



North American Multi-Model Ensemble (NMME) Background and Fall/Winter Forecasts

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(with contributions from CPC Staff)



Outline



- Background on NMME
- Skill profile (Shorter lead forecasts are generally more skillful, especially for precipitation!)
- Strengths and weaknesses of dynamical coupled model ensemble forecast systems
- Fall/Winter NMME forecast
- Missed 2014-2015 forecast
- Summary



Multi-Model Ensembles and the North-American Multi-Model Ensemble (NMME) Project



Why do use multi-model ensembles (MME) for forecasts?:

- **Allows representation of model uncertainty.**
- **Possibility of complementary skill between models.**
- **Skill of MME is frequently higher than that from the most skillful member in the ensemble (though if one model is dominantly better this is not always true).**

Dynamical models like NMME complement other tools and have strengths and weaknesses

Models/Groups Participating in NMME

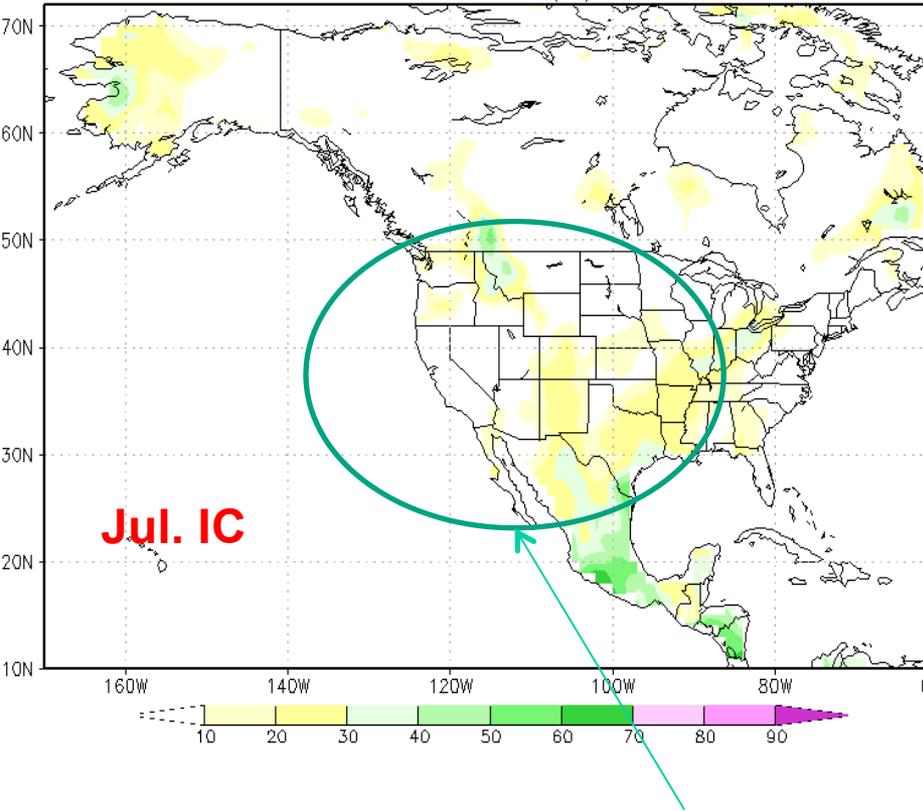
Organizations	Models
NOAA/NCEP	CFSv2
NOAA/GFDL	CM2.1 FLOR (March 2014)
NASA/GMAO	GEOS5
Environment Canada	CMC1-CanCM3 CMC2-CanCM4
NCAR	CCSM3.0 CCSM4.0 (July 2014)
NCAR	CESM1.0 (Mar. 2015)



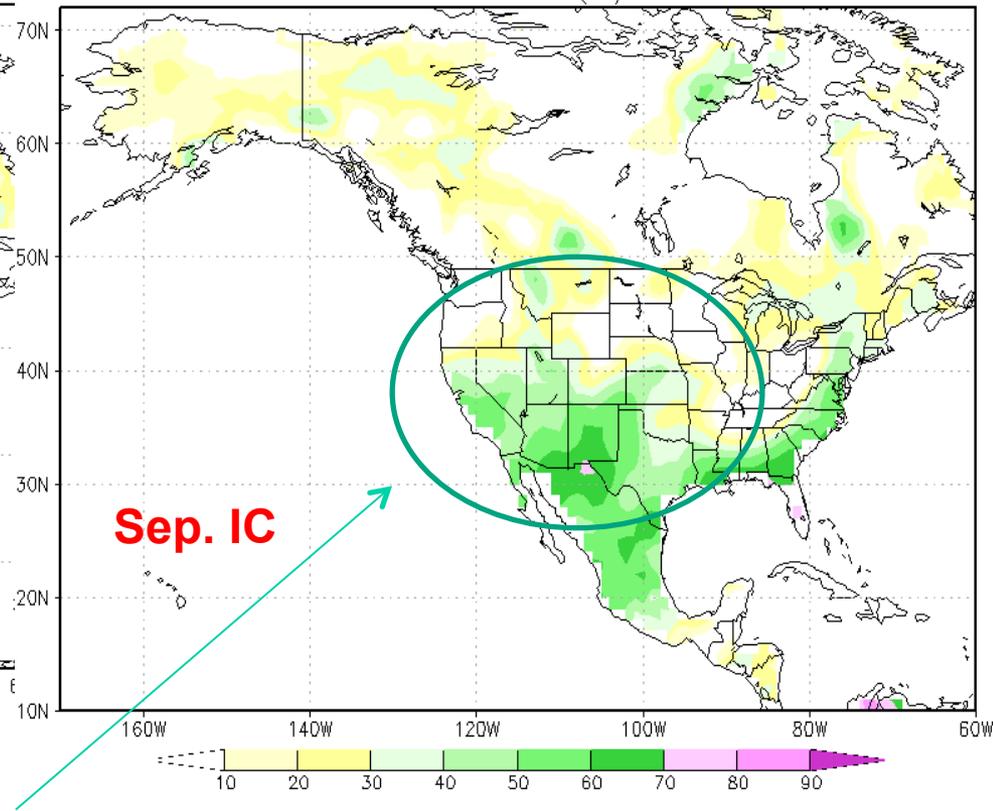
Precipitation Forecast Skill for Winter (DJF) from July and September Initial Conditions



NMME Forecast of Prate Skill (AC) IC=07 for DJF



NMME Forecast of Prate Skill (AC) IC=09 for DJF



Dramatic Increase in NMME Precipitation Forecast Skill for Western US for Forecasts Starting From September versus July



Strengths/Weaknesses of Coupled Ensemble Forecast Systems for US Fall/Winter Precipitation Forecasts



- **Strengths:**
 - Most comprehensive tool available
 - Agreement among models leads to increased faith in forecast
 - Ensemble information can be used either directly or through post-processing to produce a PDF of outcomes
 - Skillful tool for precipitation forecasts at short lead. However, that skill level is frequently low. Hybrid statistical-dynamical methods can sometimes improve the skill level.
- **Weaknesses:**
 - Atmosphere-ocean coupling tends to be too strong leading to too strong an amplitude of ENSO events and false alarms (see 2014-15 example)
 - Costly to develop



NMME Fall and Winter Temperature Forecasts

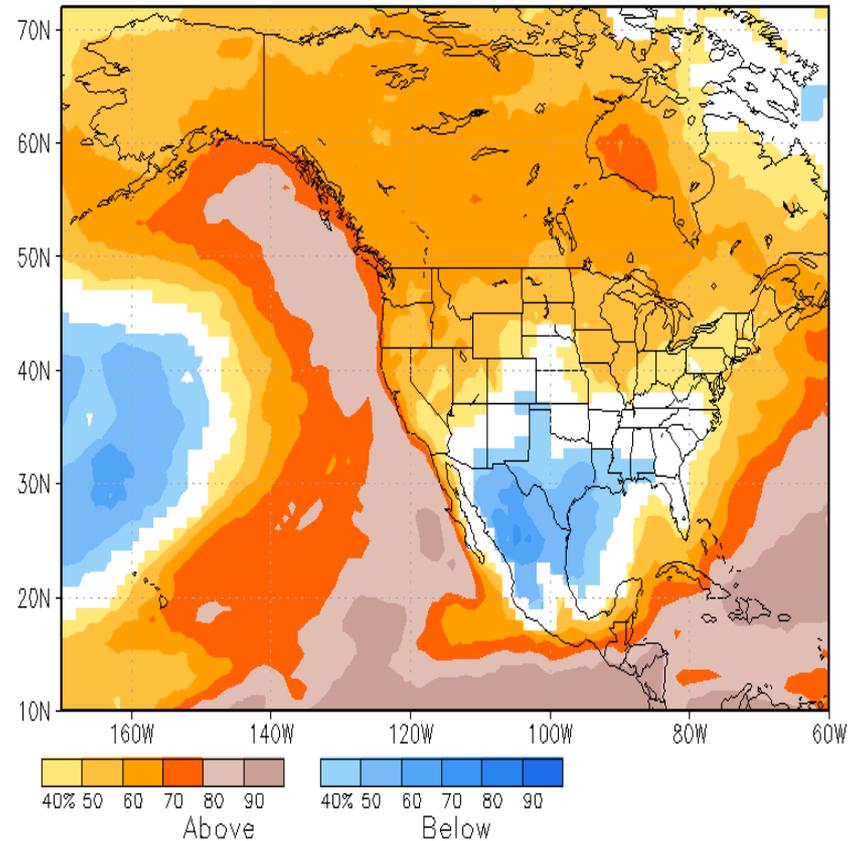
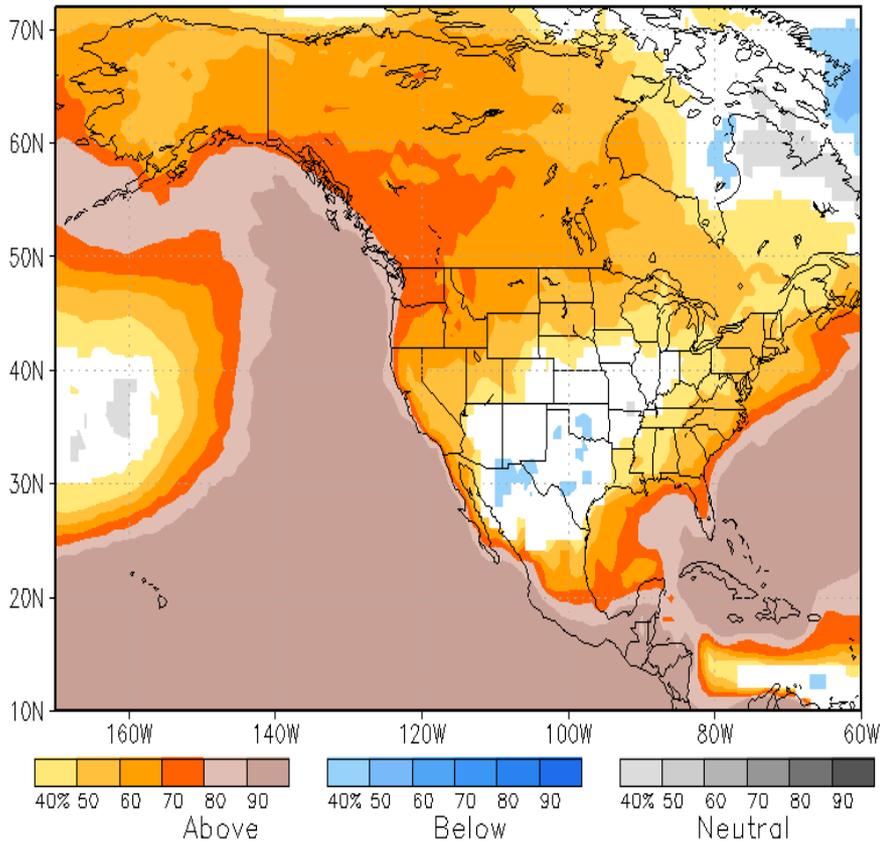


Sep.-Oct.-Nov.

Dec.-Jan.-Feb.

NMME prob fcst TMP2m IC=201507 for lead 2 2015 SON

NMME prob fcst TMP2m IC=201507 for lead 5 2015 DJF



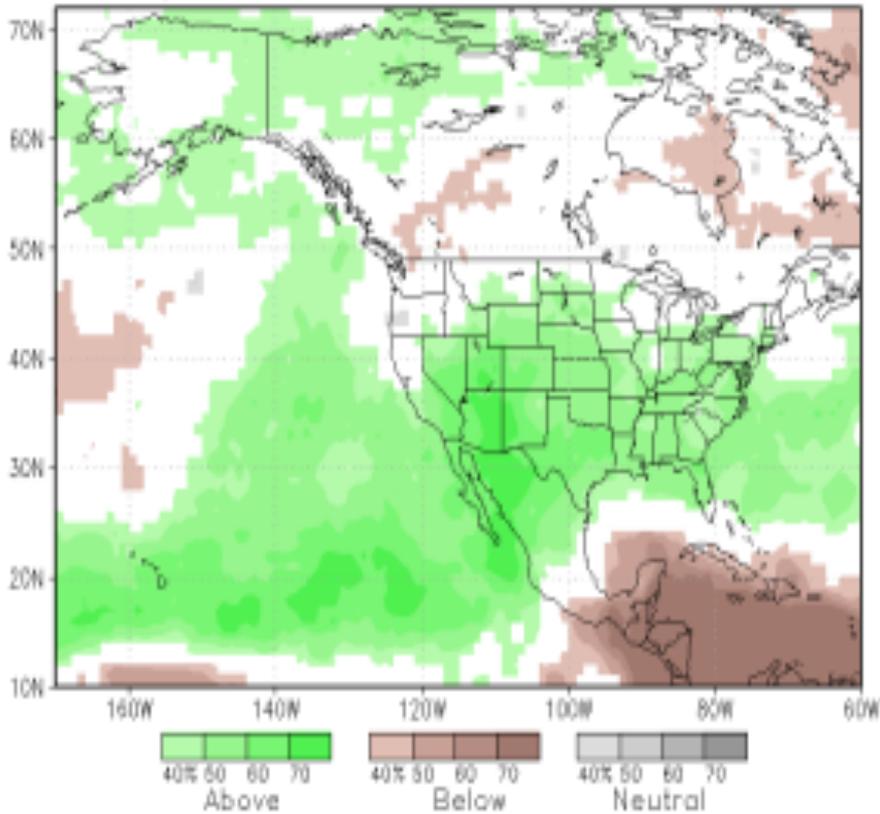


NMME Fall and Winter Precipitation



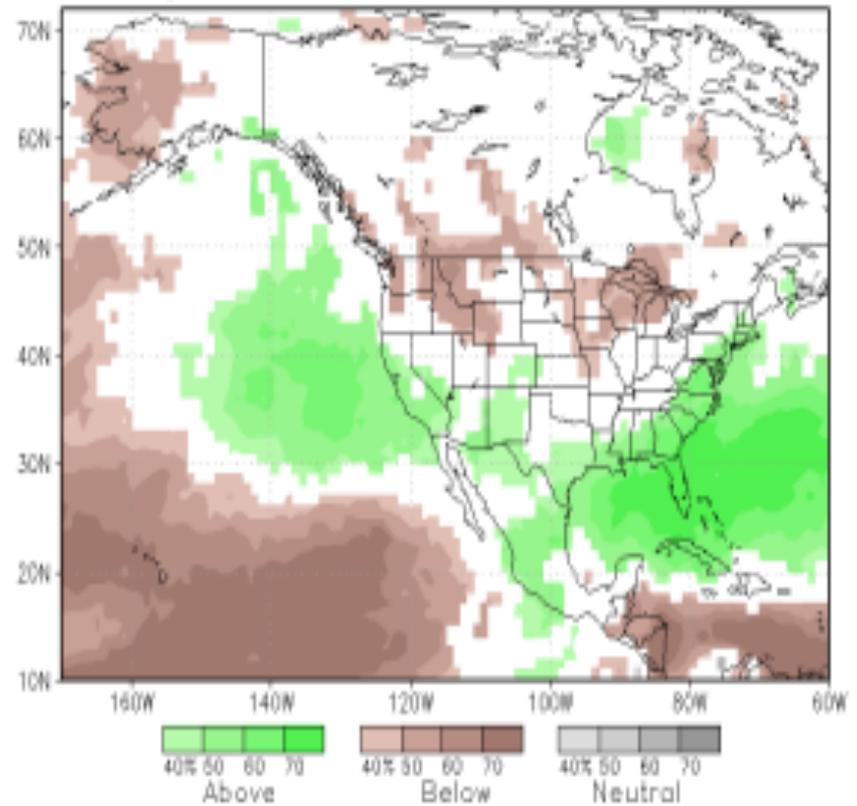
Sep.-Oct.-Nov.

NMME prob fcst Prate IC=201507 for lead 2 2015 SON



Dec.-Jan.-Feb.

NMME prob fcst Prate IC=201507 for lead 5 2015 DJF

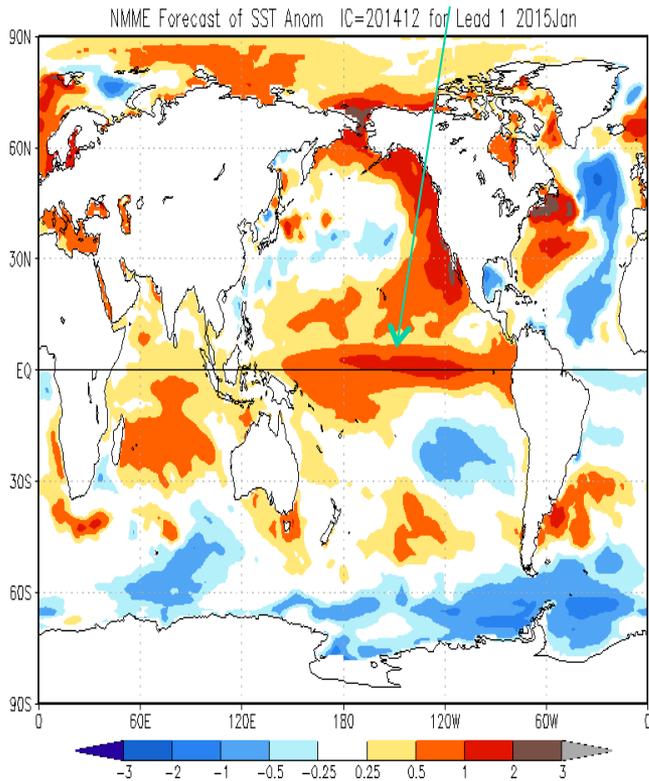




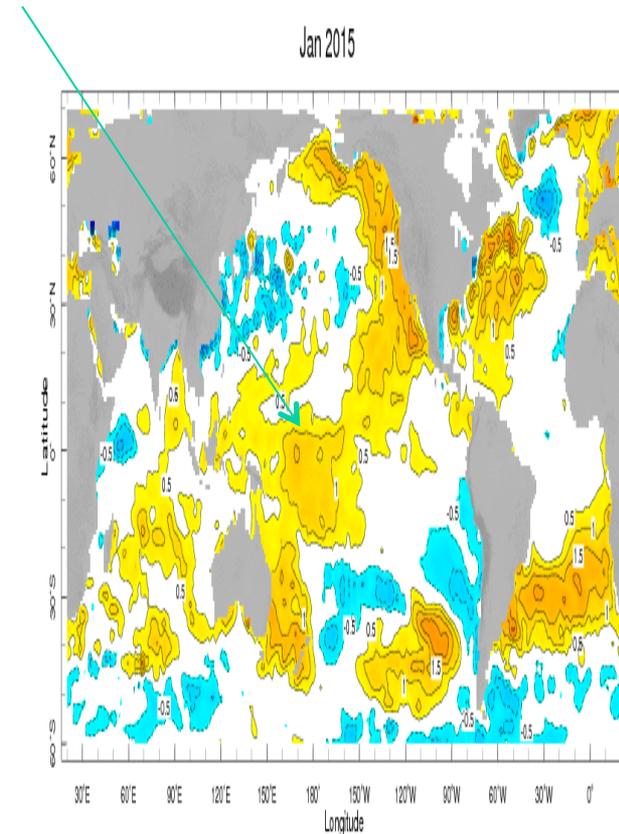
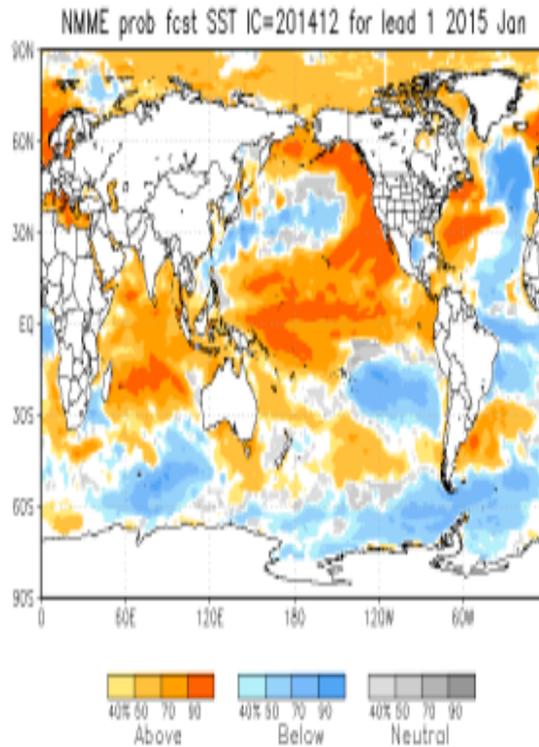
Lead 1 NMME SST Forecast Bust for January 2015



NMME system calls for weak/moderate El-Nino while actual warm SST anomalies were concentrated in western Pacific.



NMME



Observations

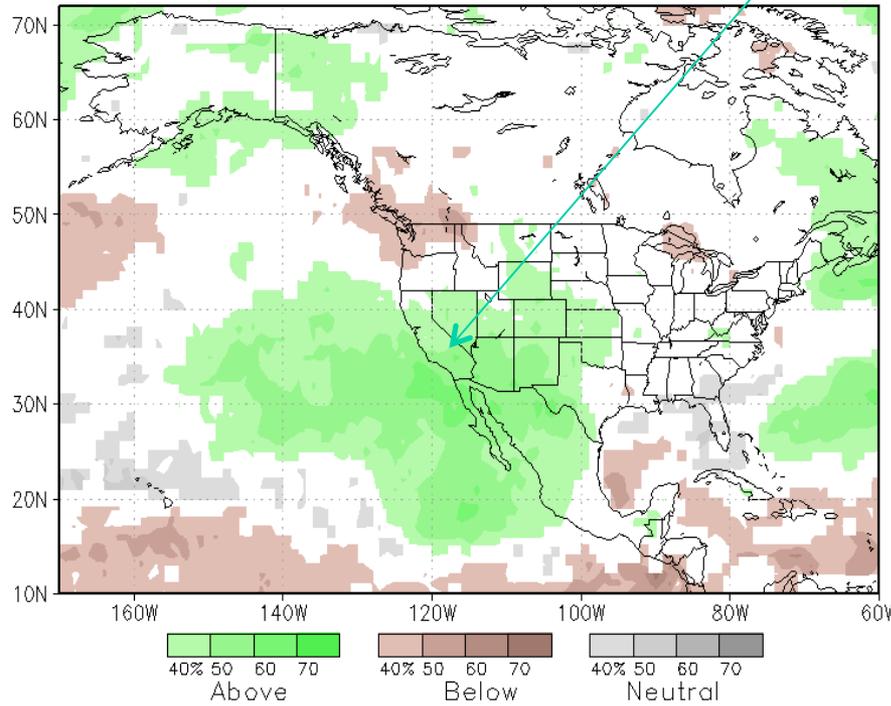


Lead 1 NMME Precipitation Forecast Bust for JFM 2015



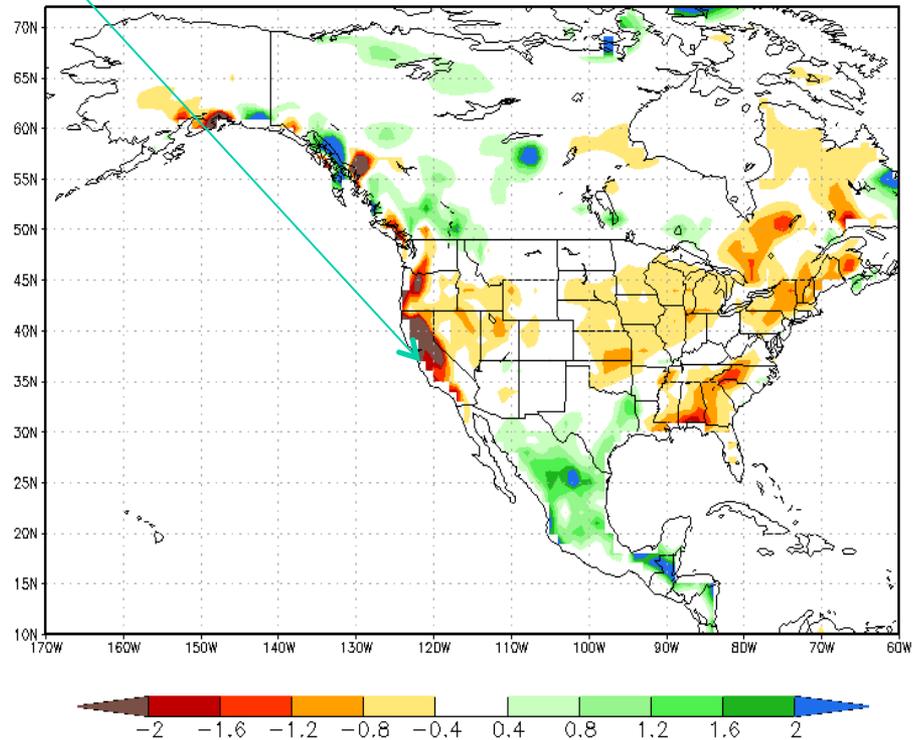
Best dynamical guidance forecast has two category error during historical drought event

NMME prob fcst Prate IC=201412 for lead 1 2015 JFM



NMME

Observed Prate anom JFM 2015



Observations



Summary



- NMME is a valuable tool for precipitation forecasting, especially at shorter leads
- Like all tools NMME precipitation forecasts have modest level of skill
- NMME forecasts should be used in conjunction with other tools when making forecasts
- Community needs to invest resources in development of hybrid statistical-dynamical forecast tools to evaluate/increase predictive skill in the short-term. This would be complementary to investment in improving skill of dynamical models