Radiative Fluxes in NCEP Operational Global Ensemble Forecasts

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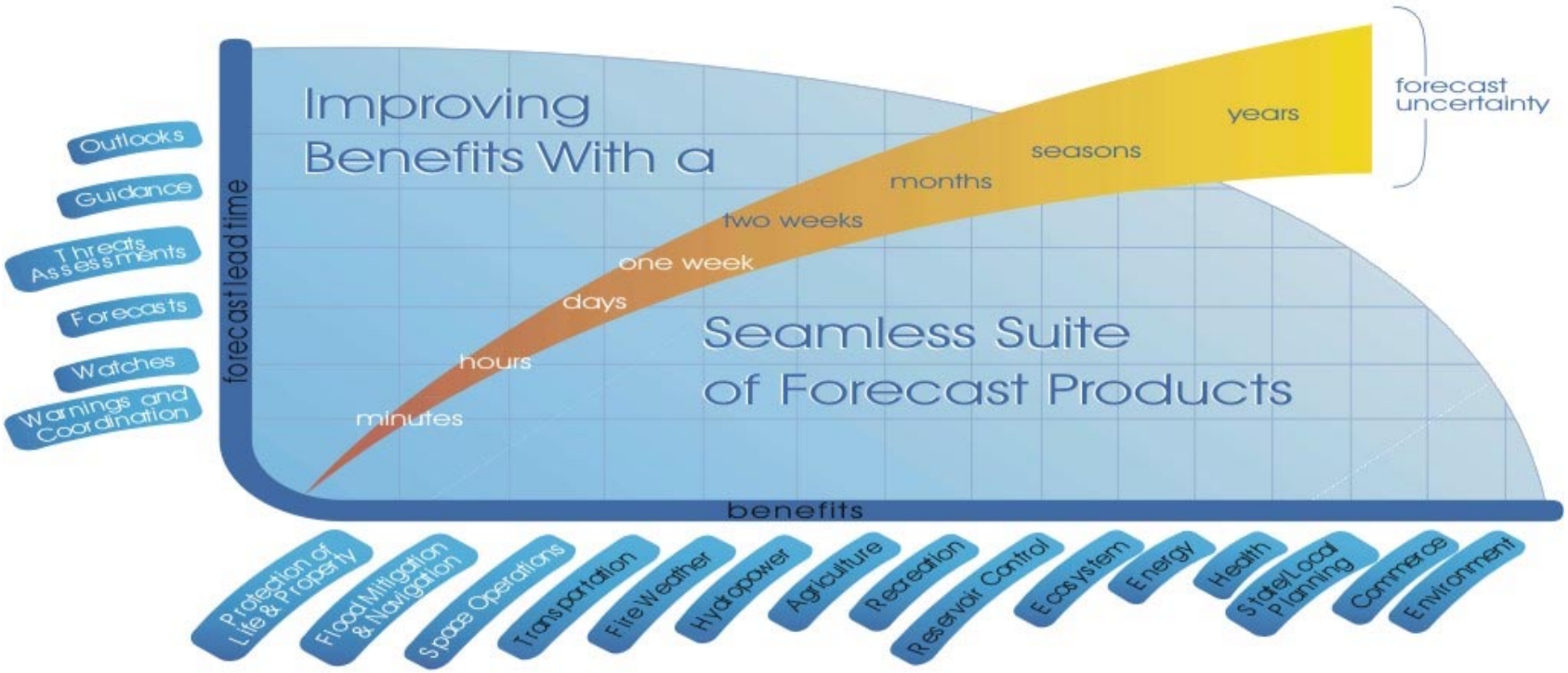
A SEAMLESS SUITE OF PRODUCTS

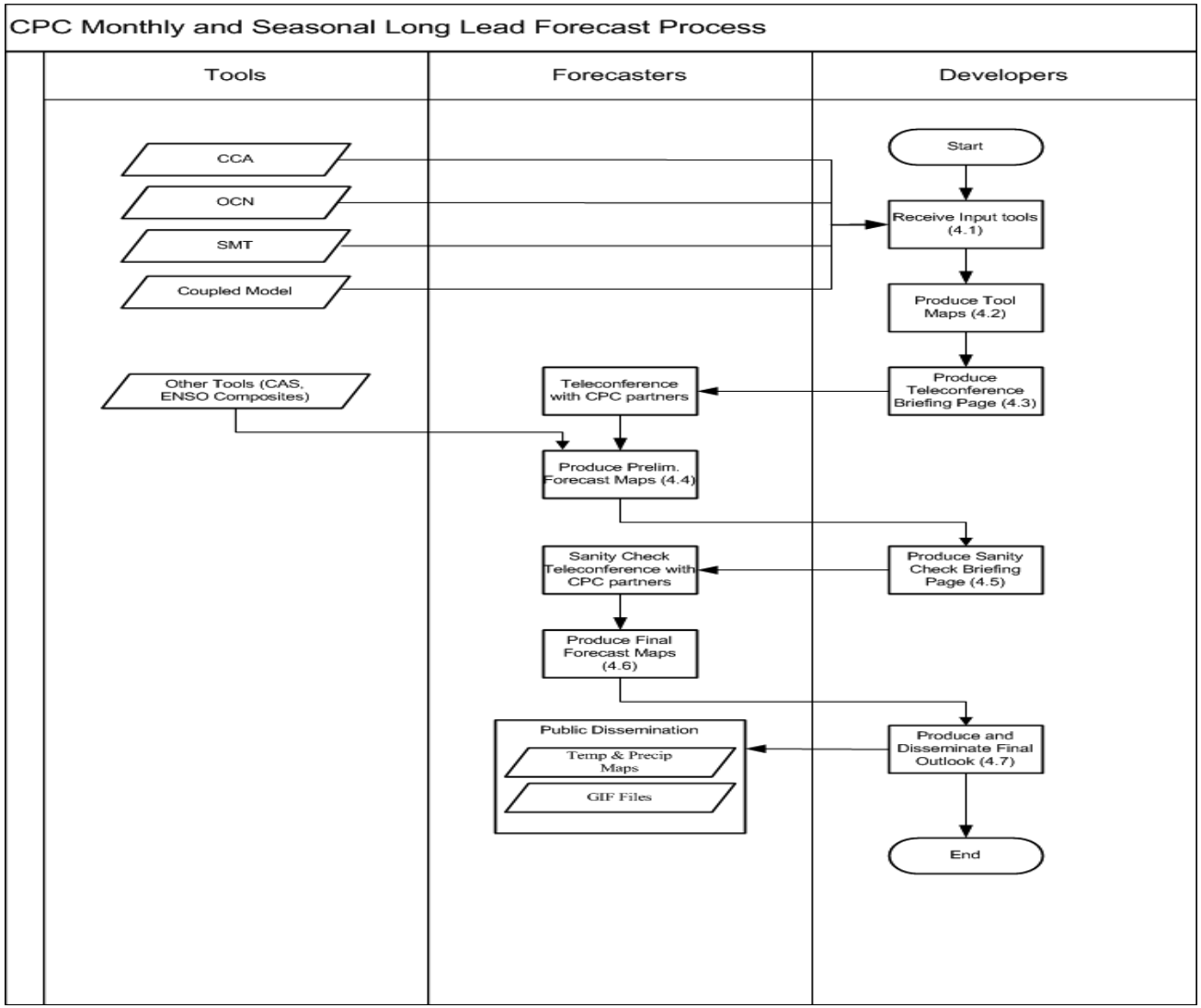
The Òseamless suiteÓ describes a set of related products which are integrated and consistent throughout time and space, as well as across forecast application and domain.



CPC Mandate

- Improve Sub-Seasonal forecasts (wk2-months)
  - Demands from the public for planning and managements
  - Statistical methods
  - Dynamical forecasts
    - Transition from “initial condition” problem to “boundary forcing” problem.

CPC Long Lead Forecasts



At and beyond 3 days lead time, the direct model output from the ensemble forecasts offers more value than that from the higher resolution control forecast.

WOBUS, TOTH AND ZHU: EVALUATION OF PROBABILISTIC FORECASTS

ECONOMIC VALUE OF FORECASTS

Given a particular forecast, a user either does or does not take action (eg, protects its crop against frost) *Mylne & Harrison, 1999*

OBSERVATION \ FORECAST	YES	NO
YES	H(its) ***Mitigated Loss***	M(isses) ***Loss***
NO	F(alse alarms) ***Cost***	C(orrect rejections) ***No Cost***

$$Mean\ Expense_{fc} = hML + mL + fC$$

$$Mean\ Expense_{perf} = oML$$

$$Value = \frac{ME_{cl} - ME_{fc}}{ME_{cl} - ME_{perf}}$$

$$ME_{cl} = min[oL,\ oML + (1-o)C]$$

o=climatological frequency

Use 10 climatologically equally likely bins to define events

Hi–res control forecast: If MRF control falls in a given climate bin, forecast is YES and NO otherwise

Lo–res ensemble forecast: Probabilities converted to a categorical fcst given the probability exceeds a certain threshold. Eg., all 30% or higher probabilities count as YES. Among different threshold probabilities one can select the one that results in largest economic value.

Results: For majority of users ensemble is more useful

Question: Is it because MRF is dichotomous, while ensemble provides full probability distribution?

NCEP Operational global ensemble forecasts

1) ***Short-to-Medium range prediction****: help sampling the uncertainty in initial conditions.*

2) Two runs per day at 00Z and 12Z

T126 up to 3 _ days -> T62 out to 16th day

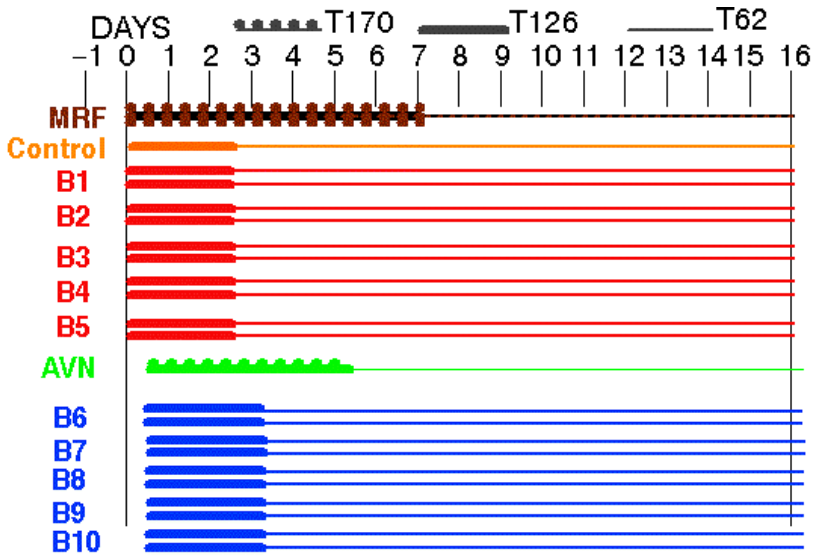
2) ***Seasonal Forecast:*** *Samples the range the range of outcomes of the seasonal mean atmospheric states*

16 members coupled model runs to forecast SST

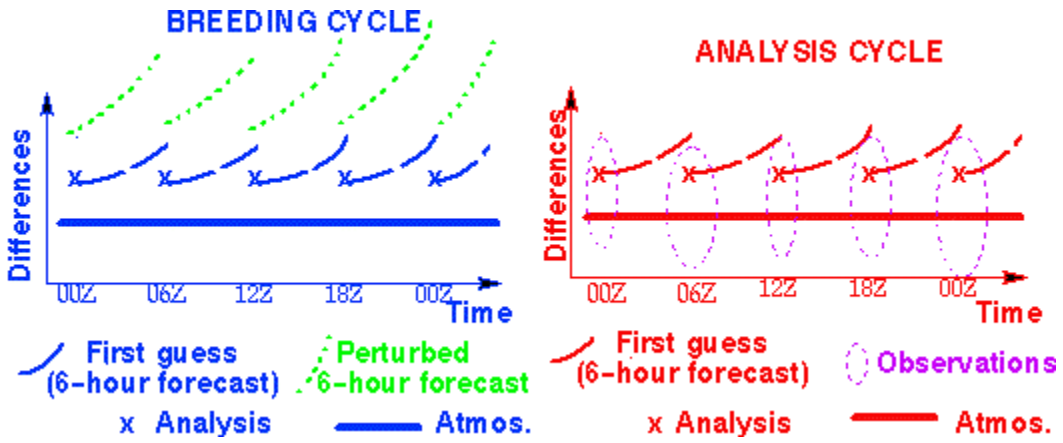
Remove SST biases-> SST anomaly + observational climatology.

20 members AGCM runs based on mean SST forecasts.

Forecast Configurations



Initial conditions for ensemble members



Seasonal Forecast

TOTH: CLIMATE ENSEMBLE PREDICTION

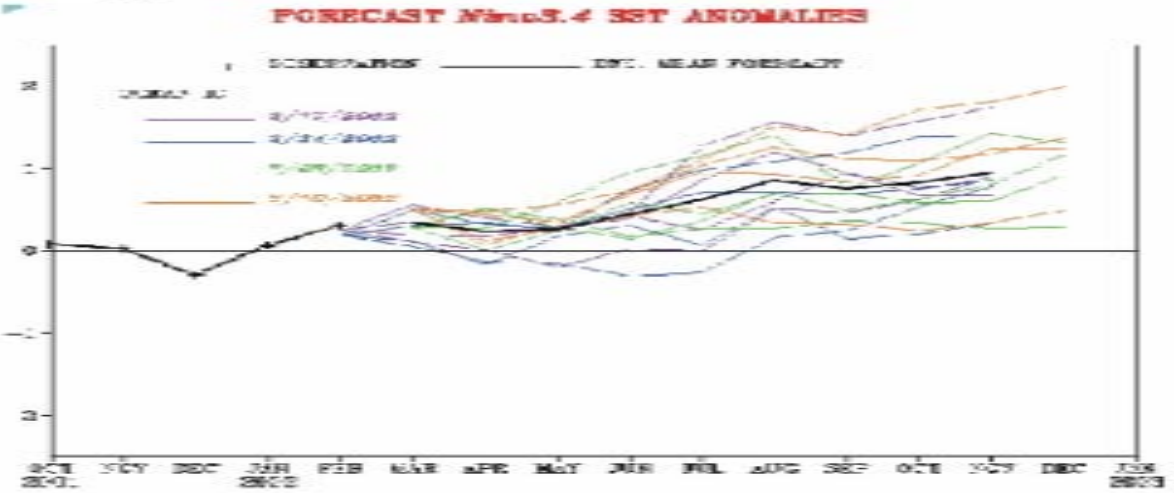
BRIDGING THE GAP BETWEEN WEATHER AND CLIMATE

CURRENT NWS PRACTICE

2) **"CLIMATE" ENSEMBLE:**

a) 12–months coupled ocean–atm fcsts

b) Average the SST fcsts



c) Run AGCM ensemble forced by average SST fcst

STRENGTH:

Ensemble approach used both for coupled and AGCM model fcsts for enhancing (weak) signal

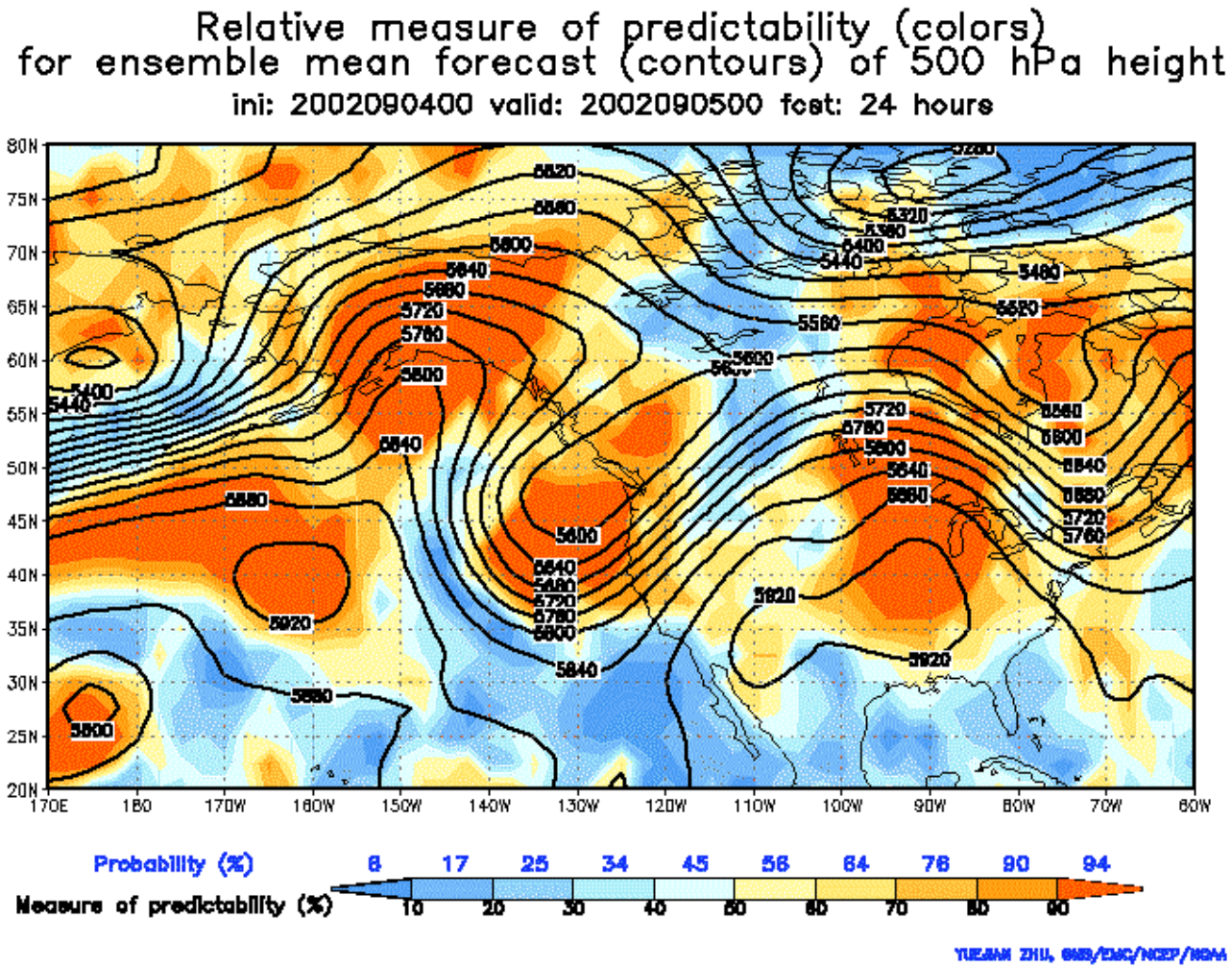
SHORTCOMINGS:

a) Coupled ensemble (lagged fcst) perturbations not optimal

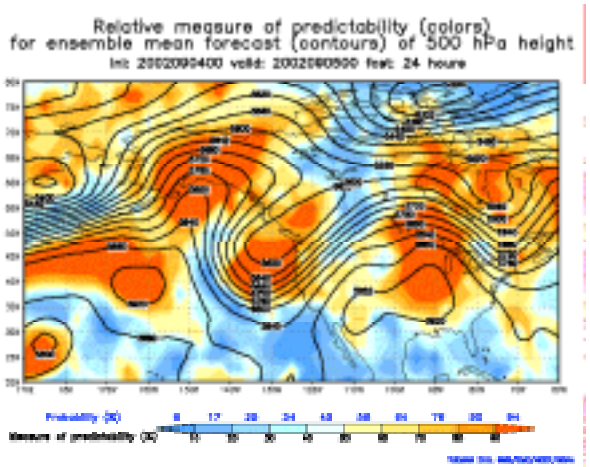
b) Uncertainty information related to SST fcst is discarded

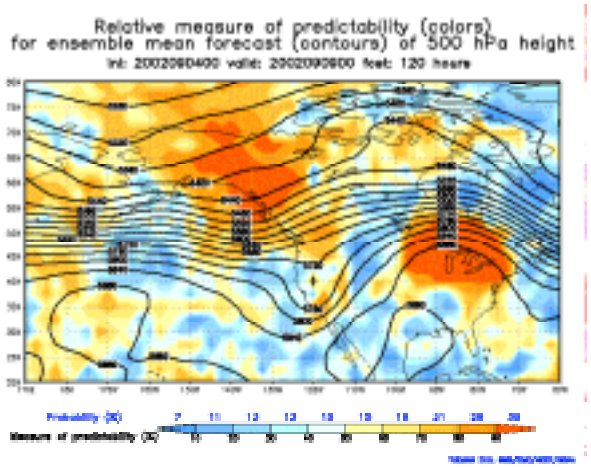
c) Initial condition information from atmosphere not used

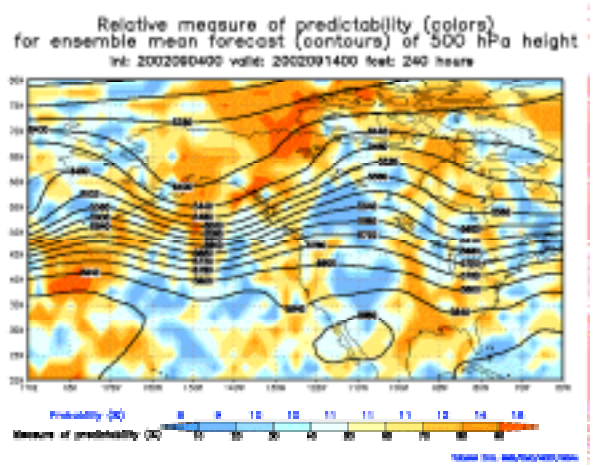
Predictability and forecast Skill

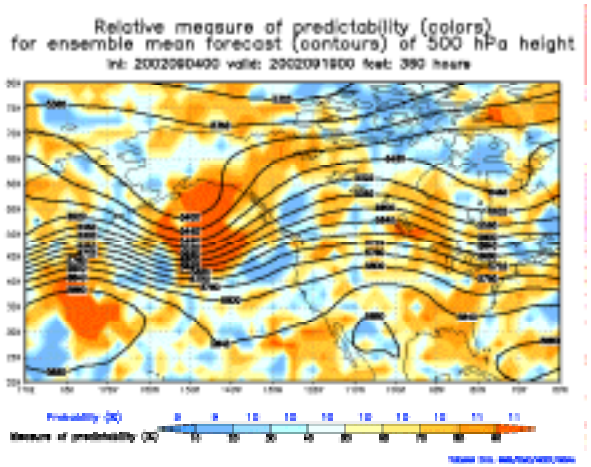


Degradation of Predictability

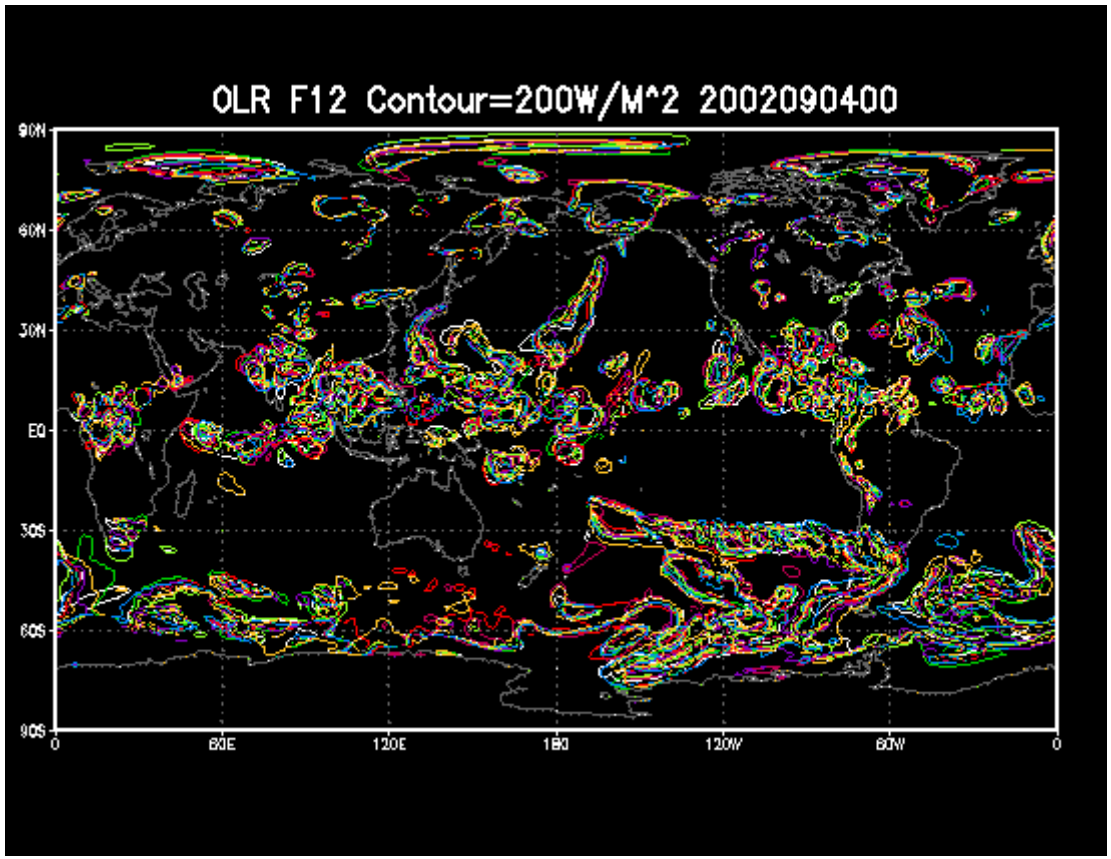




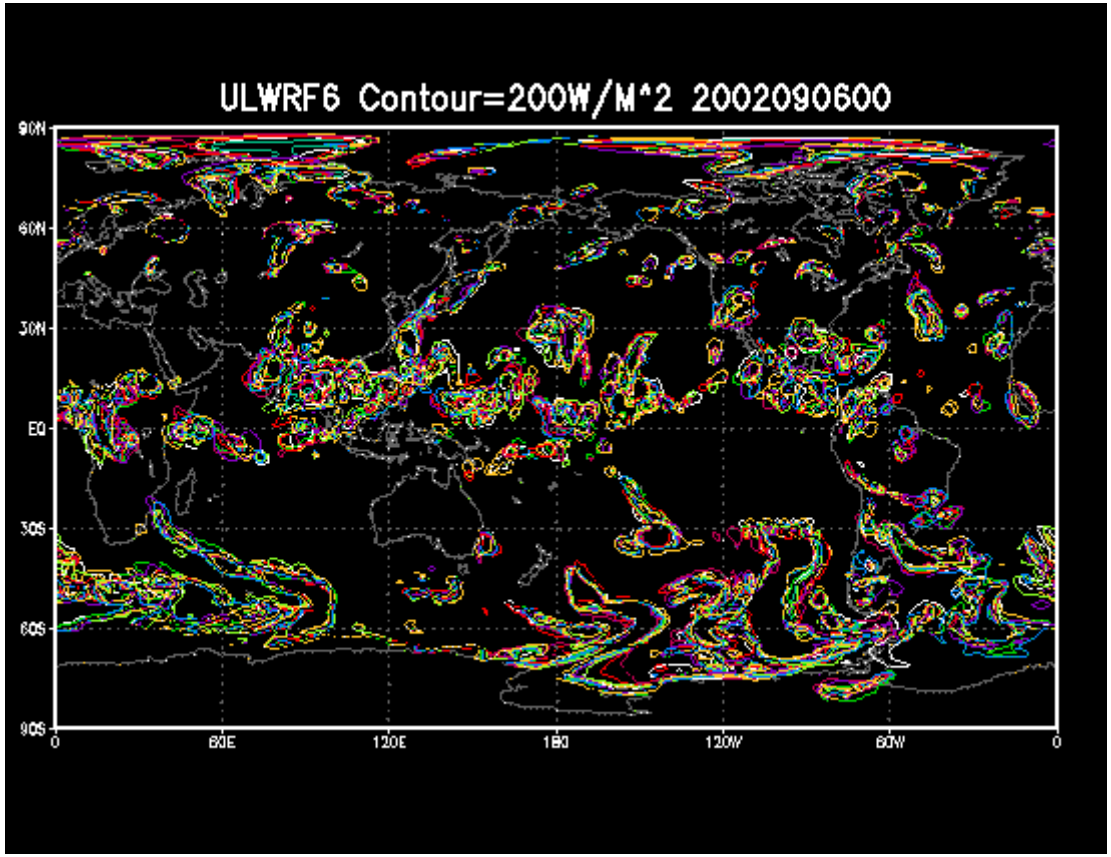




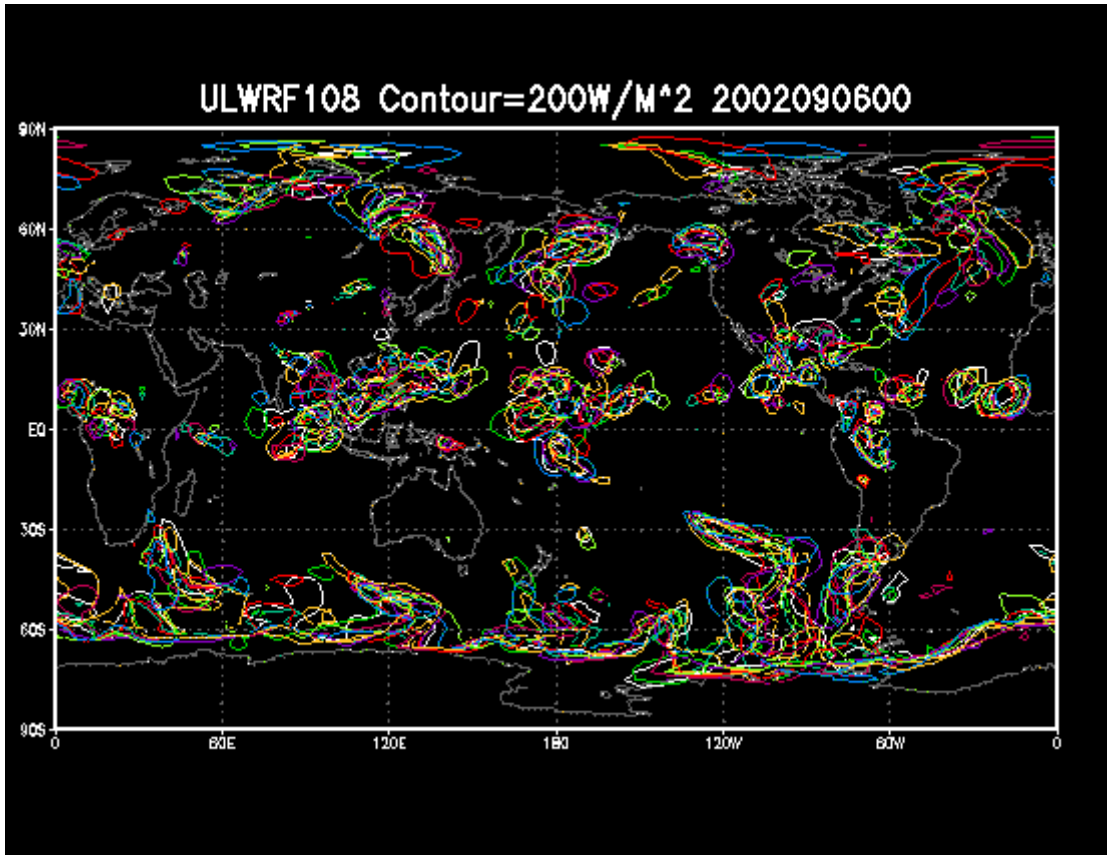
Ensemble forecasts Valid at 090412



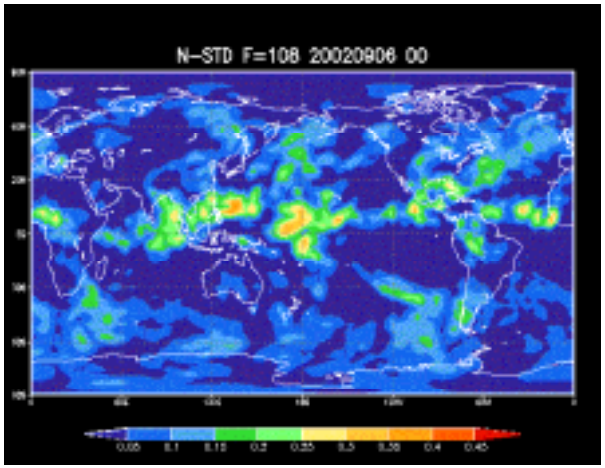
T126 ensemble forecast F6-84hr

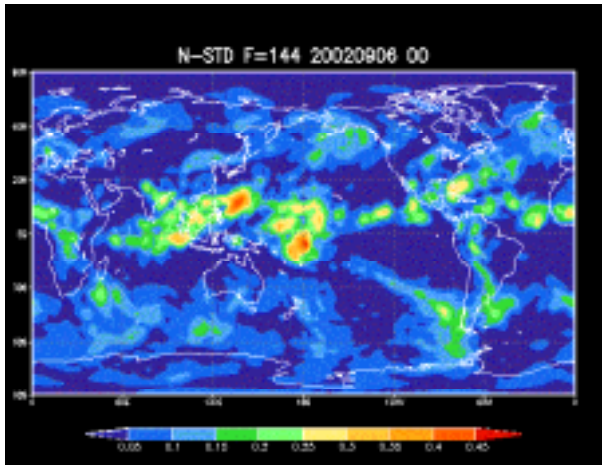


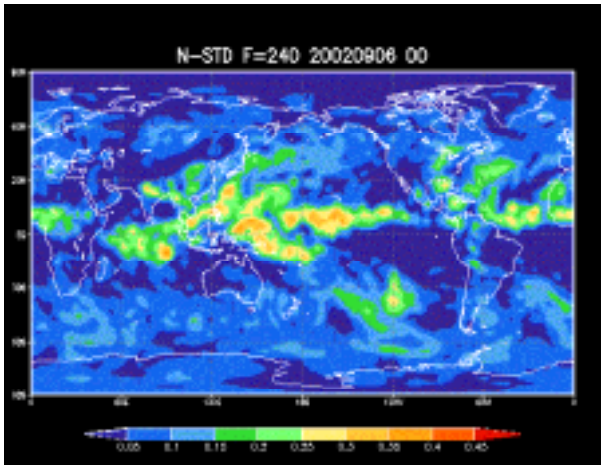
T62 extended ensemble forecast F108~384 hr

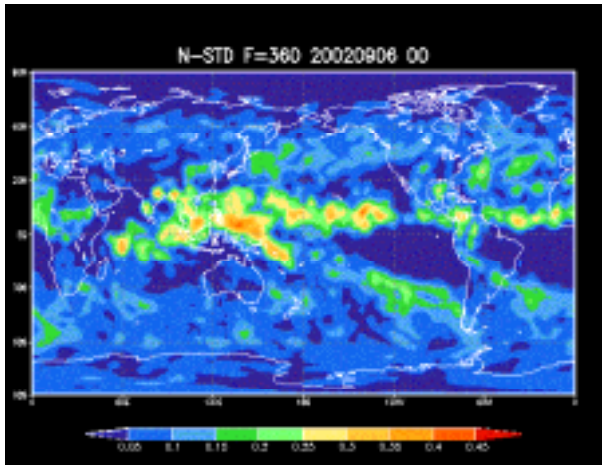


Spread of OLR ensemble members









Summary

- Ensemble forecasts provide information of predictability, very valuable for NWP, less so for climate runs. In general, the skill of the ensemble mean is higher than the single control run.
- Ensemble forecasts don't resolve model biases. Spread of the members shows the degree of agreement among members, not the degree of confidence on predictability.
- OLR spread is larger than height fields, could provide additional weather conditions.
- Need to examine surface fluxes for climate ensemble forecast runs. Model forecasts drift more.