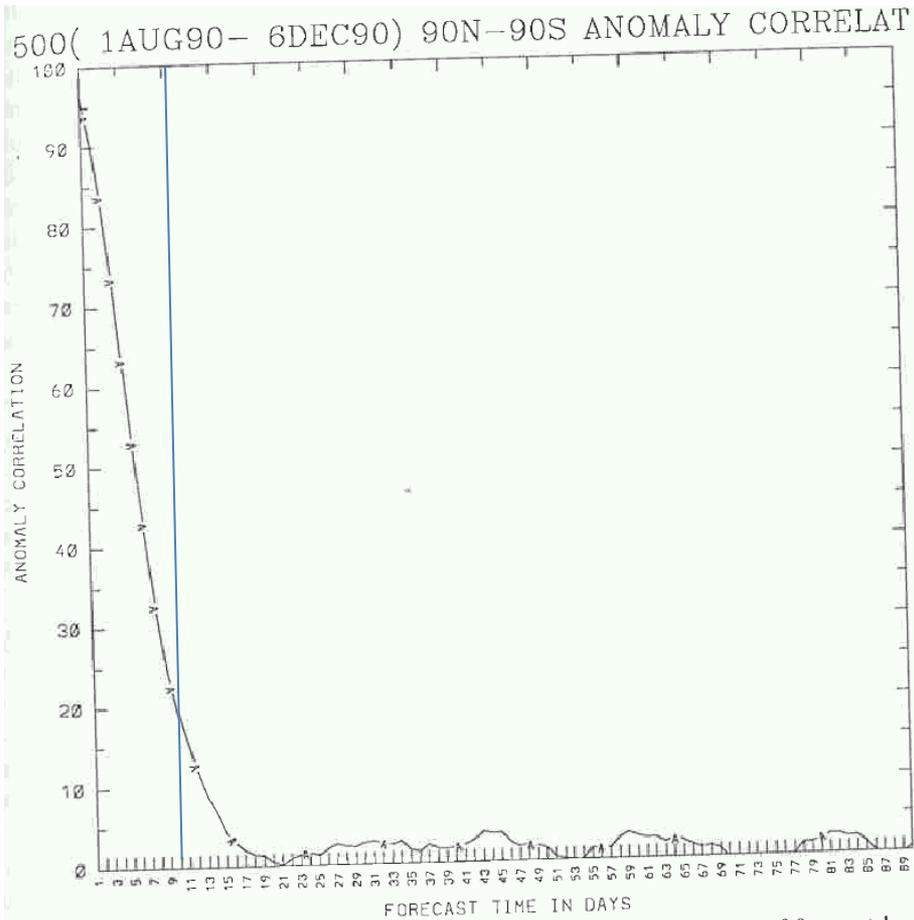
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8-14 Day Outlook (Interactive Display)		Three Month Outlook	
Temperature	Precipitation	Temperature	Precipitation
U.S. Hazards Outlook 3-7 Day 8-14 Day		U.S. Drought Information Monitor Monthly Outlook Seasonal Outlook	



Long-range weather forecasts through numerical and empirical methods,

H.M. van den Dool. (Dynamics of Atmospheres & Oceans, **1994**)



Based on the so called "DERF" (Dynamical Extended Range Forecast) runs

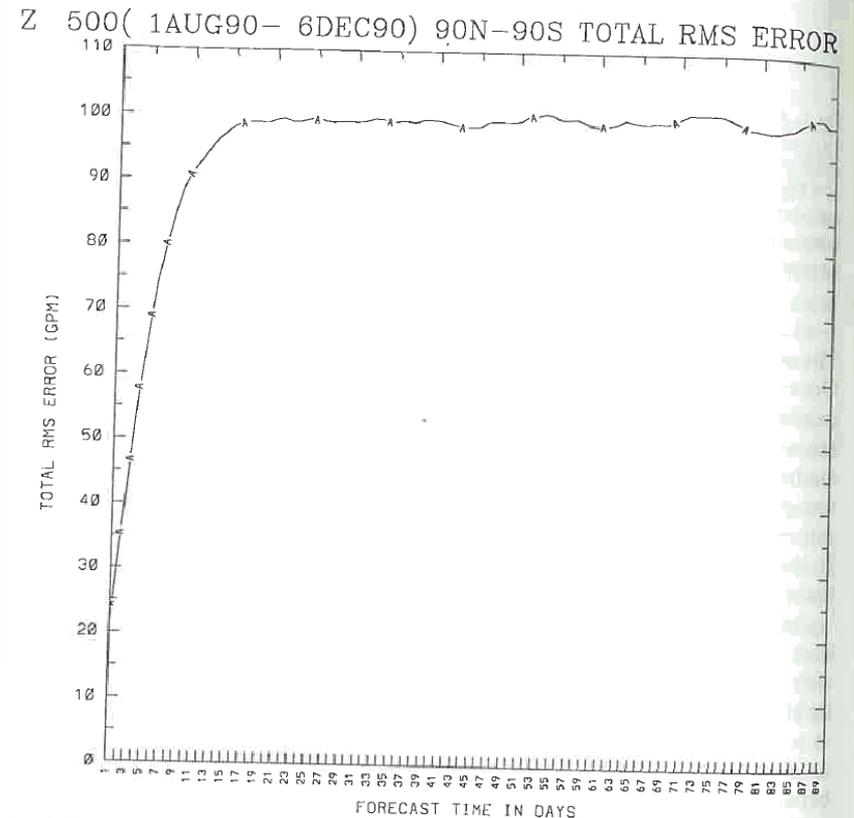


Fig. 2. The globally averaged r.m.s. error of 500 mbar geopotential forecasts, averaged over the Lorenz block (1 August 1990-6 December 1990) as a function of forecast lead time (Days 1-90).

MONTHLY WEATHER REVIEW

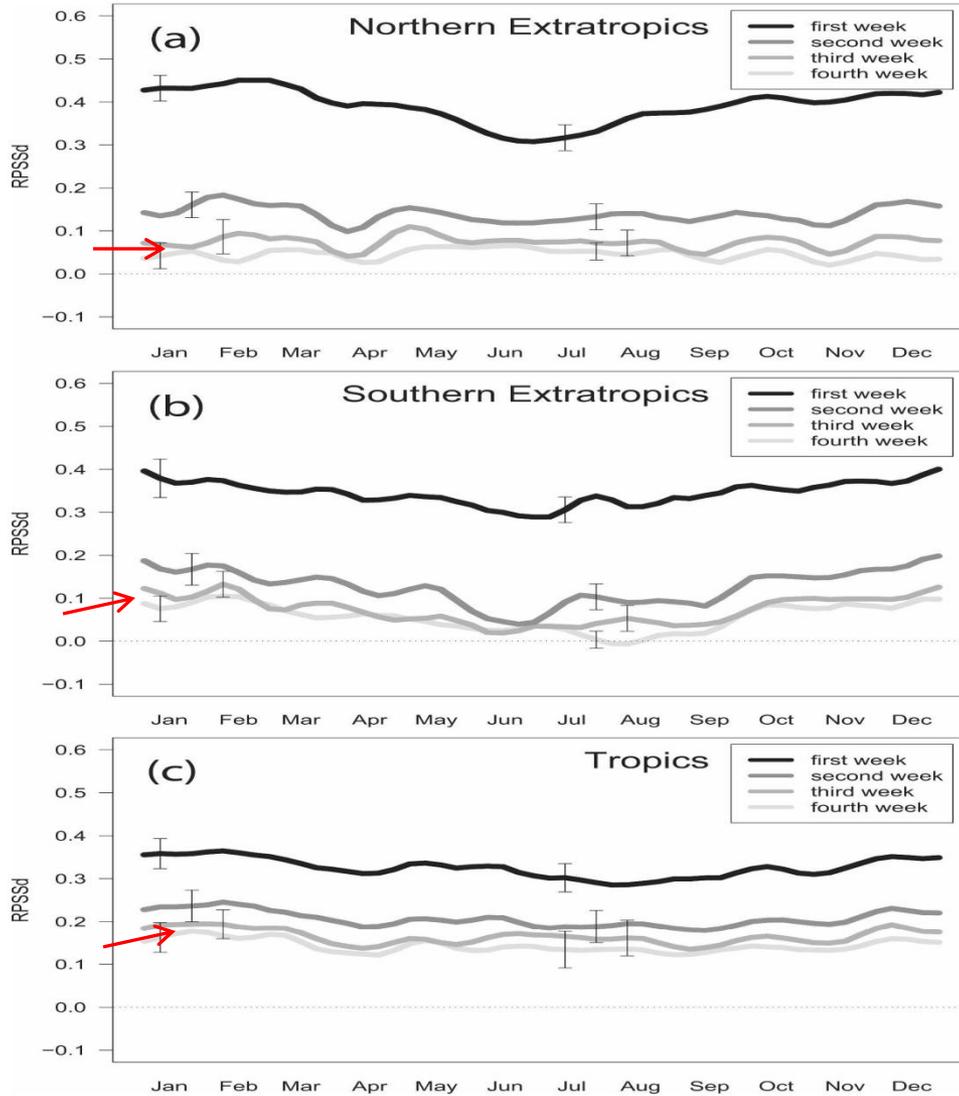


FIG. 5. Annual cycle of average skill in (a) the northern extratropics (30° – 85° N), (b) the southern extratropics (30° – 85° S), and (c) the tropics (30° S– 30° N). A five-point symmetric moving-average filter has been applied as described in the text. Both land and sea points are considered. A few typical confidence intervals are plotted to illustrate the range of uncertainty of the skill values obtained.

Probabilistic Verification of Monthly Temperature Forecasts

ANDREAS P. WEIGEL, DANIEL BAGGENSTOS, AND MARK A. LINIGER

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Federal Office of Meteorology and Climatology, MeteoSwiss, Zurich, Switzerland

(Manuscript received 6 February 2008, in final form 16 April 2008)

2013

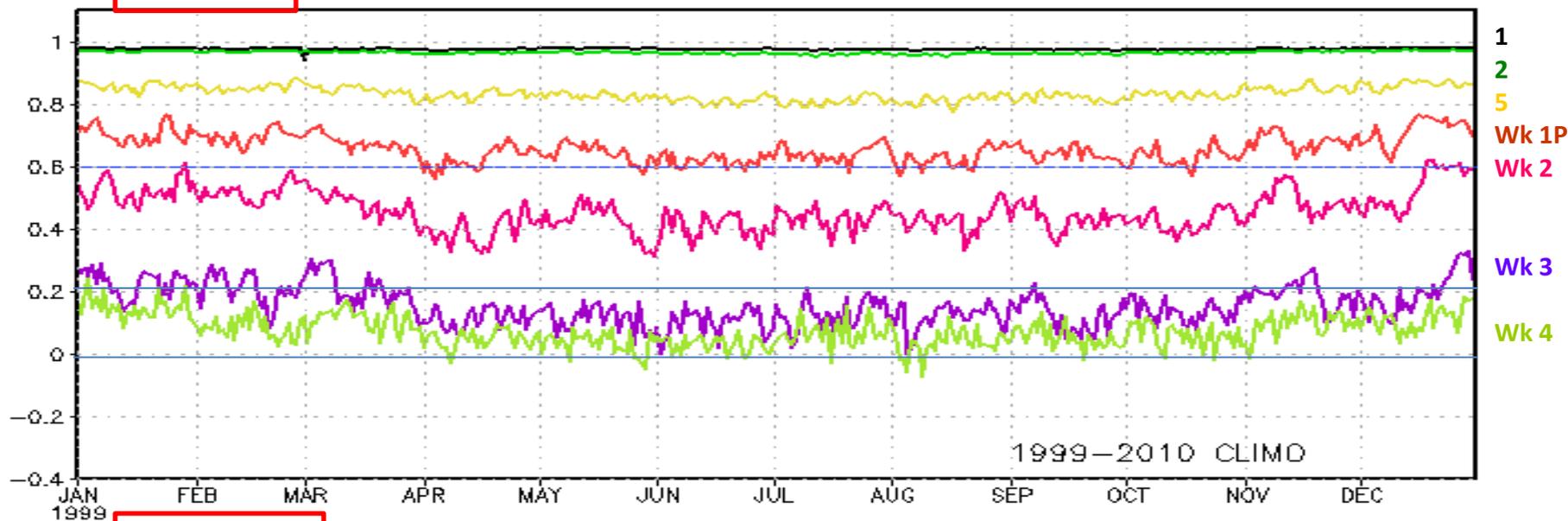
What is the “status quo” of weeks 3-4 forecasts ? based on the state of the art NCEP CFS V2 model/data base!.

No need for me to tell this group about the available 45 day historical and operational forecast data sets based on CFSR v2 model.

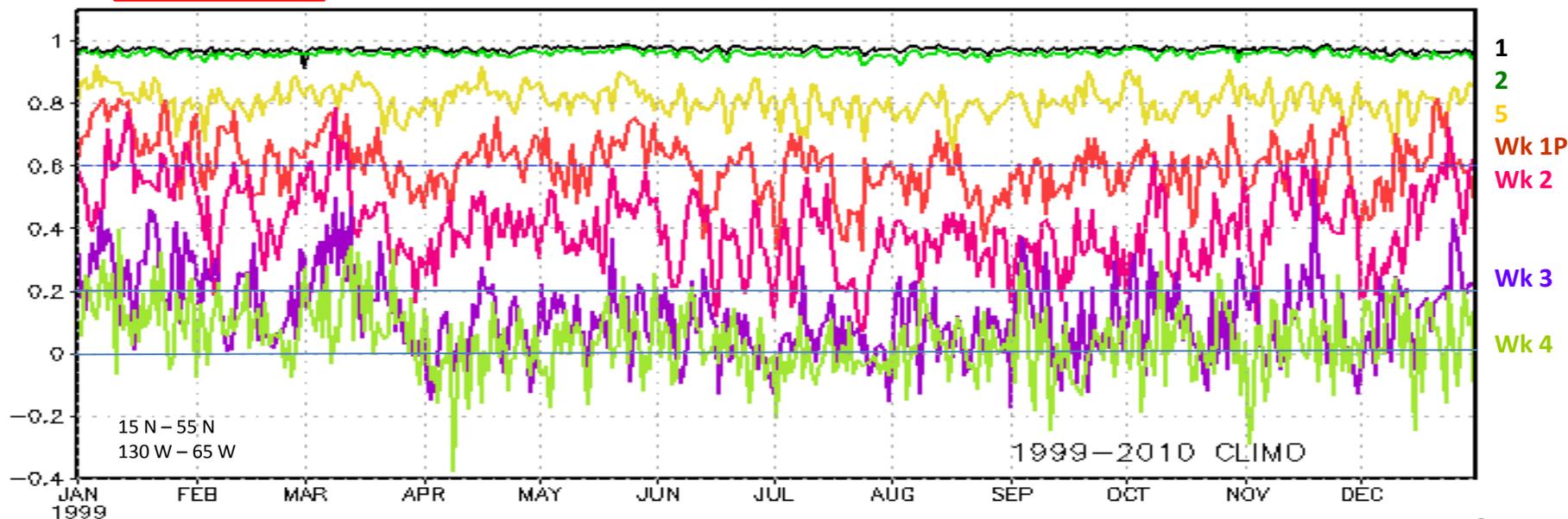
Historical: 1999-2010 (complete years). 4 member runs/day

Operational: Started ? I started looking at them since 2012/13 winter
16 members every day (4 per 00/06/12/18 ZZ)

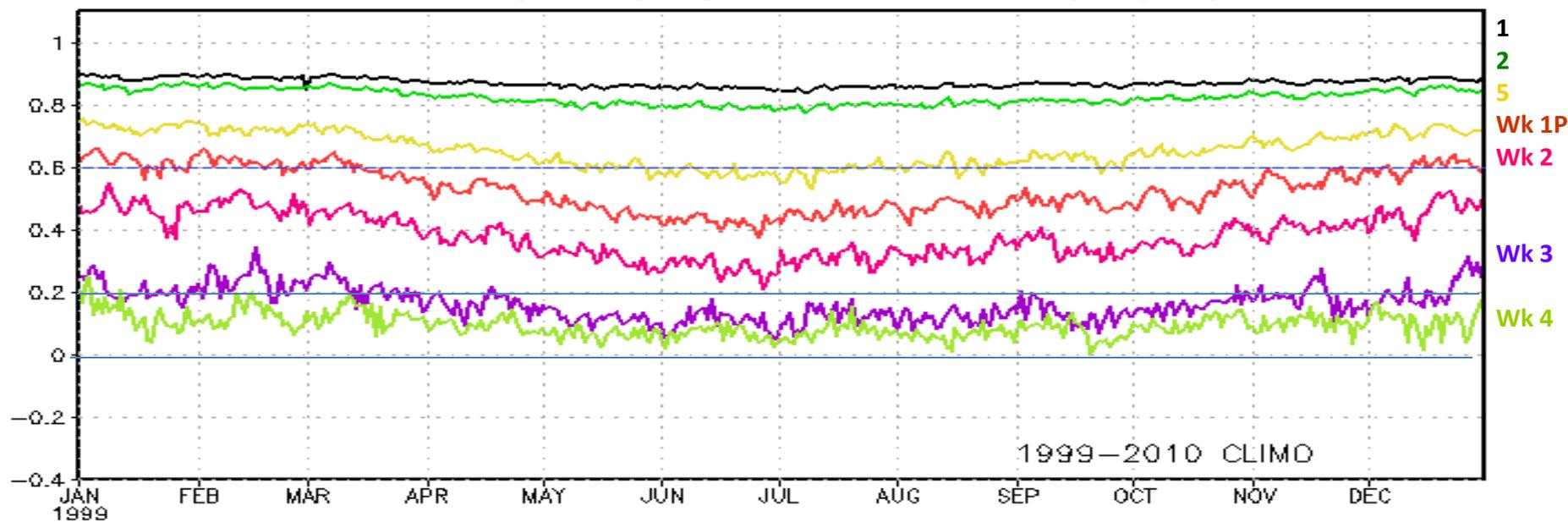
H500 **GLOBE** CFSRR:Dys 1/2/5 & Wks 1P/2/3/4 FCST SKIL



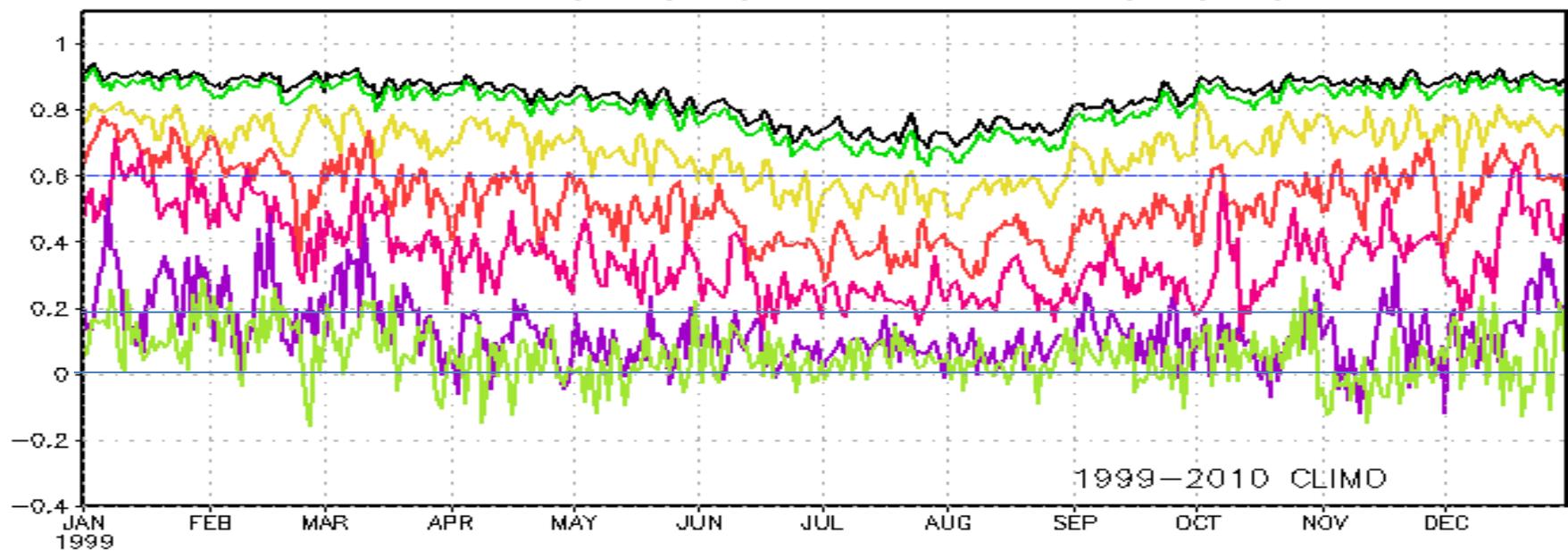
H500 **NearUS** CFSRR:Dys 1/2/5 & Wks 1P/2/3/4 FCST SKIL



T2m GLOBE CFSRR:Dys 1/2/5 & Wks 1P/2/3/4 FCST SKIL



T2m NearUS CFSRR:Dys1/2/5 & Wks 1P/2/3/4 FCST SKIL



“We know that at shorter lead times (say for less than 7-10(?) days), the future state of the atmosphere is sensitive mainly to the initial condition of the FAST atmosphere,– depends on the time/flow patterns etc?)

while at longer lead times (seasonal time scales & beyond), it is sensitive to the initial condition of the SLOW ocean (and possibly the intermediate land surface) component(s) only.”

.....

“Bridging the gap between weather and climate forecasting. Research Priorities for Intraseasonal Prediction”. ---- -- Bull. Amer. Meteor. Soc., Sep. 2007. Zoltan Toth, Malaquias Pena and Augustin Vintzileos.

What about “in between” these two time scales? Is it weather or climate, or both?
Which influences this period ? I.C.? Or B.C. ? Both? How much ?

- To evaluate weeks 3-4 predictions we have always mostly used “anomaly correlation” as the main metric where anomaly is computed as departure from some climatology? - We treat this period as climate!!!
- What is the appropriate period for the climo? Longest period available? 50 years? WMO’s 30 years? 15 ? OCN? Depending on the Climo, anomalies will be different?
- But, Does the public really care? All they need is some ‘guidance’, some ‘educated guess’ for how the ‘average’ weather will be like in the upcoming weeks, so they can go on with their lives!!
- They understand: Totals: Snow, Rain/More rain/No rain... Hot/Cold 90’s upper 80s, 40’s
- They understand: Changes from “NOW” that they remember: If NOW in a hot spell, or if in severe cold, raining for a while – they want to know how soon is this going to change....

So, for the last twenty to thirty years, in spite of the vast improvements in our understanding and modeling and so on, the predicted skill of anomalies in weeks 3-4 range have remained stubbornly low...

If you keep getting the same answer, over and over, then it may be time to reconsider the question. May be try asking a different question, instead!

"The important thing in science is not so much to obtain new facts as to discover new ways of thinking about them."
 - William Lawrence Bragg of Bragg’s Law of X-Ray diffraction. (youngest ever Nobel Laureate at age 25)

NATIONAL WEATHER SERVICE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

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Local forecast by "City, St" or ZIP code
 Enter location ... Go
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Widespread Freeze Possible Across Upper Midwest

A cold front will move into the Upper Midwest Monday into Monday night, bringing much colder air into the region. Overnight low temperatures will drop to below freezing across the eastern Dakotas, Minnesota, Wisconsin, northeastern Iowa and northern Illinois. Meanwhile, relatively warm and dry weather west of the Rockies, with scattered showers and storms across the Gulf Coast.

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Current Conditions

Washington DC, Reagan National Airport (KDCA)
 Lat: 38.86 Lon: -77.03 Elev: 16ft.
[More Local Wx](#) | [3 Day History](#) | [Mobile Weather](#)

Sunny	Mostly Clear	Partly Sunny	Showers Likely	Showers Likely	Partly Cloudy	Mostly Sunny	Partly Cloudy	Sunny
High: 68 °F	Low: 48 °F	High: 64 °F	Low: 46 °F	High: 57 °F	Low: 37 °F	High: 53 °F	Low: 36 °F	High: 52 °F

THIS AFTERNOON	TONIGHT	TUESDAY	TUESDAY NIGHT	WEDNESDAY	WEDNESDAY NIGHT	THURSDAY	THURSDAY NIGHT	FRIDAY
Sunny	Mostly Clear	Partly Sunny	Showers Likely	Showers Likely	Partly Cloudy	Mostly Sunny	Partly Cloudy	Sunny
High: 68 °F	Low: 48 °F	High: 64 °F	Low: 46 °F	High: 57 °F	Low: 37 °F	High: 53 °F	Low: 36 °F	High: 52 °F

This Afternoon	Sunny, with a high near 68. South wind around 10 mph.
Tonight	Mostly clear, with a low around 48. South wind around 7 mph.
Tuesday	Partly sunny, with a high near 64. Northwest wind 5 to 11 mph.
Tuesday Night	Showers likely, mainly after midnight. Cloudy, with a low around 46. North wind 3 to 5 mph. Chance of precipitation is 60%. New precipitation amounts of less than a tenth of an inch possible.
Wednesday	Showers likely, mainly before noon. Mostly cloudy, with a high near 57. Light and variable wind becoming west 6 to 11 mph in the afternoon. Winds could gust as high as 23 mph. Chance of precipitation is 60%. New precipitation amounts of less than a tenth of an inch possible.
Wednesday Night	Partly cloudy, with a low around 37.
Thursday	Mostly sunny, with a high near 53.



FORECAST DETAILS
 Point Forecast: College Park MD
 38.99°N 76.95°W

College Park, MD (20742) Weather

Expect dry conditions over the next six hours.

[Hourly Forecast](#)

Yesterday Today Hourly Tomorrow Weekend 5 Day 10 Day Monthly Video Forecast Map Forecasts Boat & Beach Fishing Home & Garden Pollen Travel

[Desktop App](#)

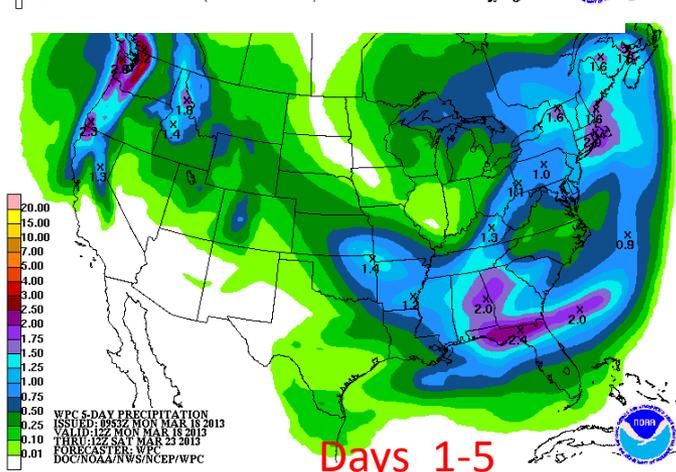
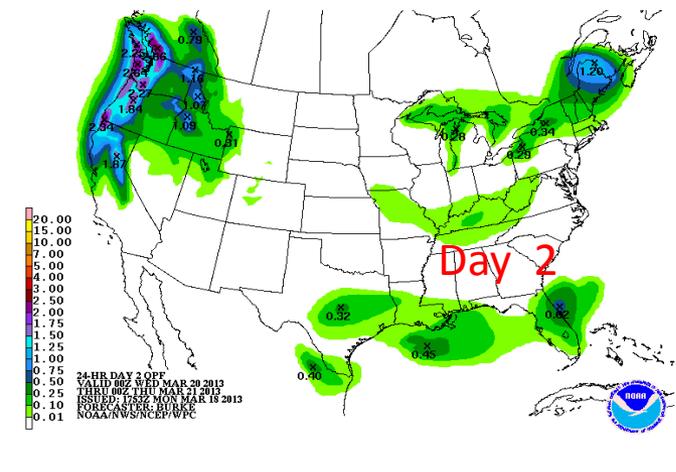
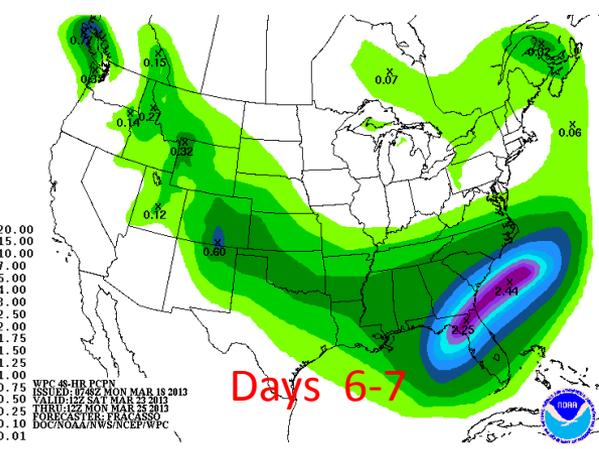
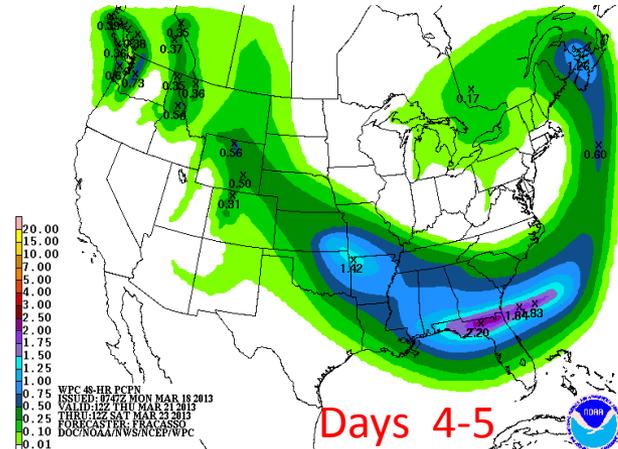
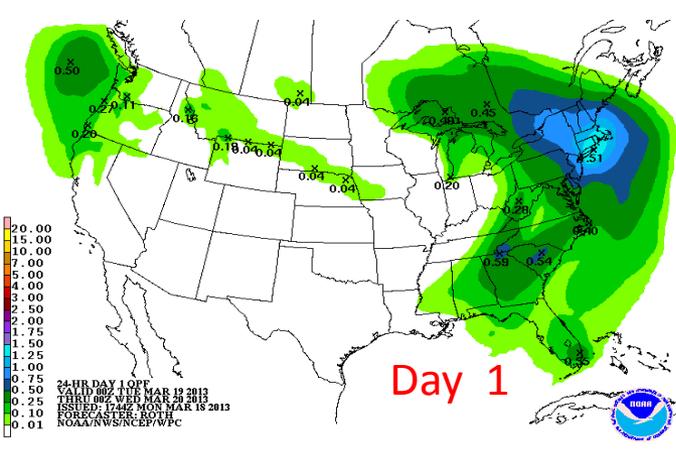
NOVEMBER FORECAST

WATCH: Shopping Trip Turns

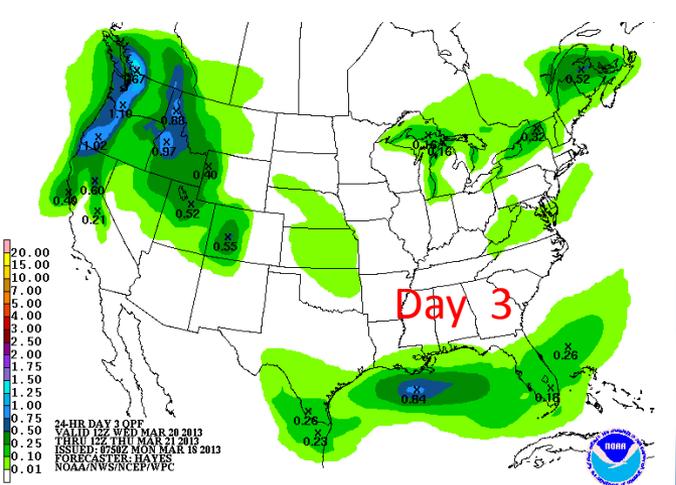
SHOCKING Hotspot for Great White...

My 10 Day Forecast Updated: Oct 21, 2013, 1:07pm EDT [Desktop App](#)

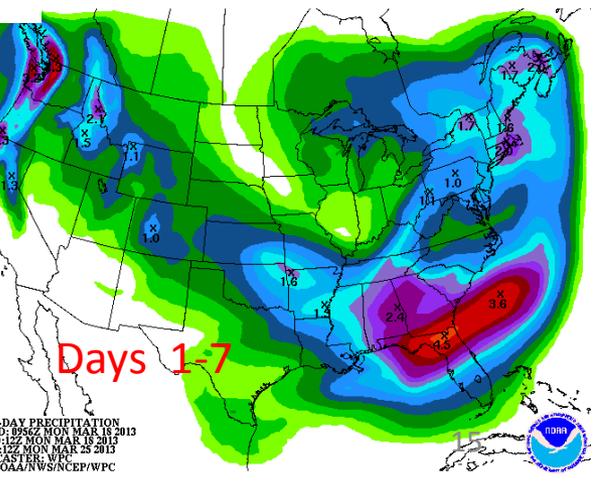
Today		66° 48°	CHANCE OF RAIN: 0%	WIND: S at 10 mph
Oct 21	Sunny			Details
Tue		65° 46°	CHANCE OF RAIN: 20%	WIND: W at 9 mph
Oct 22	Partly Cloudy			Details
Wed		55° 37°	CHANCE OF RAIN: 40%	WIND: NW at 8 mph
Oct 23	All Showers			Details
Thu		54° 36°	CHANCE OF RAIN: 20%	WIND: WNW at 12 mph
Oct 24	Partly Cloudy			Details
Fri		53° 35°	CHANCE OF RAIN: 0%	WIND: WNW at 13 mph
Oct 25	Partly Cloudy			Details
Sat		55° 40°	CHANCE OF RAIN: 0%	WIND: W at 9 mph
Oct 26	Mostly Cloudy			Details
Sun		57° 39°	CHANCE OF RAIN: 20%	WIND: SW at 9 mph
Oct 27	Partly Cloudy			Details
Mon		56° 41°	CHANCE OF RAIN: 0%	WIND: W at 9 mph
Oct 28	Sunny			Details



NCEP HPC's (Hydro
 Meteorological Prediction Ctr.)
 QPF fcsts. issued every day.



Issued Every day!
 Revised the Next day!



In the following, we show:

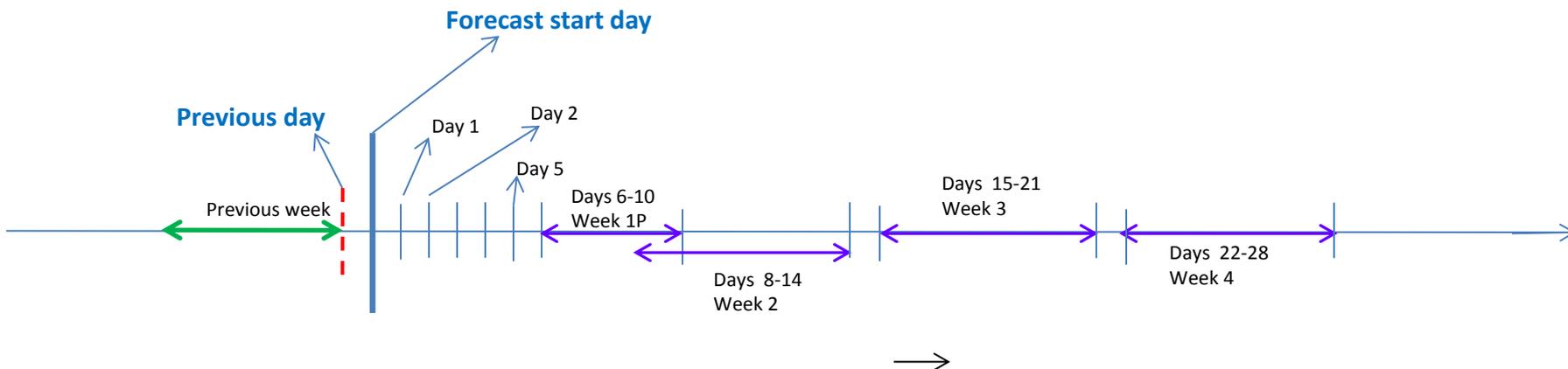
Climatological annual cycle of 1999-2010 mean Forecasts of:

Wk 1P(days 6-10), Wk 2, (shown for comparison only)

Wk 3, & Wk 4 Fcst. skill (correlation)

for 2 regions: GLOBE & Near US.

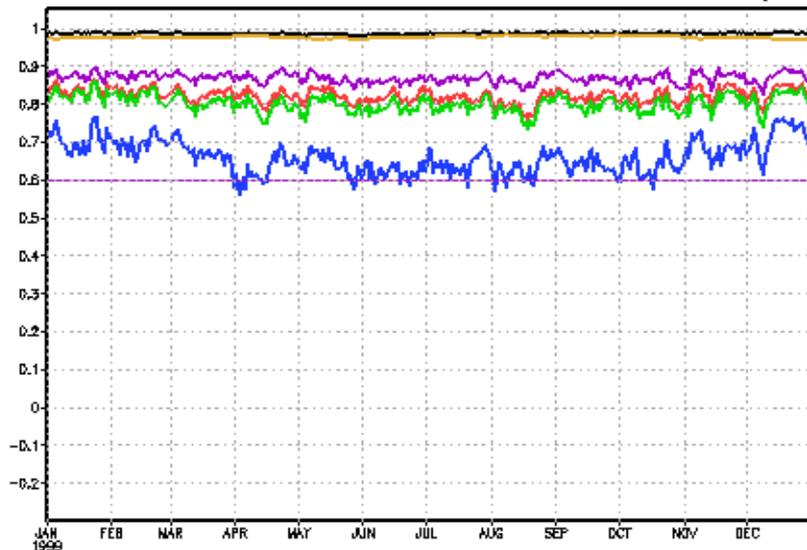
First we show for H500,
then for T2m &
then for Precip



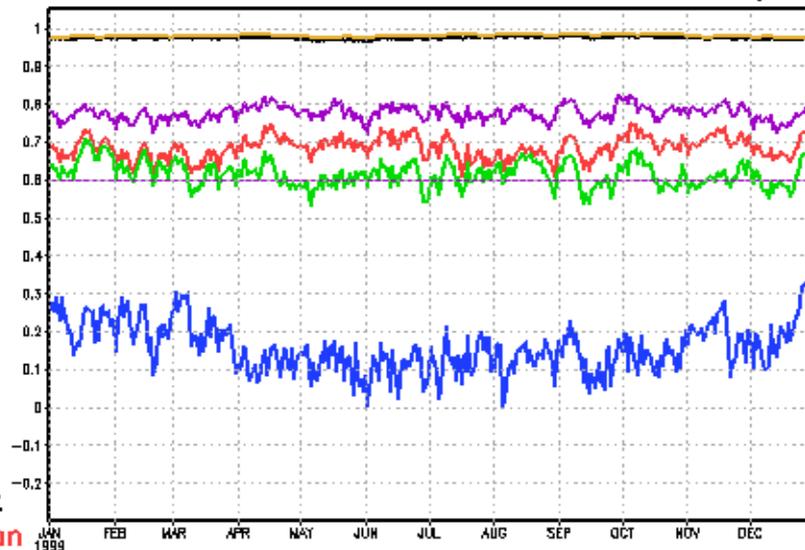
Instead using anomaly correlations (in the way used in earlier slides), let's consider:

- **Full (Field) Fcst:** Correlation in the full fields (no anomalies are computed) between corresponding CFSRR forecasts and CFSR analyses.
- **-7dy Mean:** Anomaly correlation between the forecast and verifying analyses where anomalies are computed as departures from the previous '7 day means' immediately preceding the forecast day.
- **-7dy Mean – Clim.Tendency:** Same as above, except that the climatological tendency part (for eg. From prev. week to wk3/wk4) is also subtracted before computing correlation.
- **Traditional. Climo:** The traditional anomaly correlation – where anomaly (be it for 1/2/5 day or for weeks 1p/2/3/4) is computed as departure from **'Traditional'** long term mean (here 1999-2010) climo.
- **Null(climo) Fcst:** Climatology is used as forecast. Correlation in the full fields (no anomalies are computed) between corresponding climo (as fcst) and CFSR analyses.
- **-1dy Mean:** Anomaly correlation between the forecast and verifying analyses where anomalies are computed as departures from the 'previous day' means immediately preceding the forecast day.

H500: GLOB: WK 1P FCST skill CLIMO: 6 diff ways



H500: GLOB: WK 3 FCST skill CLIMO: 6 diff ways



Full fcst

-7dy Mean

-7dy Mean -Clim.tendency

-Trad.Climo

Null(climo) fcst

-1dy mean

H500

Globe

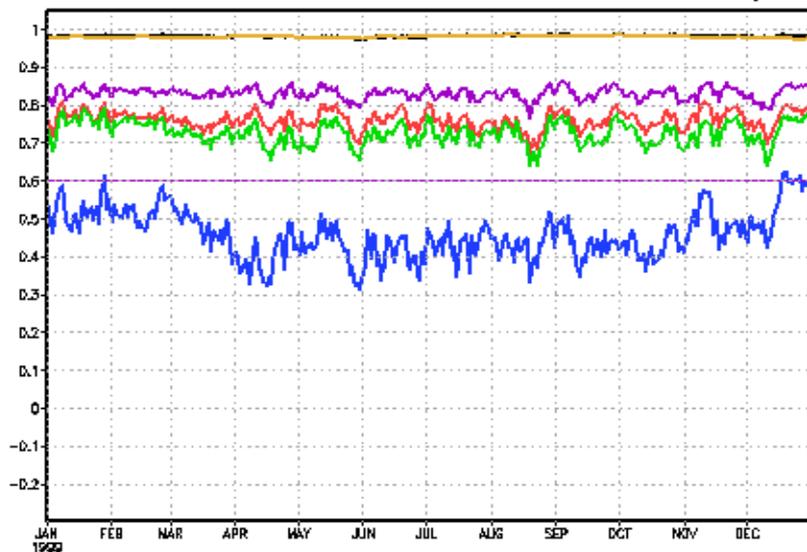
Wk 1P

Wk 2

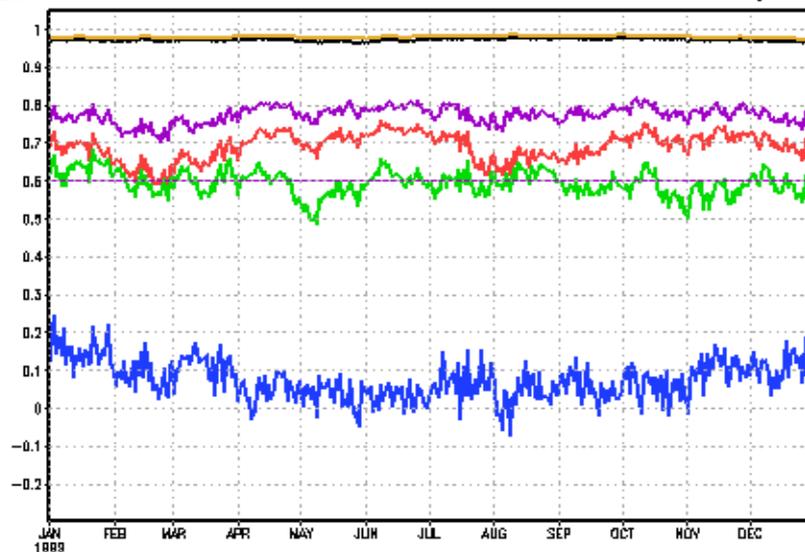
Wk 3

Wk 4

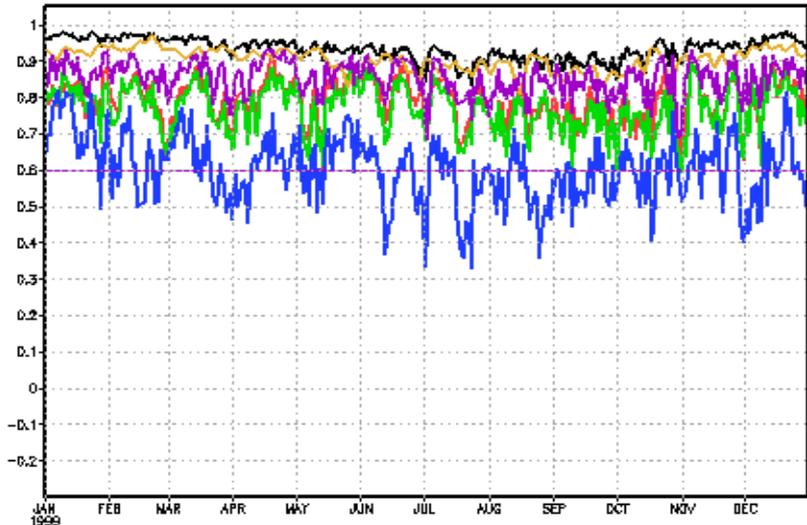
H500: GLOB: WK 2 FCST skill CLIMO: 6 diff ways



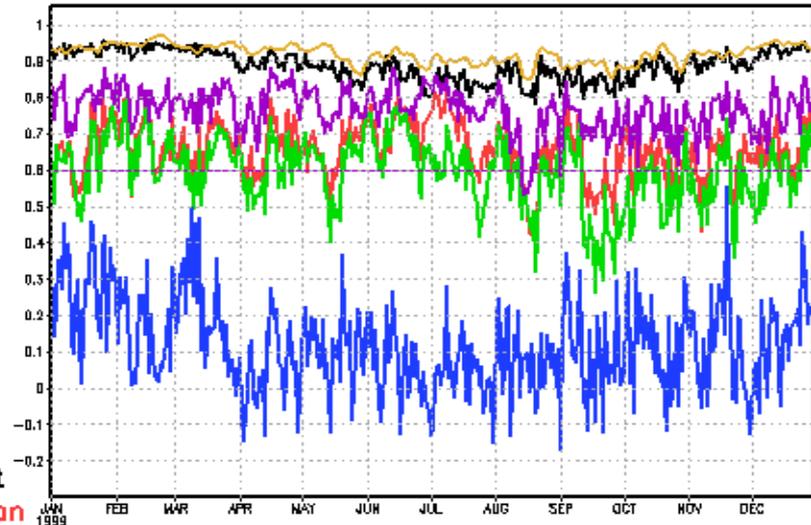
H500: GLOB: WK 4 FCST skill CLIMO: 6 diff ways



H500: Near US: WK 1P FCST skill CLIMO: 6 diff ways



H500: Near US: WK 3 FCST skill CLIMO: 6 diff ways



Full fcst

-7dy Mean

-7dy Mean -Clim.tendency

-Trad.Climo

Null(climo) fcst

-1dy mean

H500

Near US

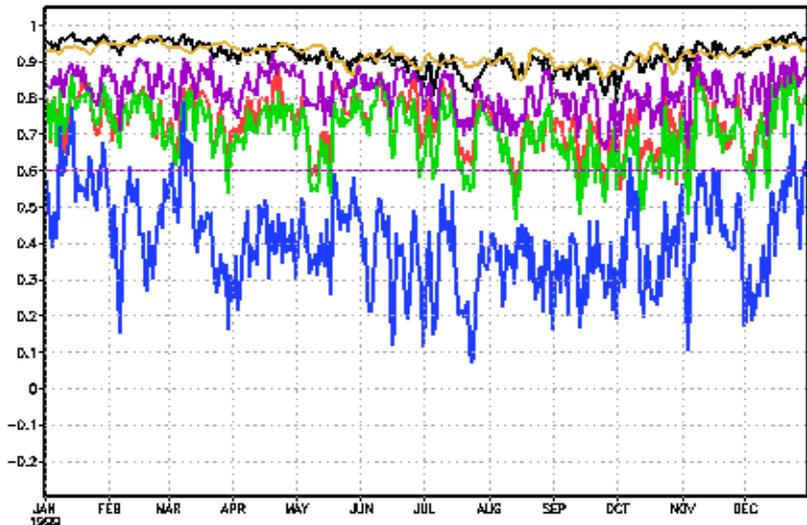
Wk 1P

Wk 2

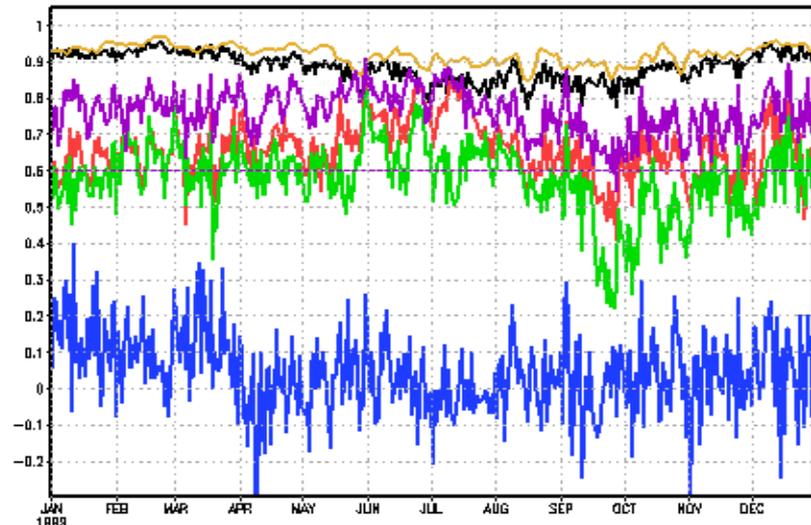
Wk 3

Wk 4

H500: Near US: WK 2 FCST skill CLIMO: 6 diff ways

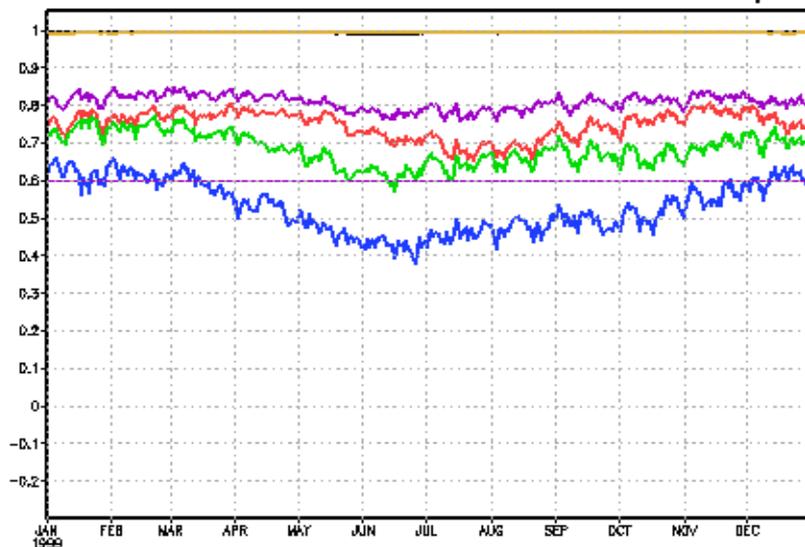


H500: Near US: WK 4 FCST skill CLIMO: 6 diff ways

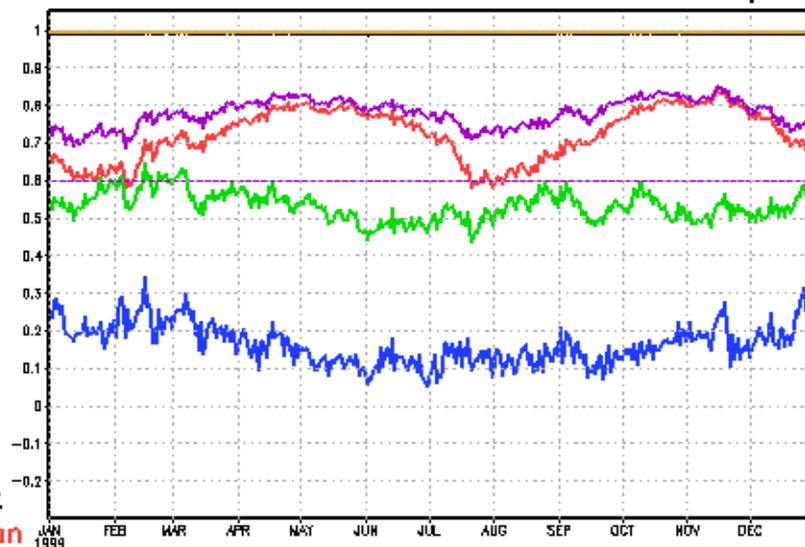


Muthuel Chelliah/CPC/NCEP/NWS

T2m: GLOB: WK 1P FCST skill CLIMO: 6 diff ways



T2m: GLOB: WK 3 FCST skill CLIMO: 6 diff ways



Full fcst

-7dy Mean

-Clim.tendency

-Trad.Climo

Null(climo) fcst

-1dy Mean

T 2m.

Globe

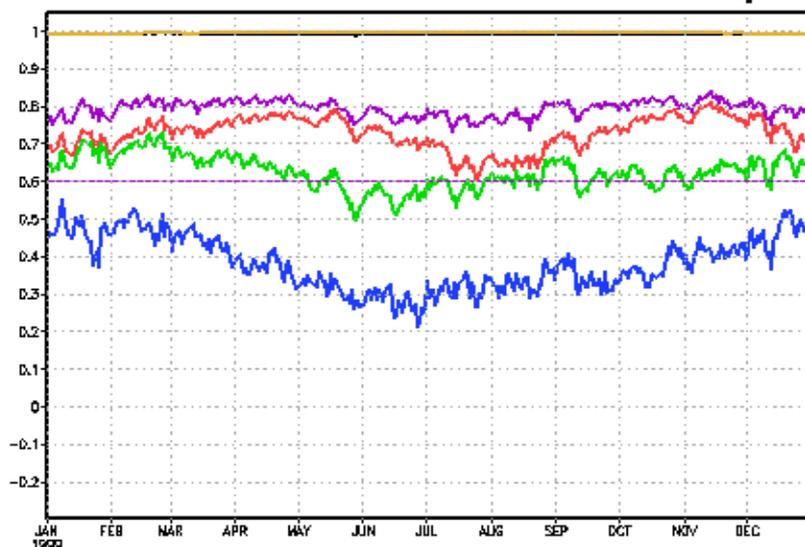
Wk 1P

Wk 2

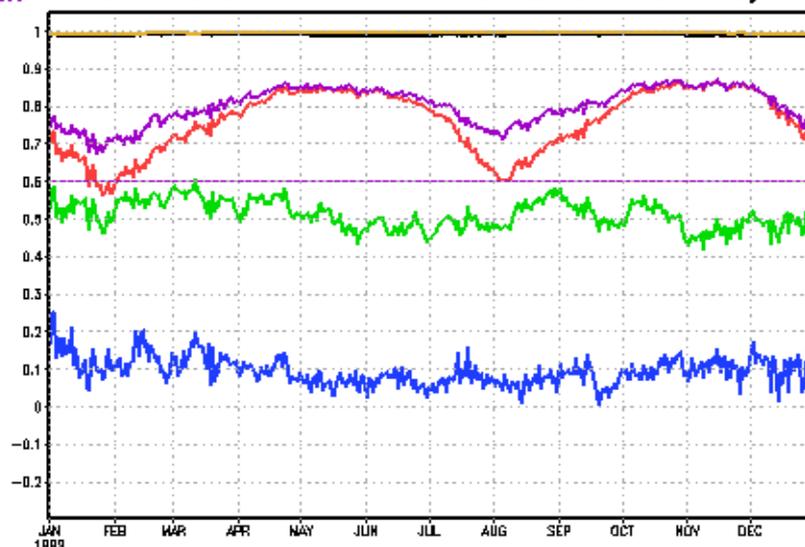
Wk 3

Wk 4

T2m: GLOB: WK 2 FCST skill CLIMO: 6 diff ways

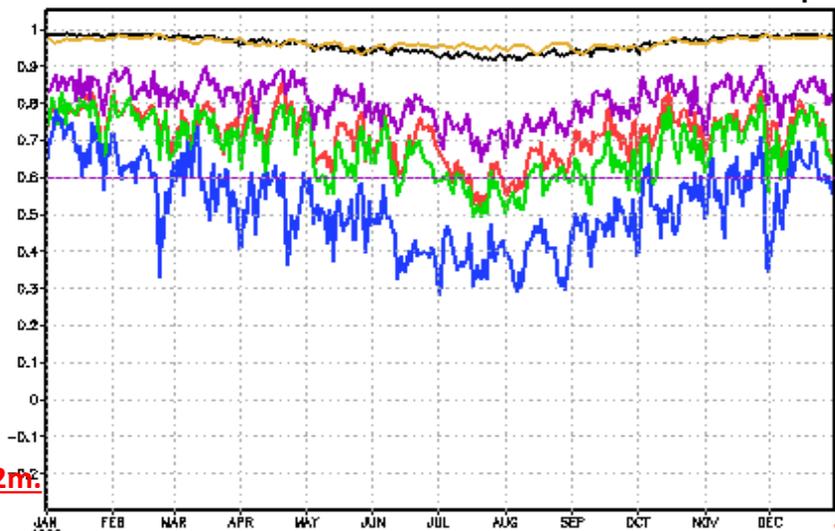


T2m: GLOB: WK 4 FCST skill CLIMO: 6 diff ways

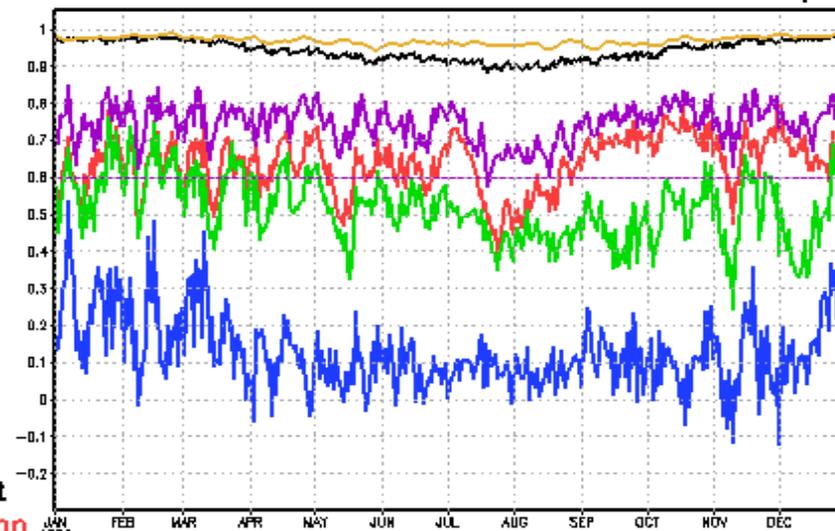


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T2m: Near US: WK 1P FCST skill CLIMO: 6 diff ways



T2m: Near US: WK 3 FCST skill CLIMO: 6 diff ways



T2m:

Near US

Full fcst

-7dy Mean

-7dy Mean -Clim.tendency

-Trad.Climo

Null(climo) fcst

-1dy Mean

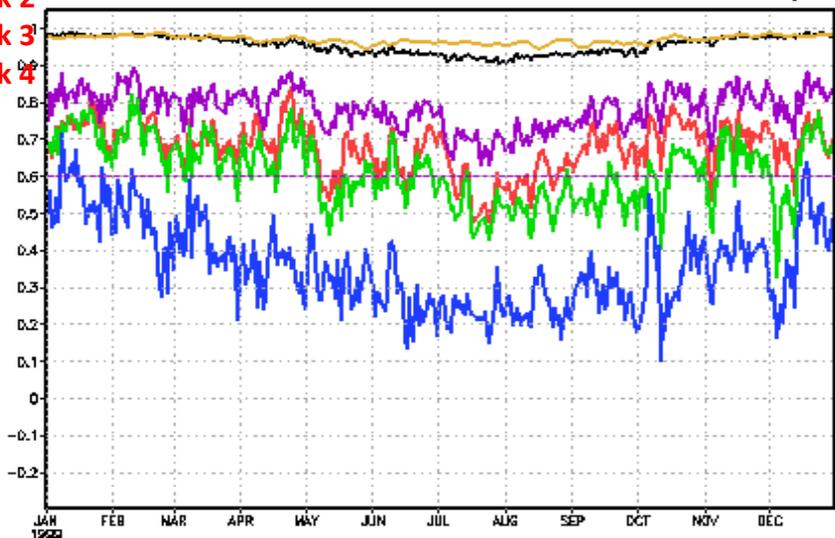
Wk 1P

Wk 2

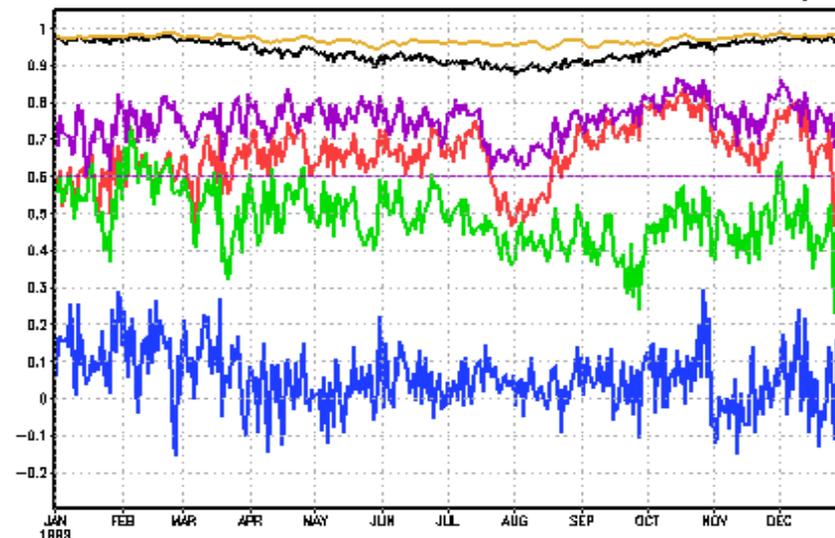
Wk 3

Wk 4

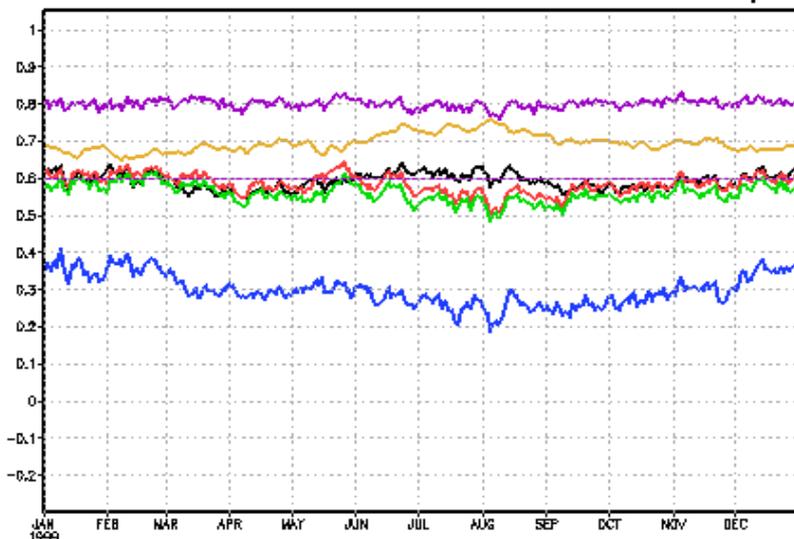
T2m: Near US: WK 2 FCST skill CLIMO: 6 diff ways



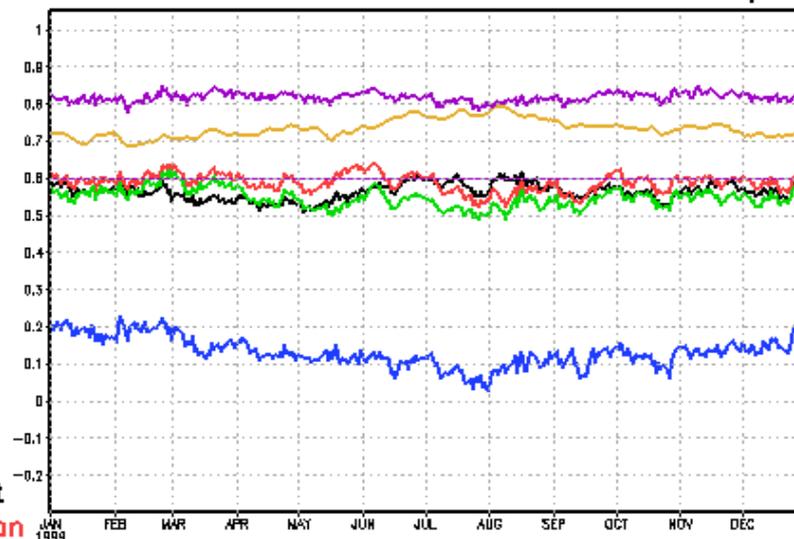
T2m: Near US: WK 4 FCST skill CLIMO: 6 diff ways



Prate: GLOB: WK 1P FCST skill CLIMO: 6 diff ways



Prate: GLOB: WK 3 FCST skill CLIMO: 6 diff ways



Full fcst

-7dy Mean

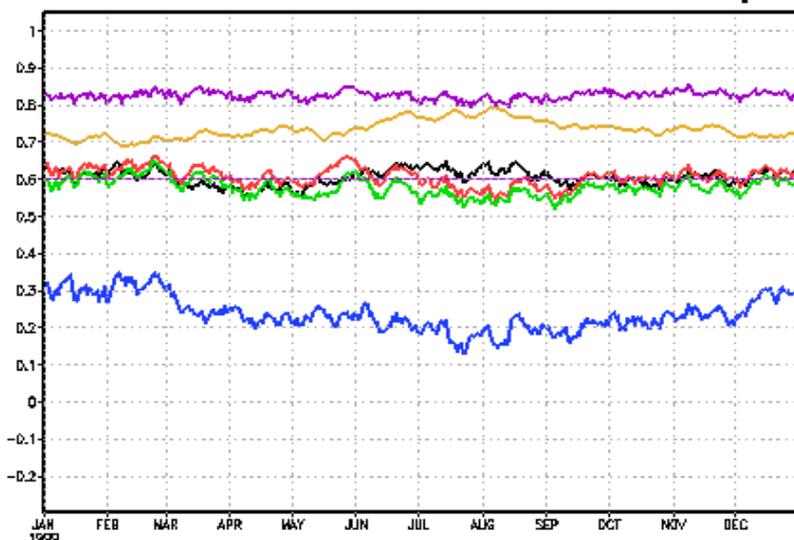
-7dy Mean -Clim.tendency

-Trad.Climo

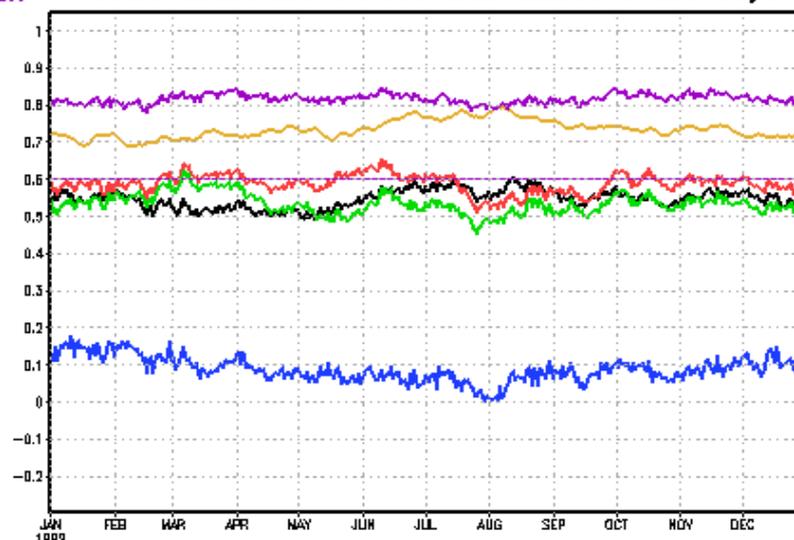
Null(climo) fcst

-1dy Mean

Prate: GLOB: WK 2 FCST skill CLIMO: 6 diff ways



Prate: GLOB: WK 4 FCST skill CLIMO: 6 diff ways



Prate

Globe

Wk 1P

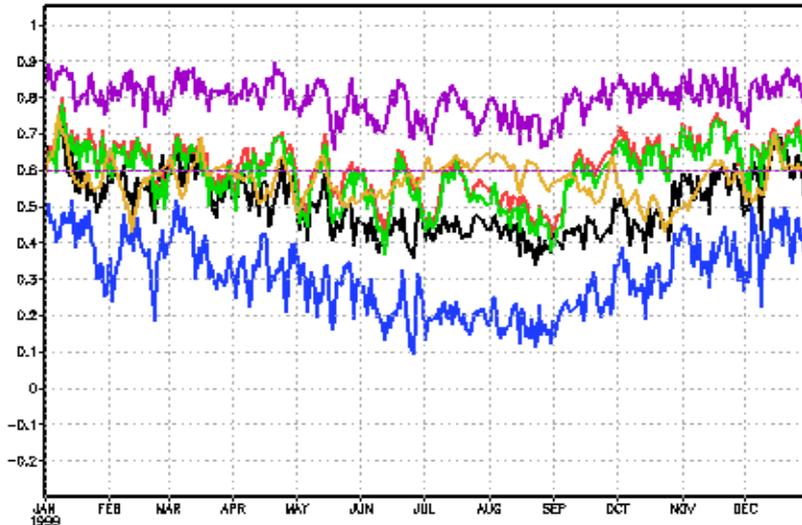
Wk 2

Wk 3

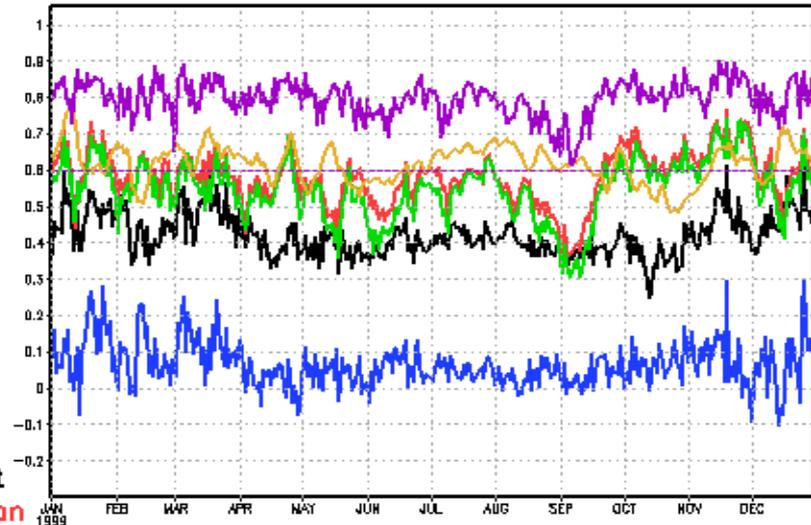
Wk 4

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Prate: Near US: WK 1P FCST skill CLIMO: 6 diff ways



Prate: Near US: WK 3 FCST skill CLIMO: 6 diff ways



Full fcst

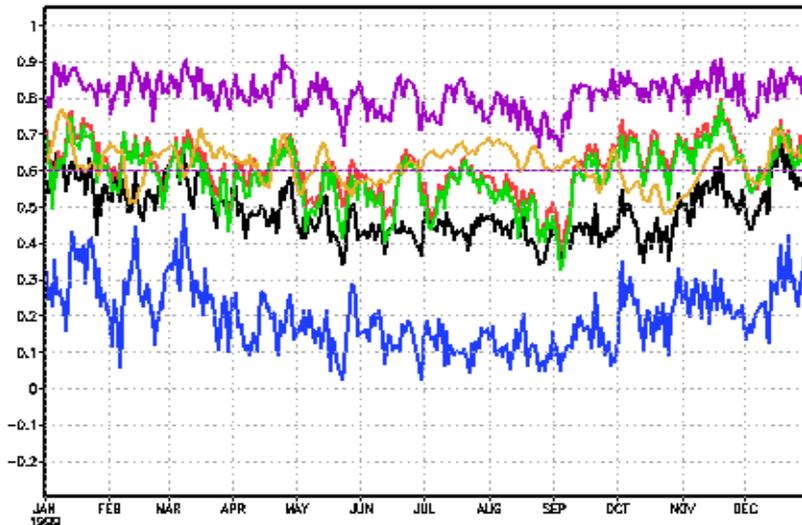
-7dy Mean -Clim.tendency

-Trad.Climo

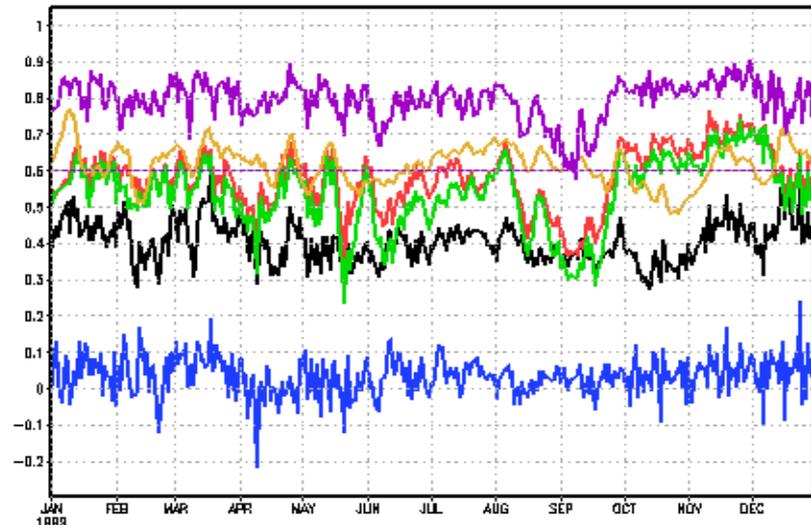
Null(climo) fcst

-1dy Mean

Prate: Near US: WK 2 FCST skill CLIMO: 6 diff ways



Prate: Near US: WK 4 FCST skill CLIMO: 6 diff ways



Prate

Near US

Wk 1P

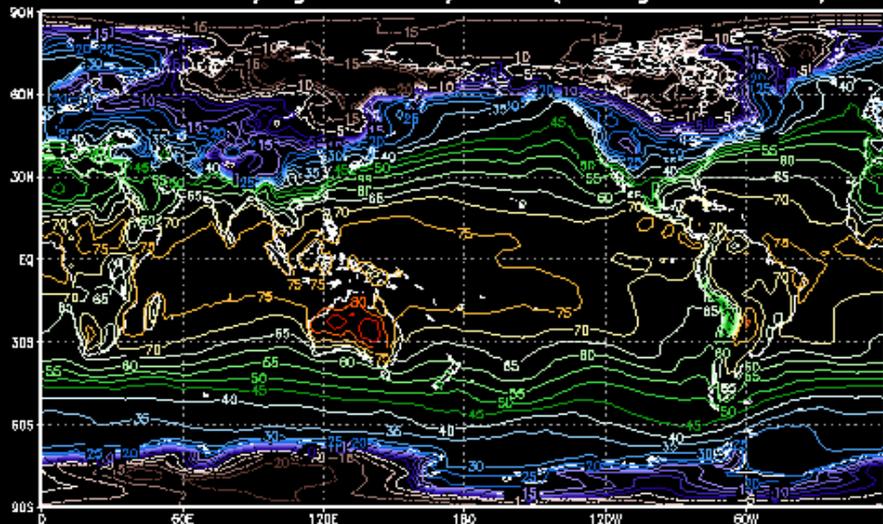
Wk 2

Wk 3

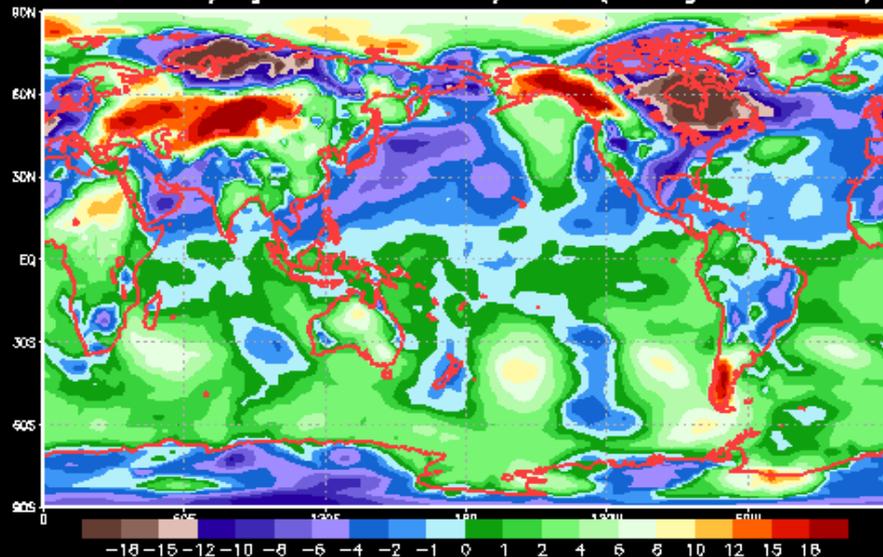
Wk 4

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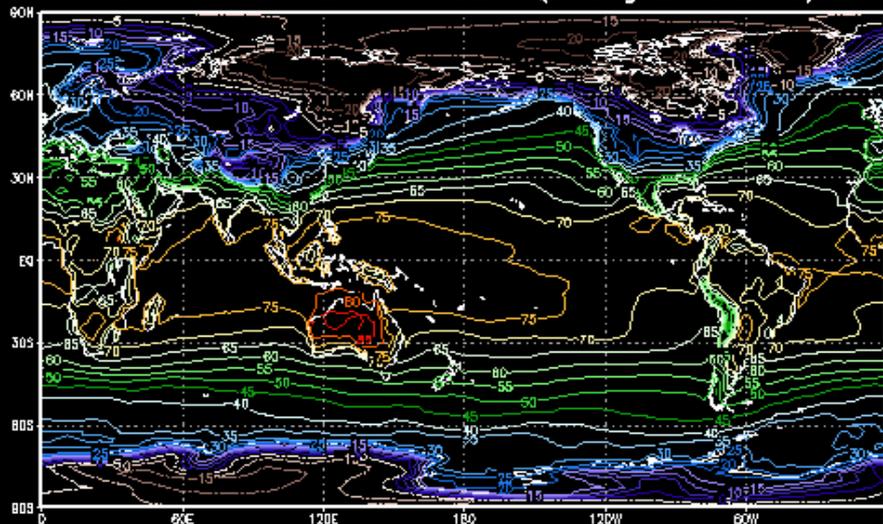
CFSR: Verifying T2m 7day mean(ending 21Jan2013)



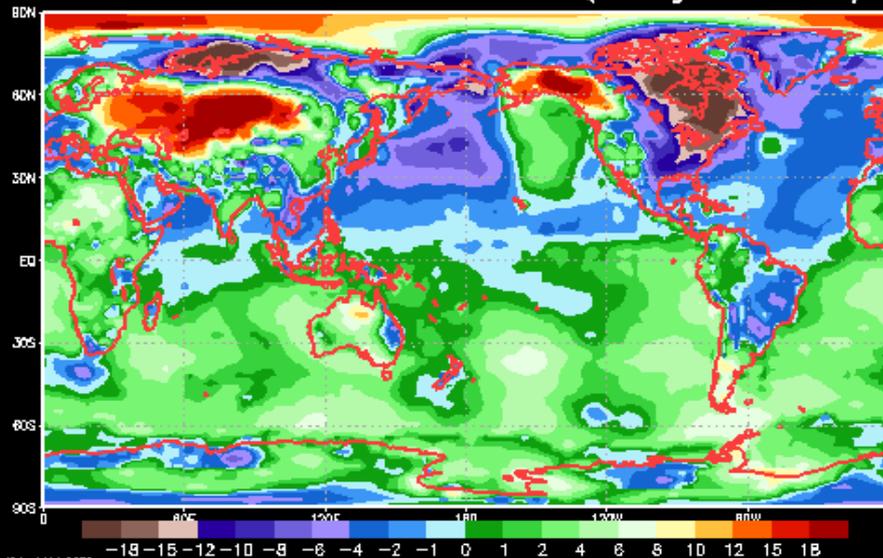
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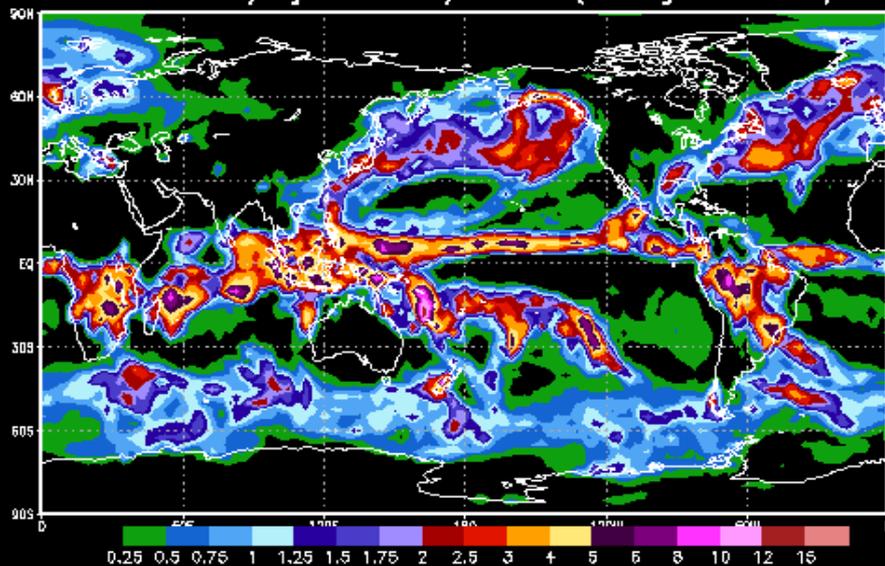
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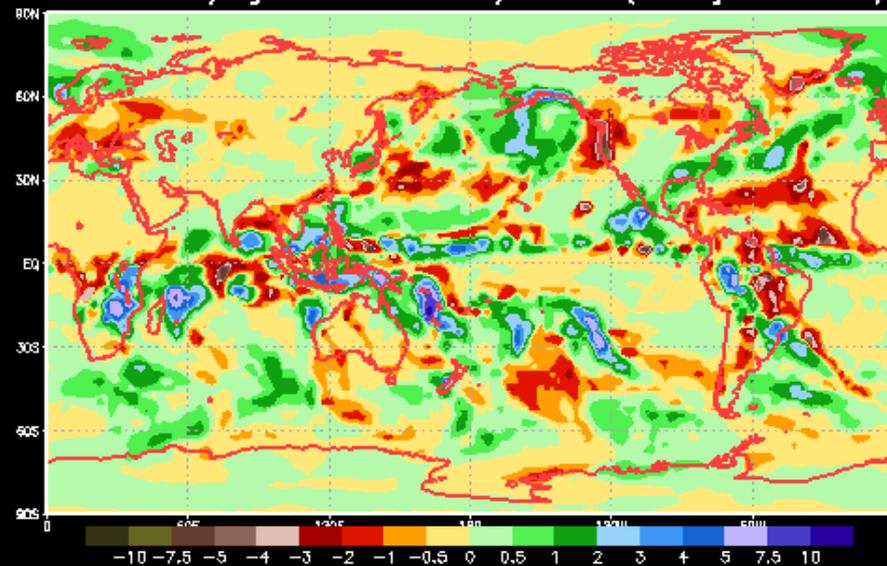
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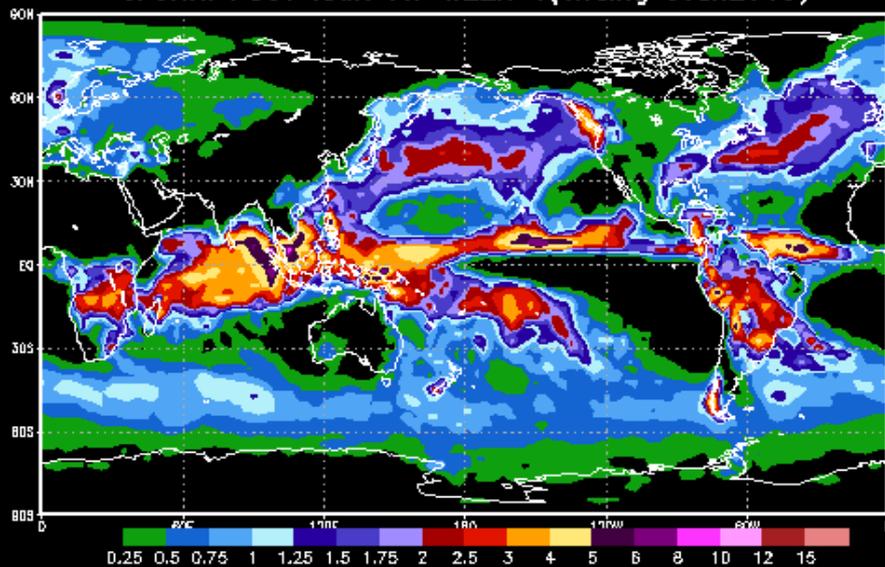
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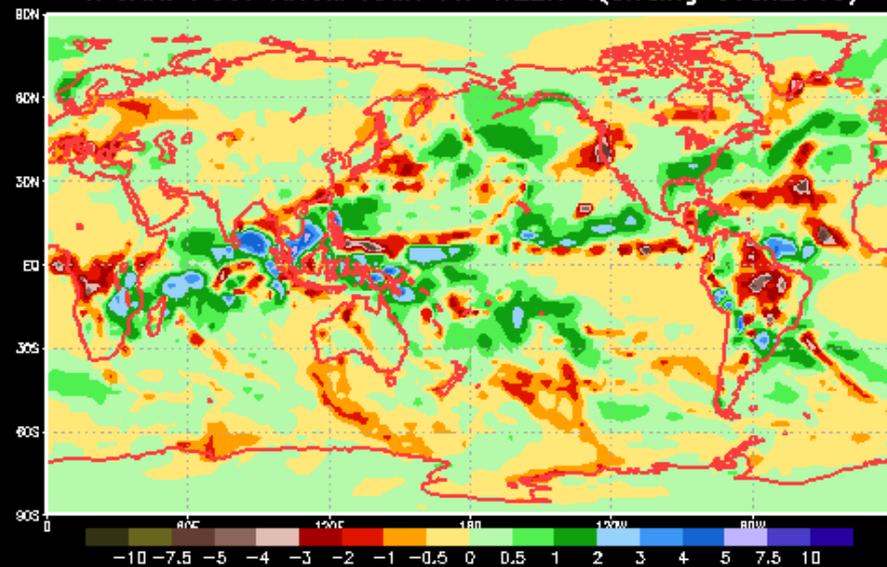
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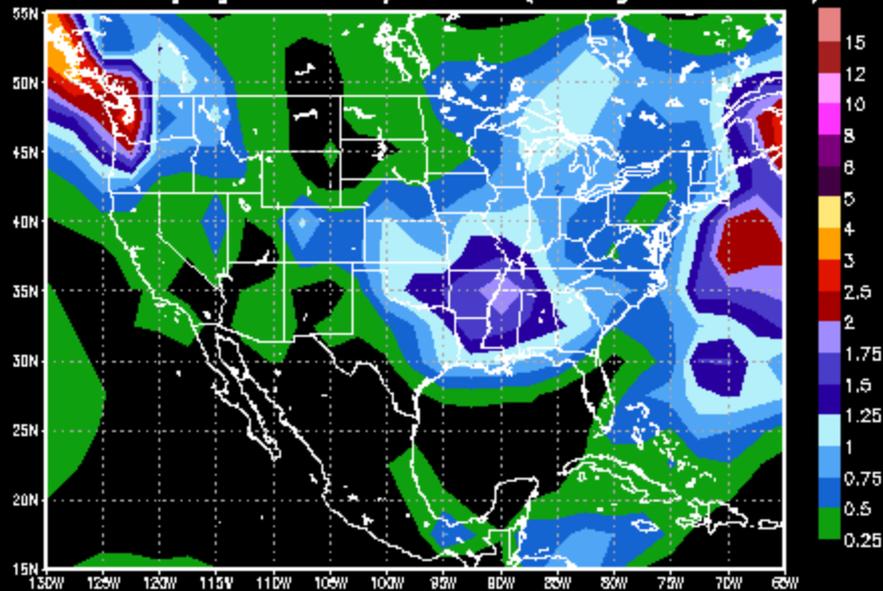
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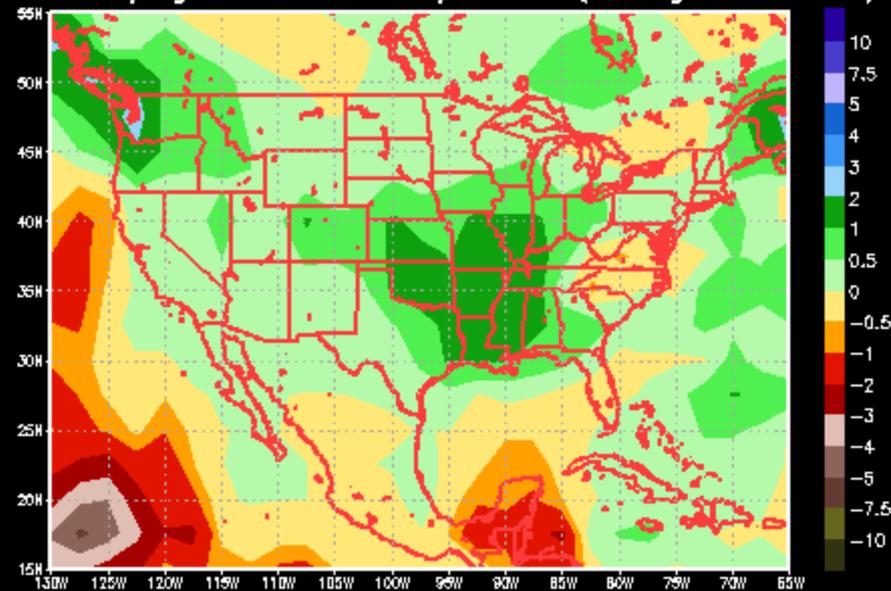
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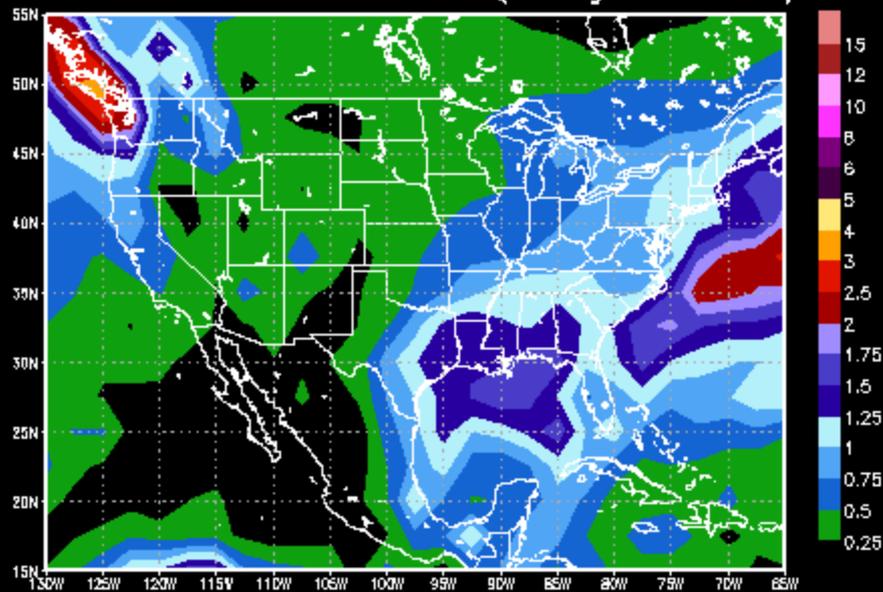
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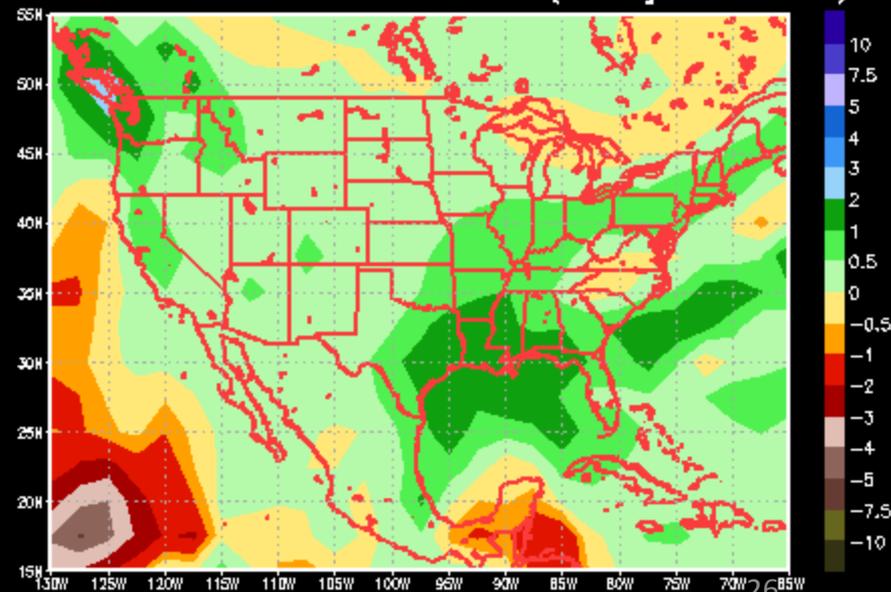
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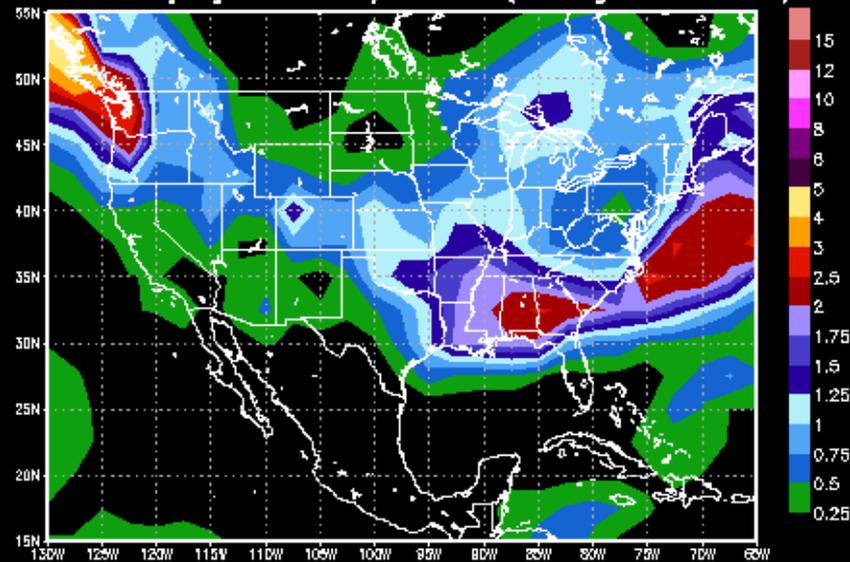
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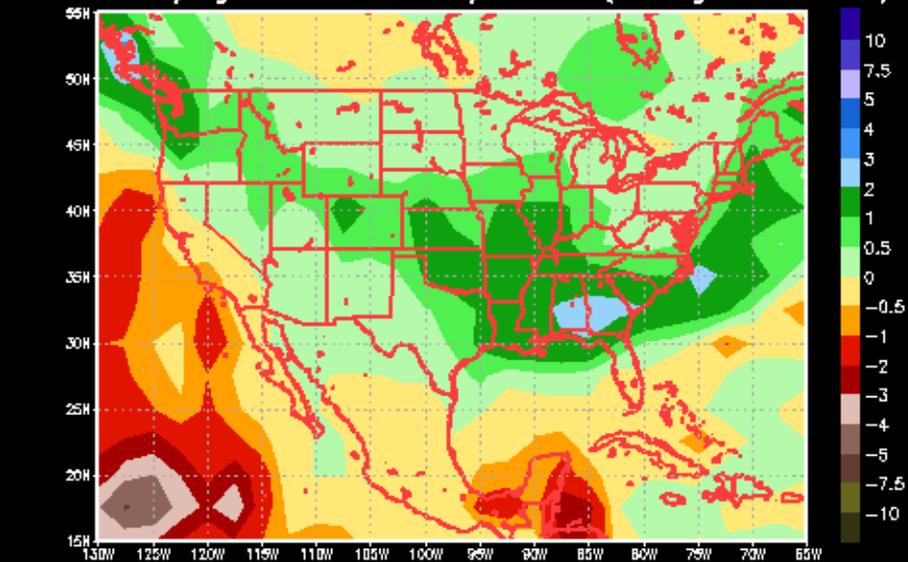
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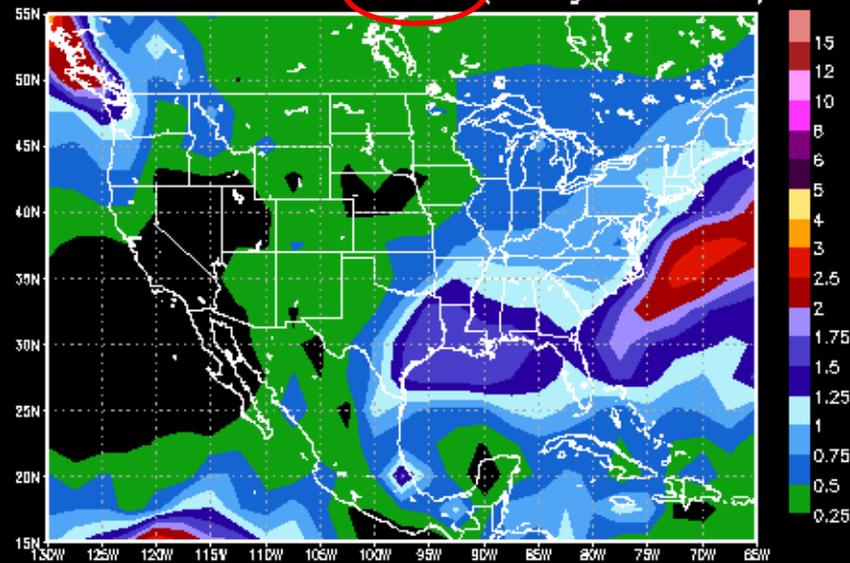
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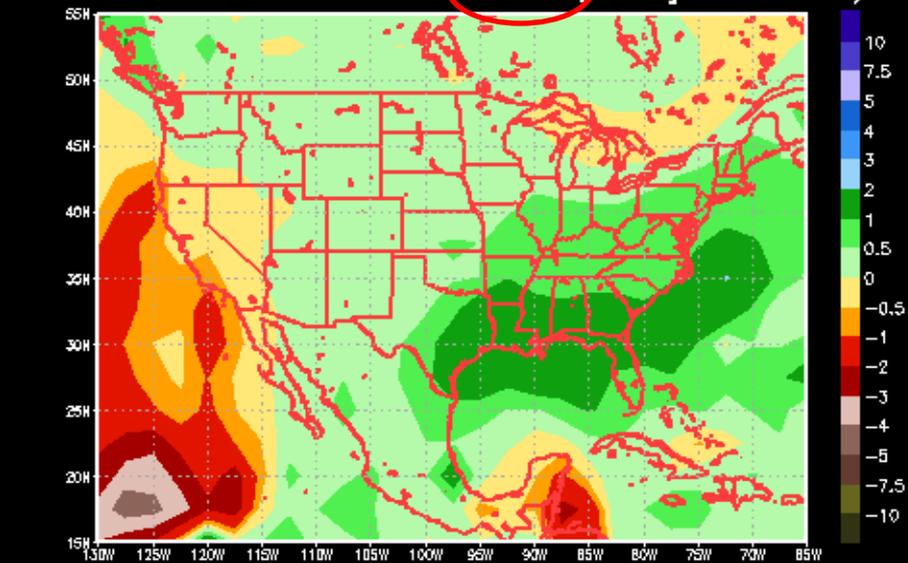
CFSR: Verifying ANOM RAIN 7day accum.(ending 24Feb2013)



CFSRR: FCST RAIN for WEEK 4(ending 24Feb2013)



CFSRR: FCST ANOM RAIN for WEEK 4(ending 24Feb2013)



In summary:

- If we do not have an open mind and are not willing to think differently about how we treat forecasts in the weeks 3-4 time scale, then twenty years from now, I am not sure whether we will be in a different place than we are now...
- But if we are willing to explore producing forecasts, or at least some sort of 'guidance' for 'weeks 3 & 4' along the lines presented here, even on an 'experimental basis', and let the public be the judge of whether these "forecasts" are of 'any value' to them. (No need for expensive long-term hindcasts, or delays in model implementing model improvements) – I assume Industries and utility companies may have some sort of interest in these forecasts (some interest was already expressed!)
- I am making and updating in a 'real time' basis, and put these forecasts and recent skill scores in my personal website with appropriate caveats of course (as not "official", but experimental forecasts) at <http://www.cpc.ncep.noaa.gov/products/people/muthu/chek.cfsr.fcst/>
- A manuscript is under preparation.

The END 😊

Thanks for listening!

Any questions?