The International Multi-Model Ensemble at NCEP

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37th CDPW Workshop; October 25th, 2012

Project Overview

- Purpose: To prepare and make available bias-corrected numerical prediction guidances for CPC/NCEP particularly
- Routine collection and post-processing of seasonal forecasts from NCEP, ECMWF, MeteoFrance and UKMet Office
- Approach: Product generation and Verification procedures similar to NMME. Both NMME and IMME are mostly authomatized

IMME= CFS+ EUROSIP MODELS

	NCEP/CFSv2	ECMWF	UKMET	METF
Atmospheric Model	T126L64	Syst 4: T255L91	Glosea4 (120km) L85	T42L91 (T63-linear grid)
Ocean Model	MOM4 L40 0.25 deg Eq, 0.5 deg global	NEMO 0.3 deg Eq 1 deg global	NEMO L75 0.3 deg Eq 1 deg global	ORCA 0.5 deg Eq 2 deg global
Atmosphere/Ocean Coupling Frequency	30 minutes	3 hr	IN	IN
Land Model	NOAH 4-layer	IN	IN	IN
Sea Ice Model	3-layer interactive Seaice model	IN	IN	IN
Period of Hindcasts	1982-2010 (29 years)	1981-2010 (30 years)	1989-2002 (14 years)	1981-2009 (29 years)
Number of hindcast members	24(28)	15	12	11
Number of Leads	0-9 months	0-7 months	0-6 months	0-6 months

IN: Information needed

Monthly average variables

- SST, Precipitation rate and 2mT
- U,V wind components at 850hPa and 200hPa
- Some models with 850 Air Temperature

130 members

- Hindcasts:
  - Three models including CFS provide the full (12 months initial conditions) data
  - One model generates and delivers the hindcast in real-time

55 members

IMME and NMME

Product resolution	2.5x2.5 deg	1x1 deg
Lead time (months)	0 - 6	0 – 7
Hindcast	1982-2009	1982-2010 1-2 wks in advance
Ensemble Size	3 models (130 members) Potentially 4 (170m)	7 models (~100 members)
Generating institution	Operational Centers	NCEP, US Research Institutes

IMME hindcasts

	Years	Ens size	Start months	Lead (mo)
CFSv2	1982-2010	24-28	12	0-8
EC/s4	1981-2010	15	12	0-7
UK/s4	1989-2002	12	RT	0-6
MetF/s3	1981-2009	11	12	0-7

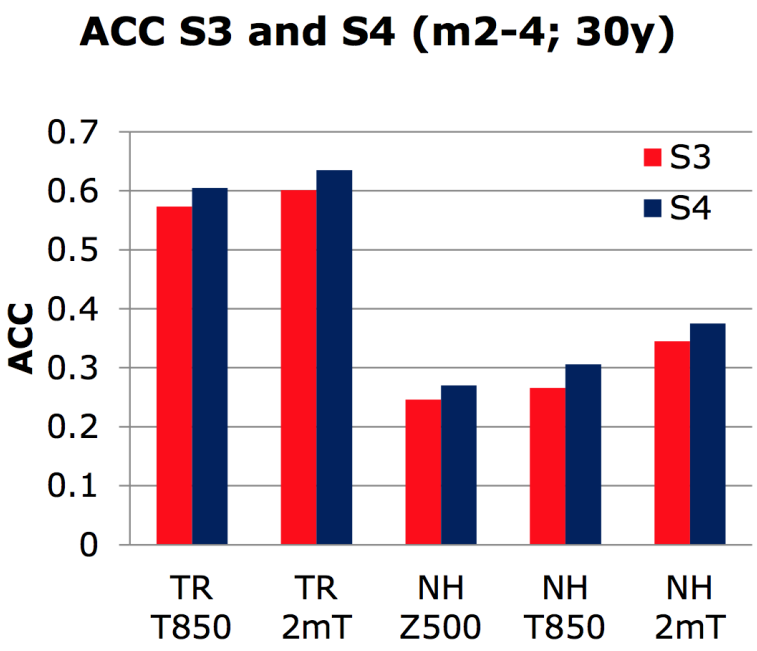
European forecast data

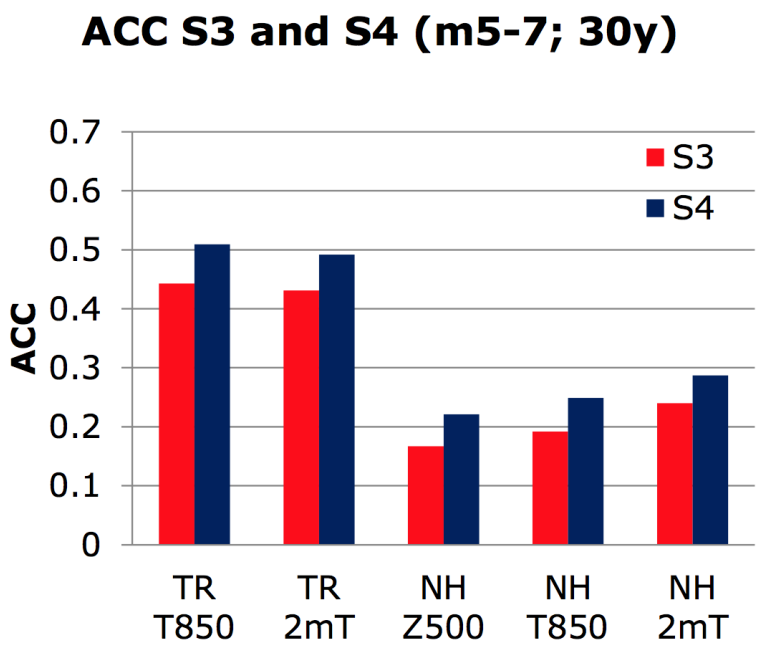
- Tim Stockdale (ECMWF) receives the data from UKMO and MeteoF, processes them into a suitable grib format, then sends them on to NCEP
- ECMWF System 4 was put into operations last December
- MeteoFrance expected to upgrade its forecast system this year
- UKMO started sending real-time hindcast three months ago

ECMWF System 4

Tropospheric scores

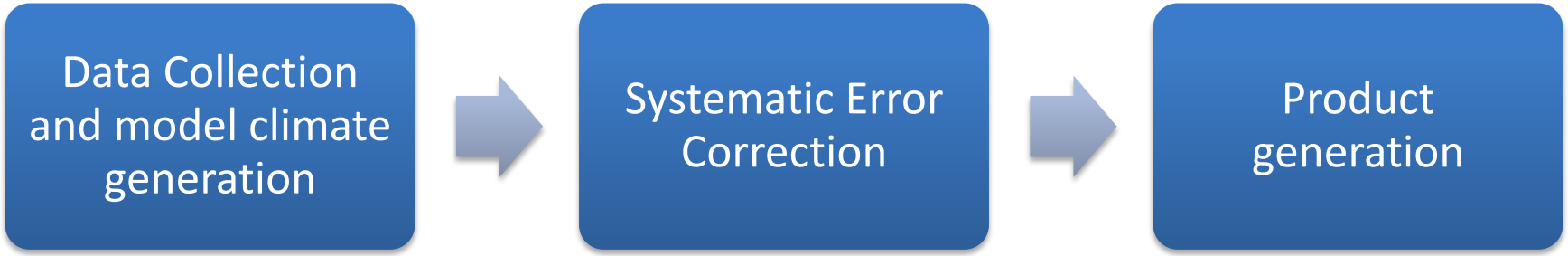
Spatially averaged grid-point temporal ACC





From: Tim Stockdale (ECMWF)

Monthly routine process

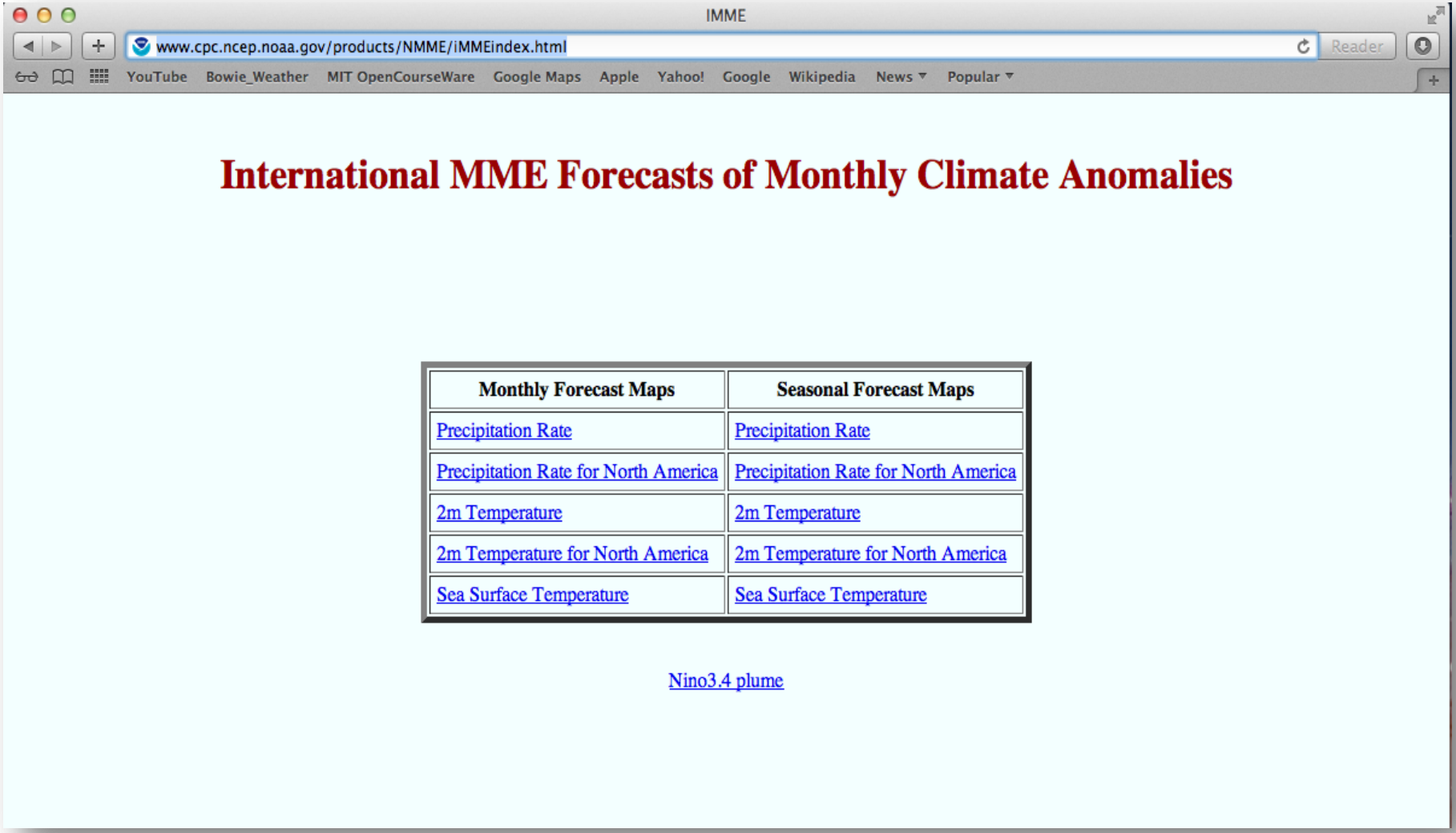


- Variables: SST, 2mT and PRATE
- CFS 40-mem lagged
- Model Climatology: Average of 30yrs hindcast data for the current initial month

- Model climate is removed
- No additional corrections
- Skill masks

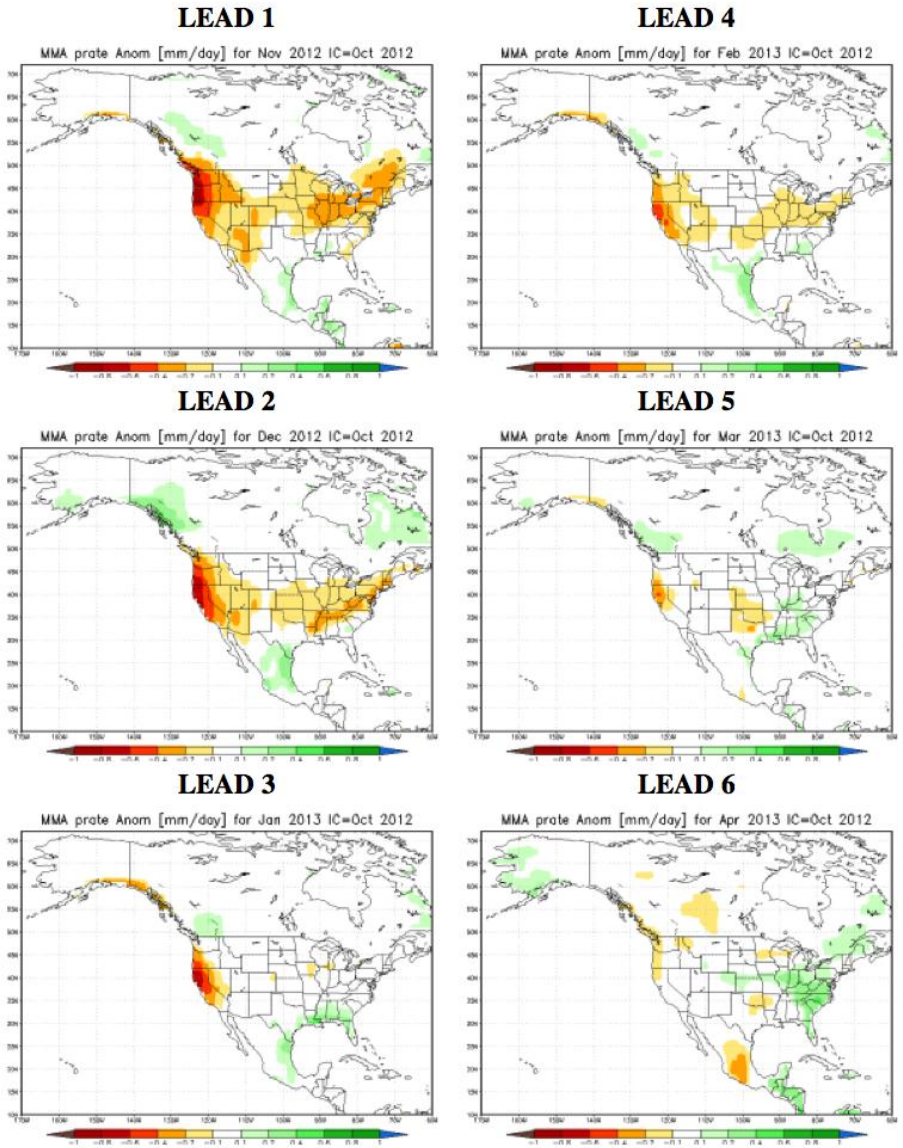
- Monthly and seasonal anomaly forecast maps
- Nino 3.4 Plume

Products Website



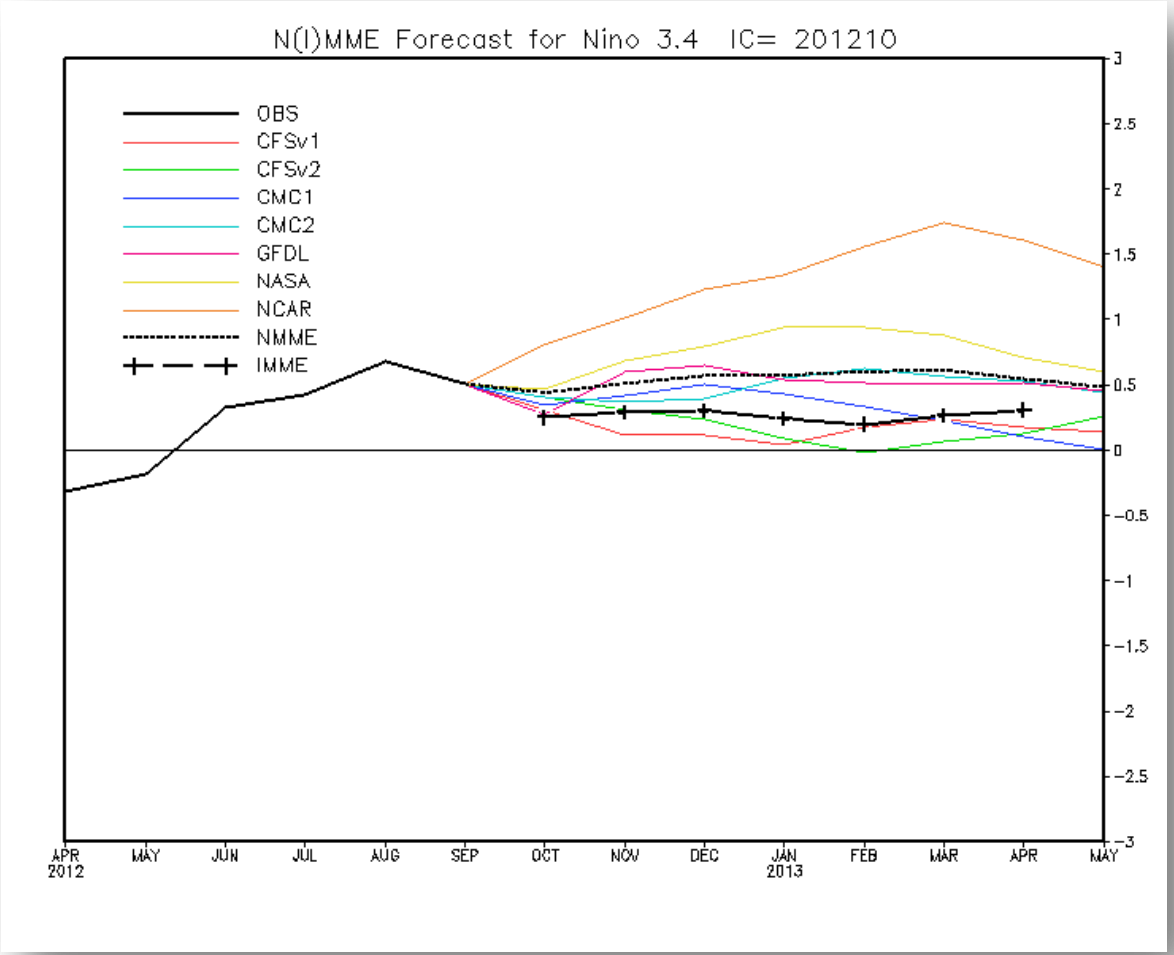
- As per ECMWF-NCEP agreement, only combined model products are available to the public
- APCC seasonal project also provide these data along with models from other centers

IMME prate_us forecast

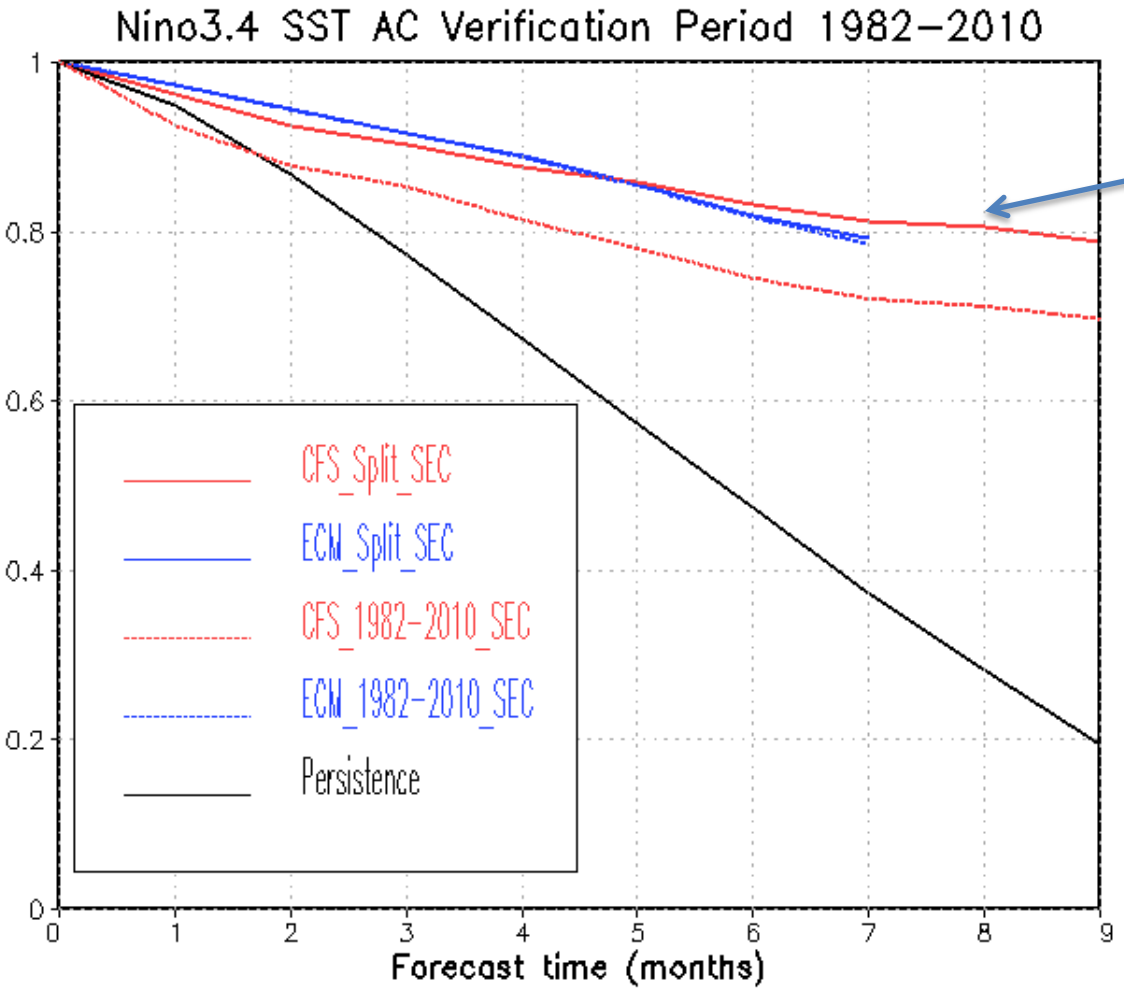


- Same format as NMME
- Products are interpolated to 1x1 resolution to depict important features over land

ENSO Plume


N(I)MME Forecast for Nino 3.4 IC= 201210
OBS
CFSv1
CFSv2
CMC1
CMC2
GFDL
NASA
NCAR
NMME
IMME
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
APR 2012
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
JAN 2013
FEB
MAR
APR
MAY

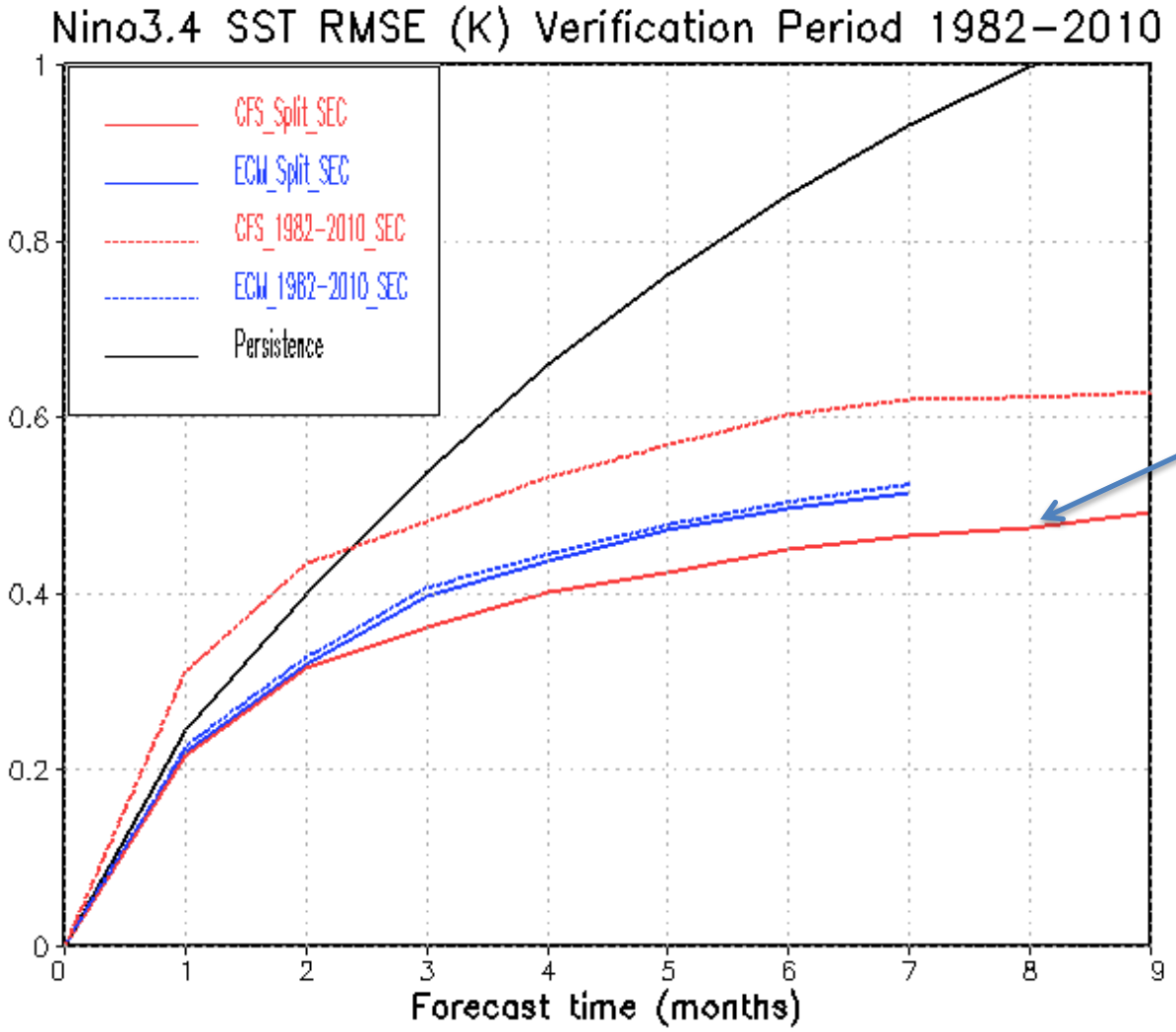
CFS and EC System 4



Split model climate

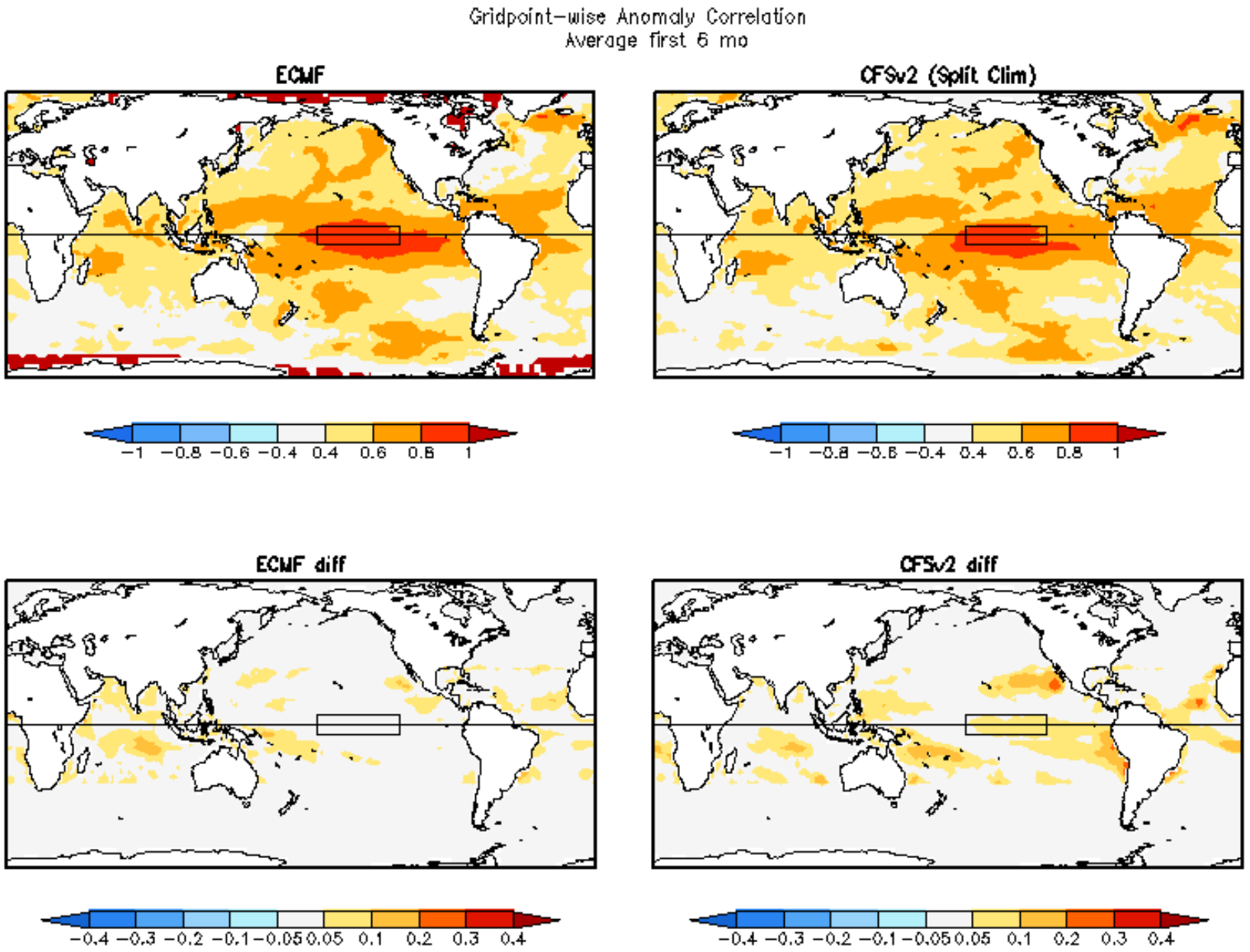
Useful skill out to 8 months for Nino 3.4 Index

CFS and EC System 4



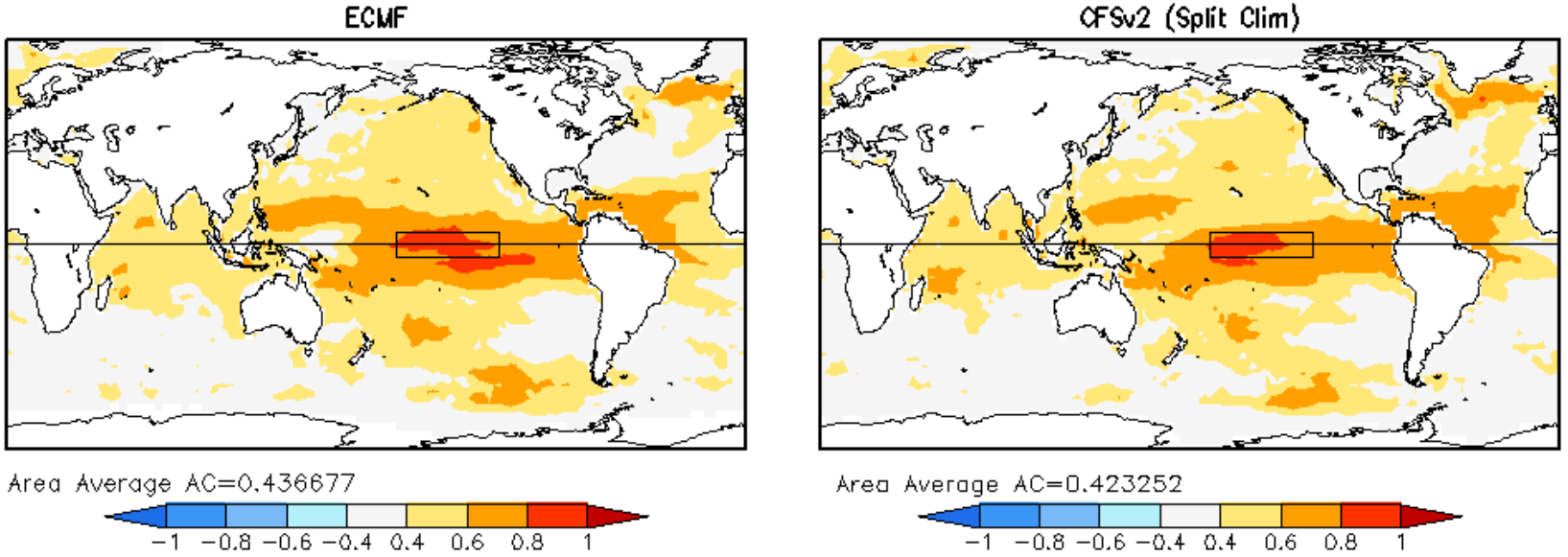
Split model climate

Effect of Split model climate (30S to 30N) on AC

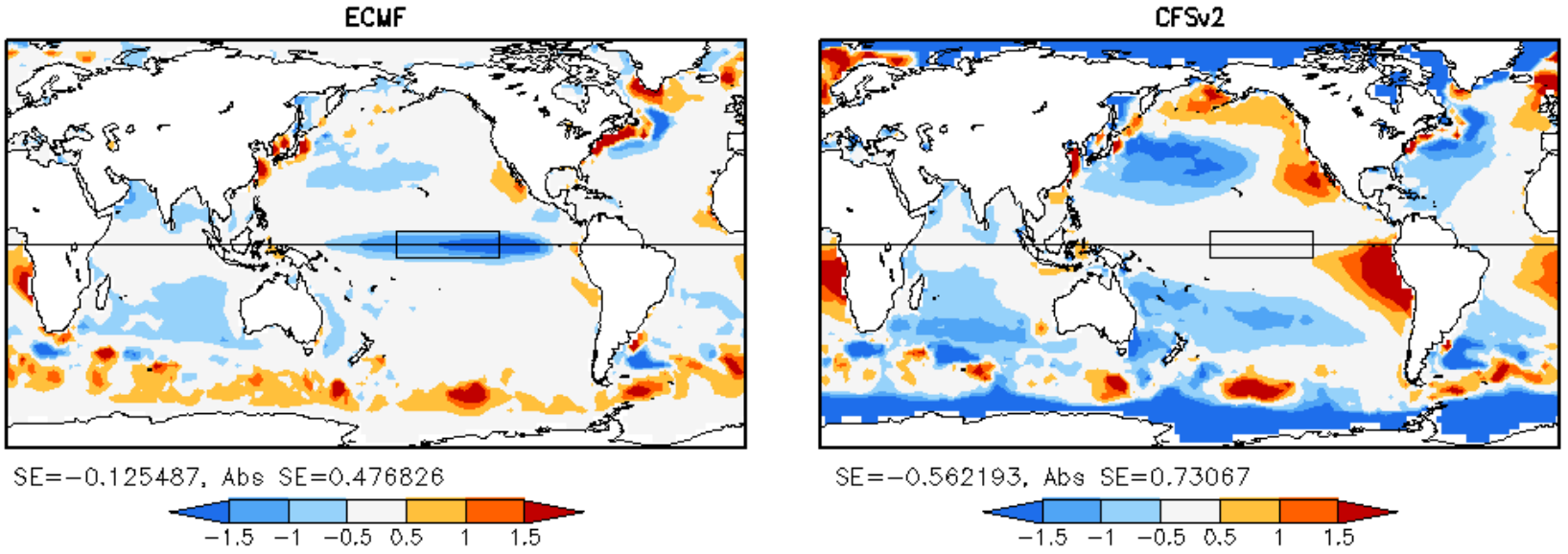


Lead 0 excluded

All initial months, all leads average
Gridpoint–wise Anomaly Correlation

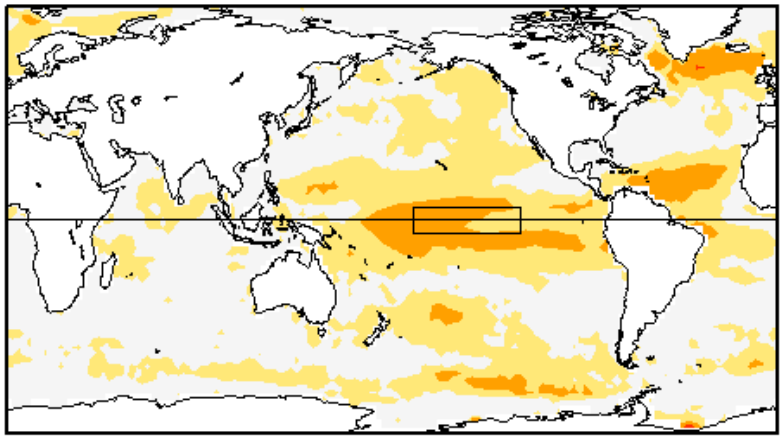


Systematic Error [K]



All initial months, all leads average
Gridpoint–wise Anomaly Correlation

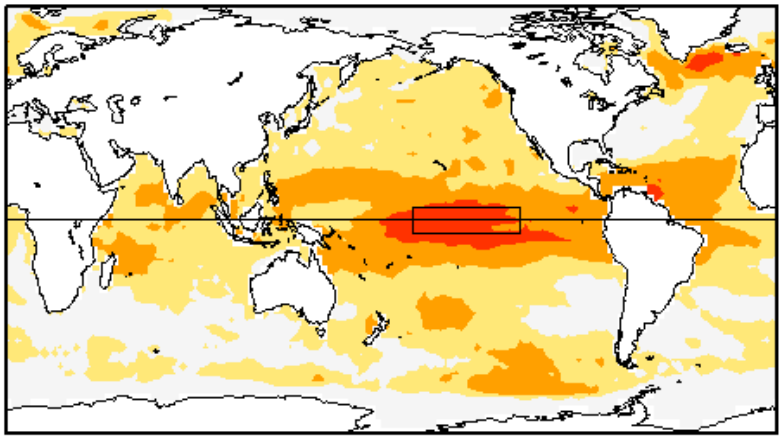
PERS



Area Average AC=0.392184

−1 −0.8 −0.6 −0.4 0.4 0.6 0.8 1

MME Average (Split Clim)

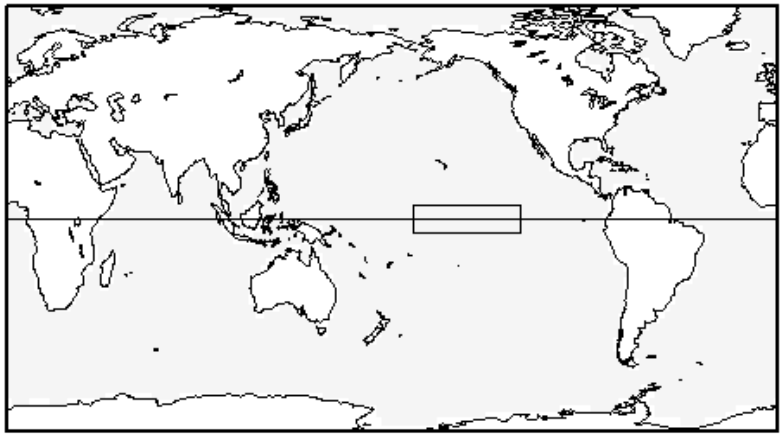


Area Average AC=0.493145

−1 −0.8 −0.6 −0.4 0.4 0.6 0.8 1

Systematic Error [K]

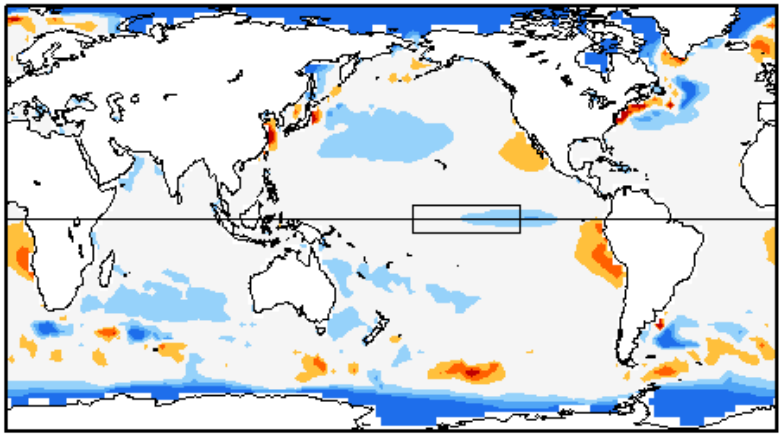
PERS



SE=−0.00281714, Abs SE=0.00718846

−1.5 −1 −0.5 0.5 1 1.5

MME Average

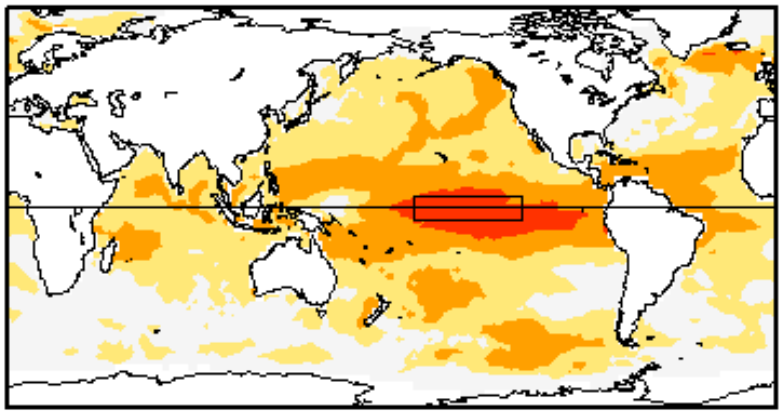


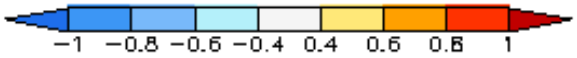
SE=−0.25248, Abs SE=0.364789

−1.5 −1 −0.5 0.5 1 1.5

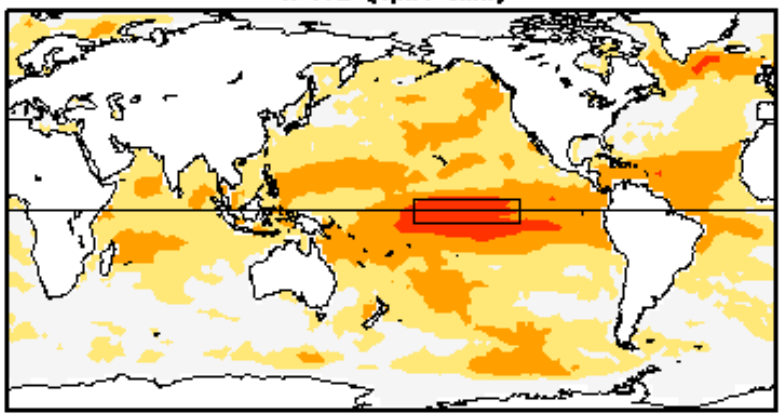
Gridpoint-wise Anomaly Correlation
Average first 6 mo

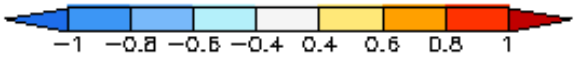
ECMF



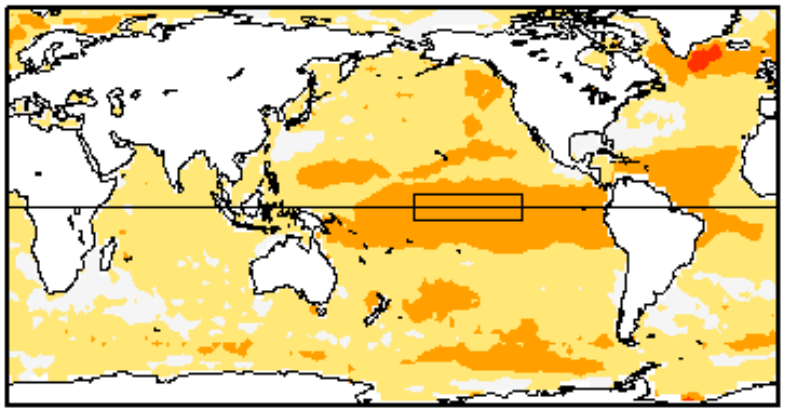


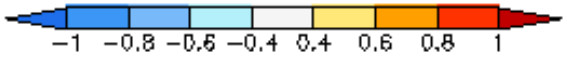
CFSv2 (Split Clim)



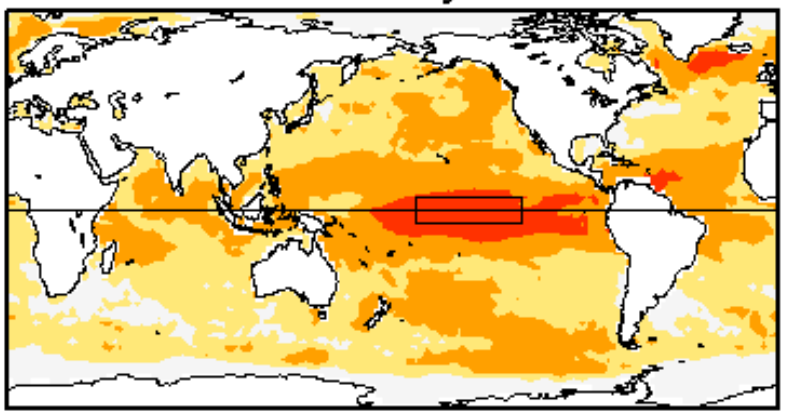


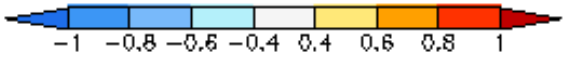
Persistence



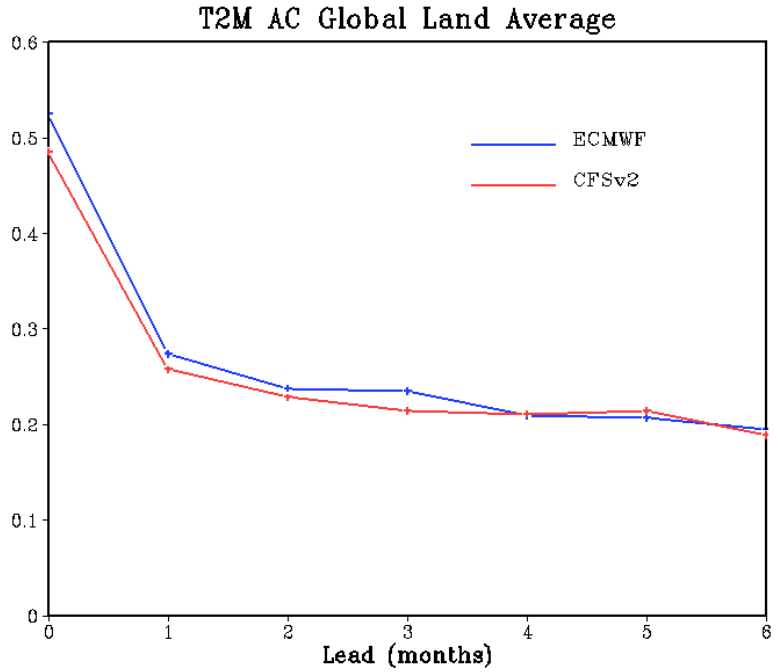


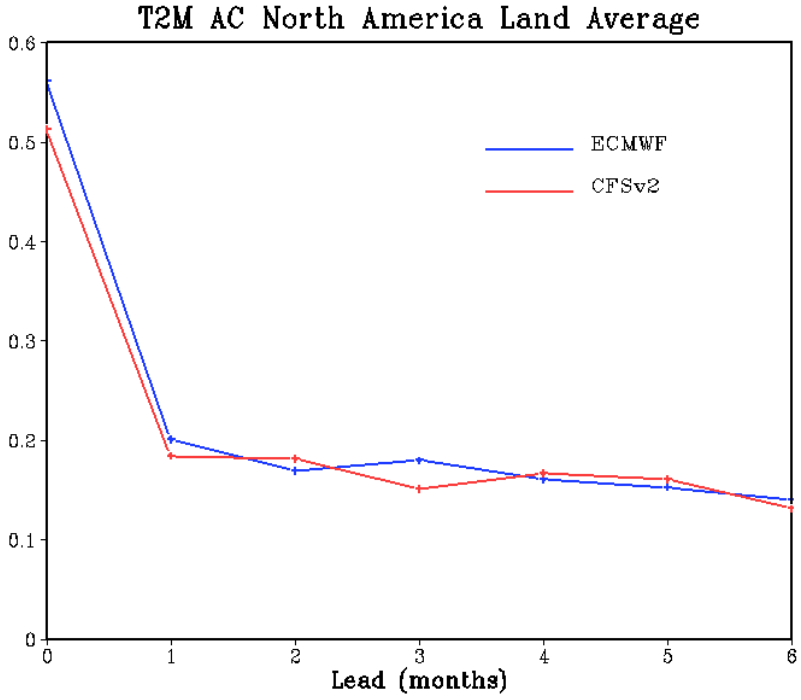
MME average

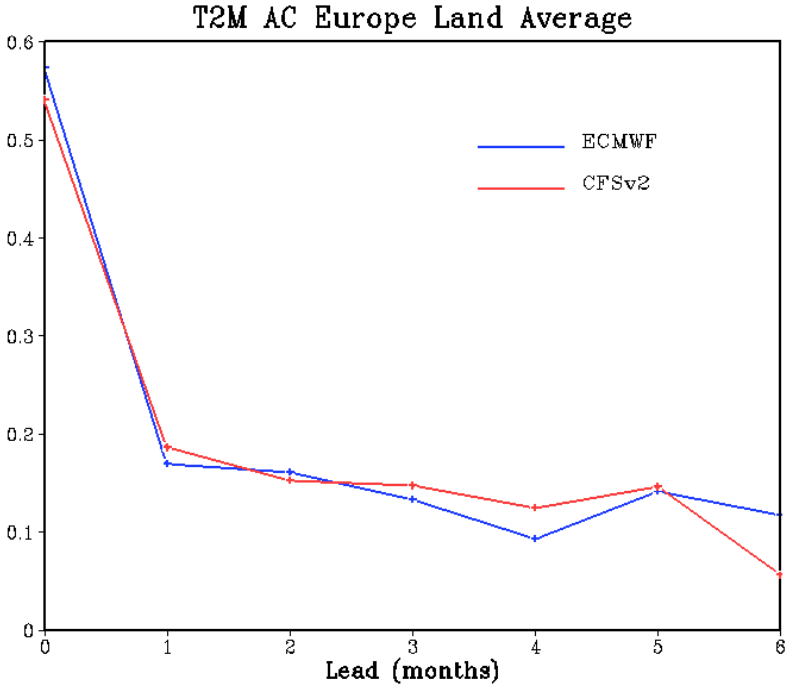




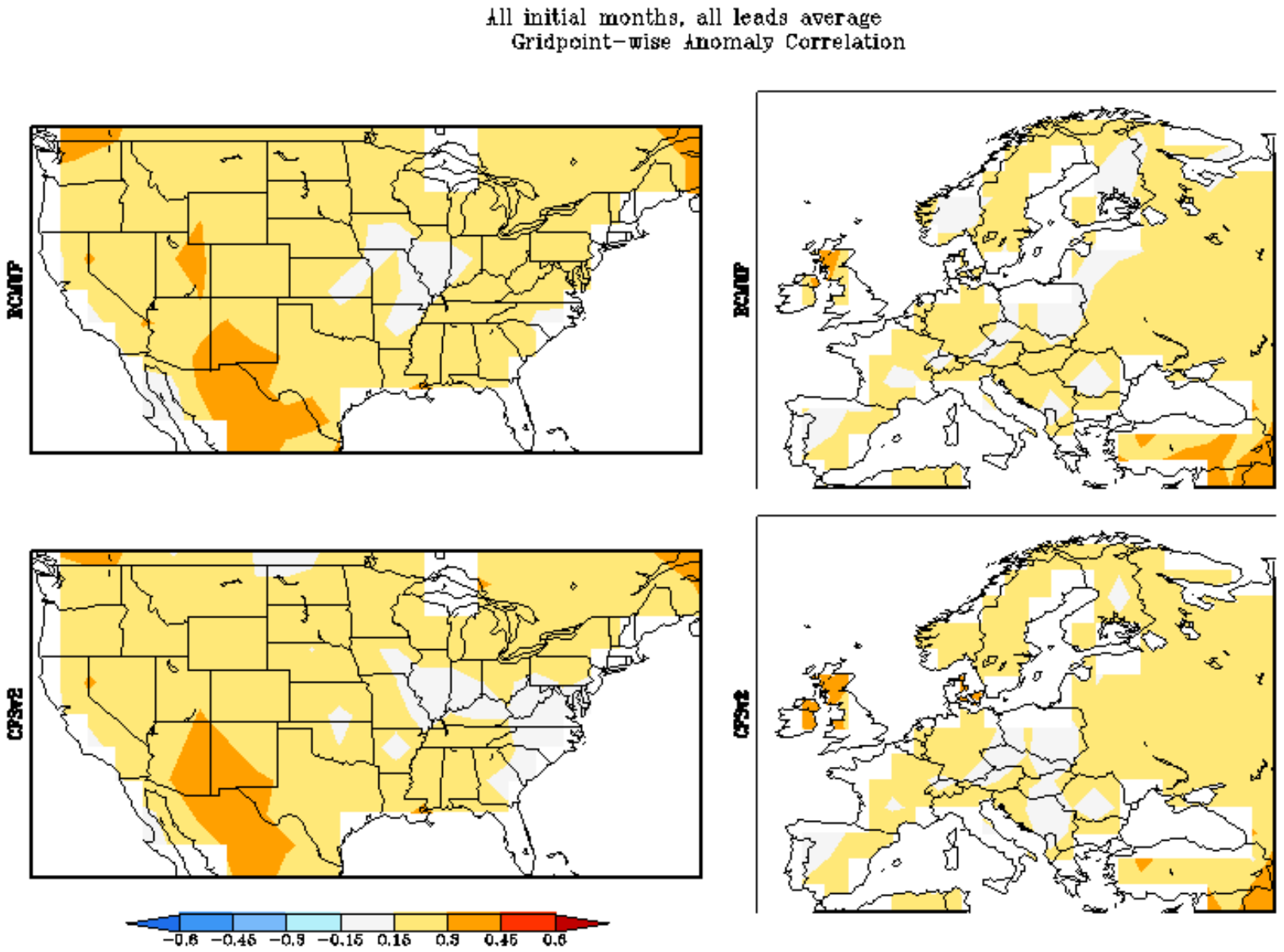
All initial months







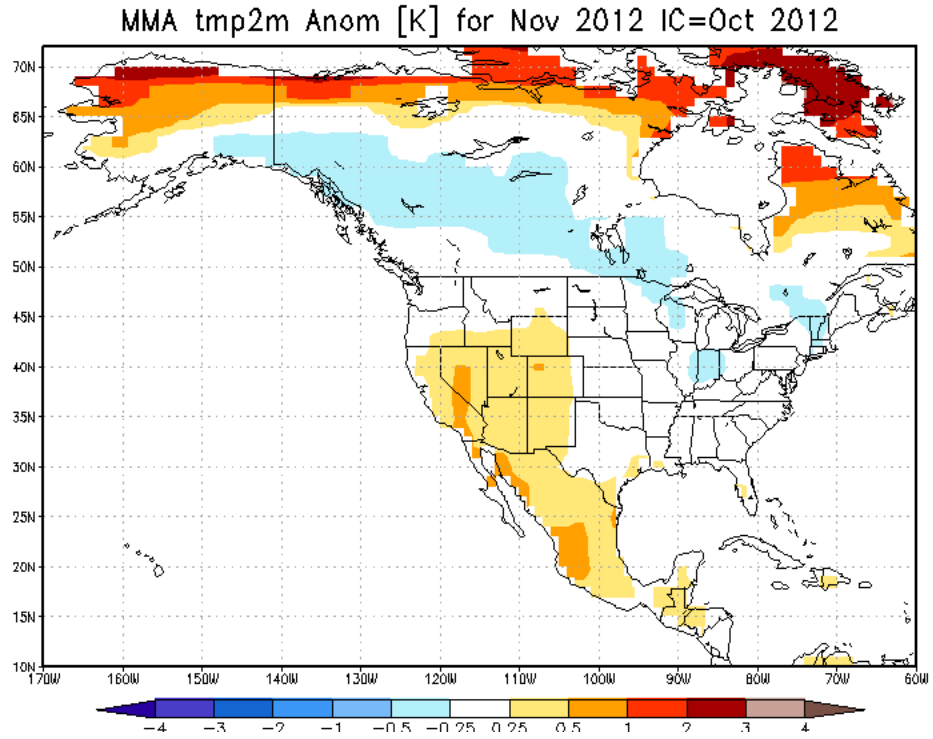
2mT over US and Europe

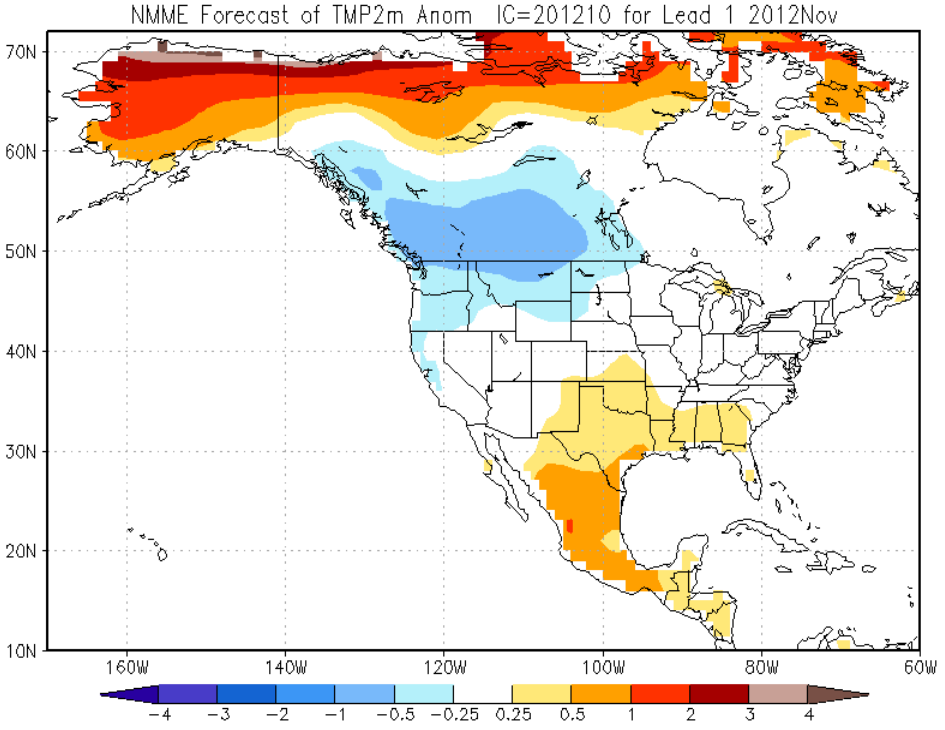


Current developments

- Skill Masks
- Probabilistic forecast products
- New variables: wnd200hPa, wnd850hPa
- Ensemble spread adjustments

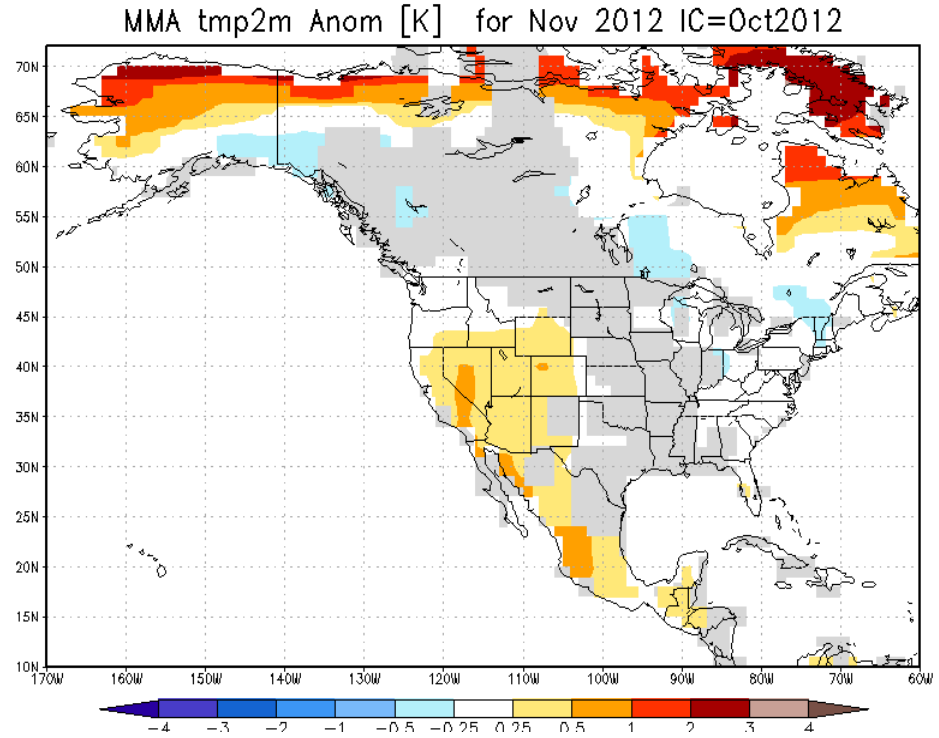
Lead 1, NA 2mT Forecast

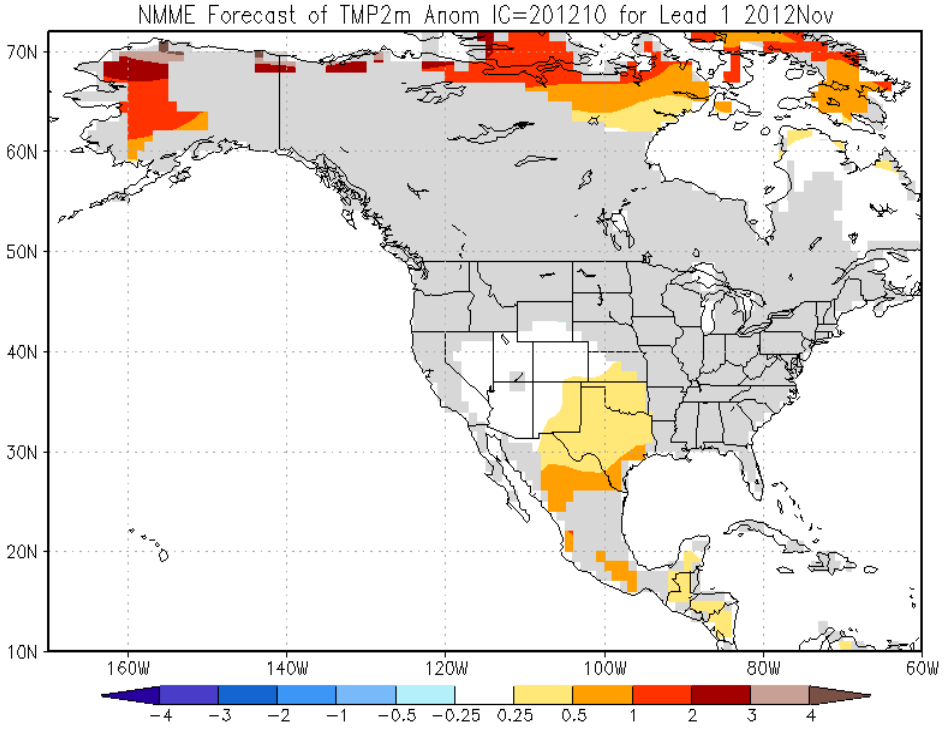




Lead 1, NA 2mT Forecast

WITH SKILL MASK





Complementary geographical regions of decent skill

Looking ahead

- MeteoFrance new seasonal forecast system
- EUROSIP model resolution at 1x1
- MetOffice data to be included in operational products
- Consolidation methods
- Trends
- Extremes

Summary

- NCEP receives the real time seasonal predictions by the Eurosip partners from by the 8th of the month since December 2011
- In parallel with the NMME the IMME scripts and codes are developed as consistent as possible
- SE corrections and several performance statistics have been computed
- The assessments indicate that some products have useful skills