

# Progress Report on Subseasonal NMME Forecasts: Skill, Predictability, and Multi-model Combinations

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# Project

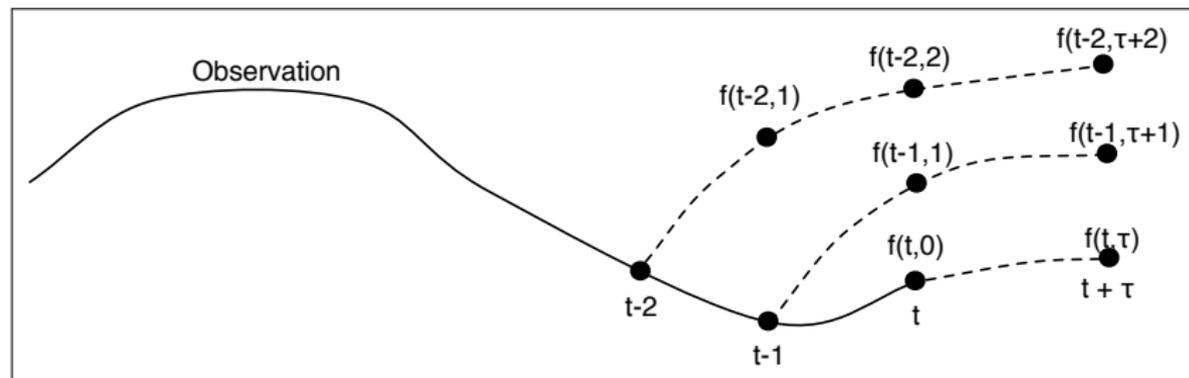
## Goals

1. Develop statistically informed protocol for subseasonal prediction.
2. Rigorously compare multi-model skill to individual forecast skill.
3. Assess whether subseasonal forecasts capture linear impacts of MJO.
4. Rigorously quantify predictability and skill of subseasonal forecasts.

## Personnel

<b>Investigators</b>	Timothy DelSole	PI
	Michael Tippett	co-PI
	Kathleen Pegion	co-PI
<b>NOAA Contact:</b>	Arun Kumar	
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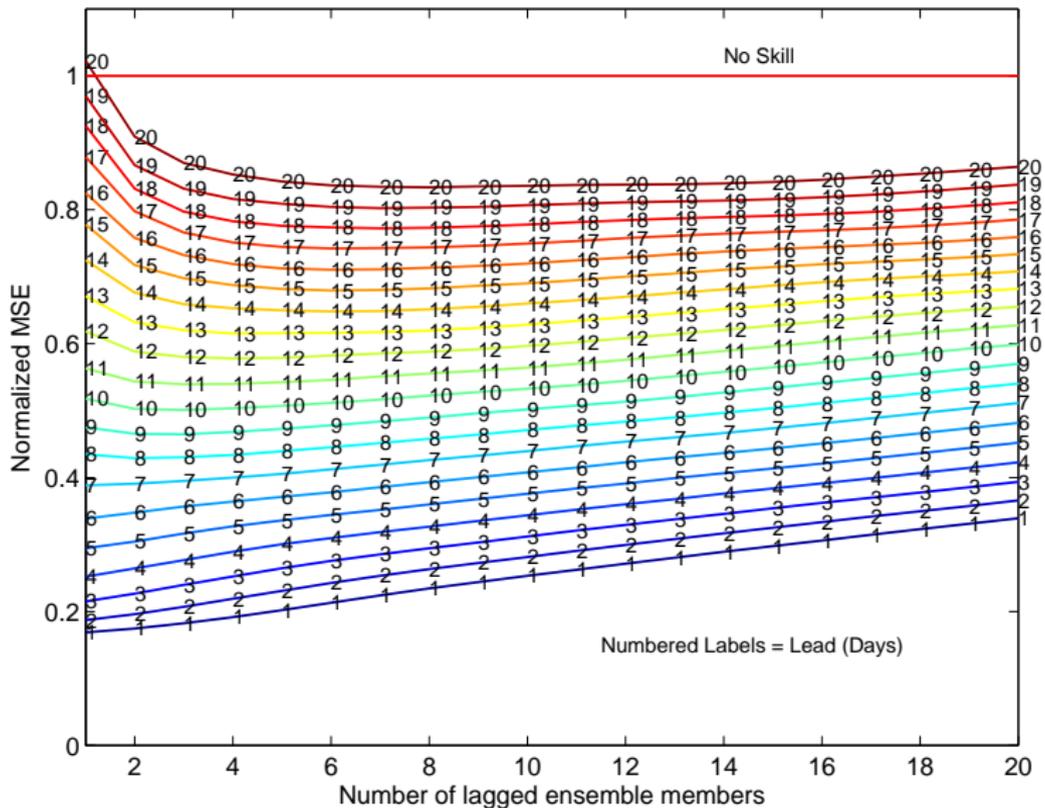
# Lagged Ensemble Forecasts of the MJO



1. Forecasts are from CFSv2 45-day hindcasts 1990-2010
2. MJO diagnosed using Wheeler and Hendon's RMM1/RMM2
3. Consider only daily means initialized on 0Z, Nov. - Feb.
4. Removed mean conditioned on initial condition and lead.

$$\text{MSE} = \left\langle (\text{RMM1}_{\text{CFSv2}} - \text{RMM1}_{\text{OBS}})^2 + (\text{RMM2}_{\text{CFSv2}} - \text{RMM2}_{\text{OBS}})^2 \right\rangle$$

MSE of CSFV2 hindcast of MJO  
November–February 1999–2010



# Conclusions

1. Skill exists even at 20 days leads.
2. For leads  $< 7$  days, one-member ensemble has most skill.
3. For leads  $> 12$  days, five-member ensemble has near-maximum skill.

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**Are differences in MSE statistically significant?**

## Comparing Forecast Skill

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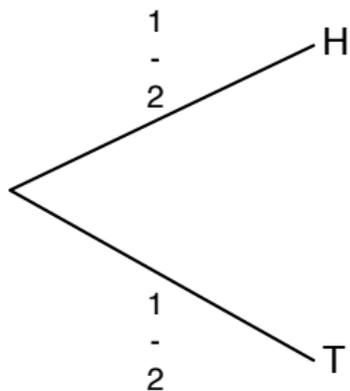
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## Skill of Single Events

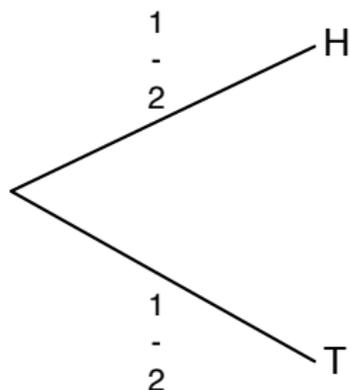
Identify Events When Forecast H has more skill than Forecast T.



Null hypothesis: probability that H has more skill than T is 50/50.

# Skill of Single Events

Identify Events When Forecast H has more skill than Forecast T.

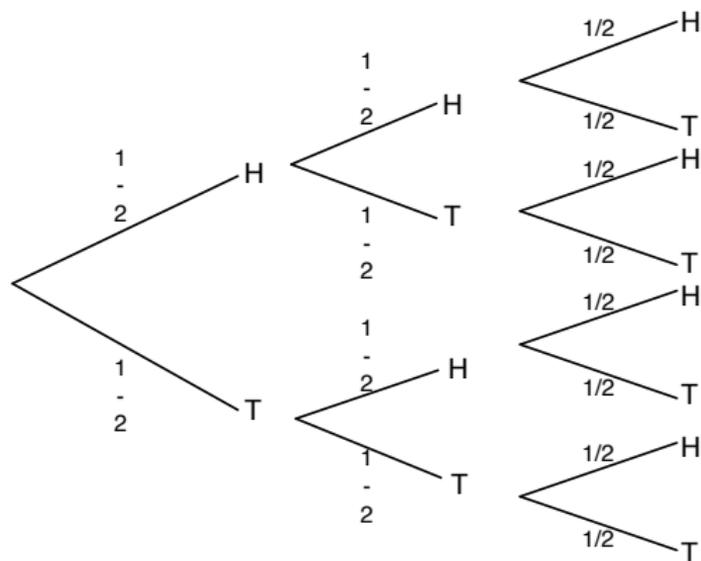


Null hypothesis: probability that H has more skill than T is 50/50.

- ▶ No caveats about independence.
- ▶ No assumptions about distribution of forecast errors.
- ▶ No restrictions on the criterion for deciding skill.

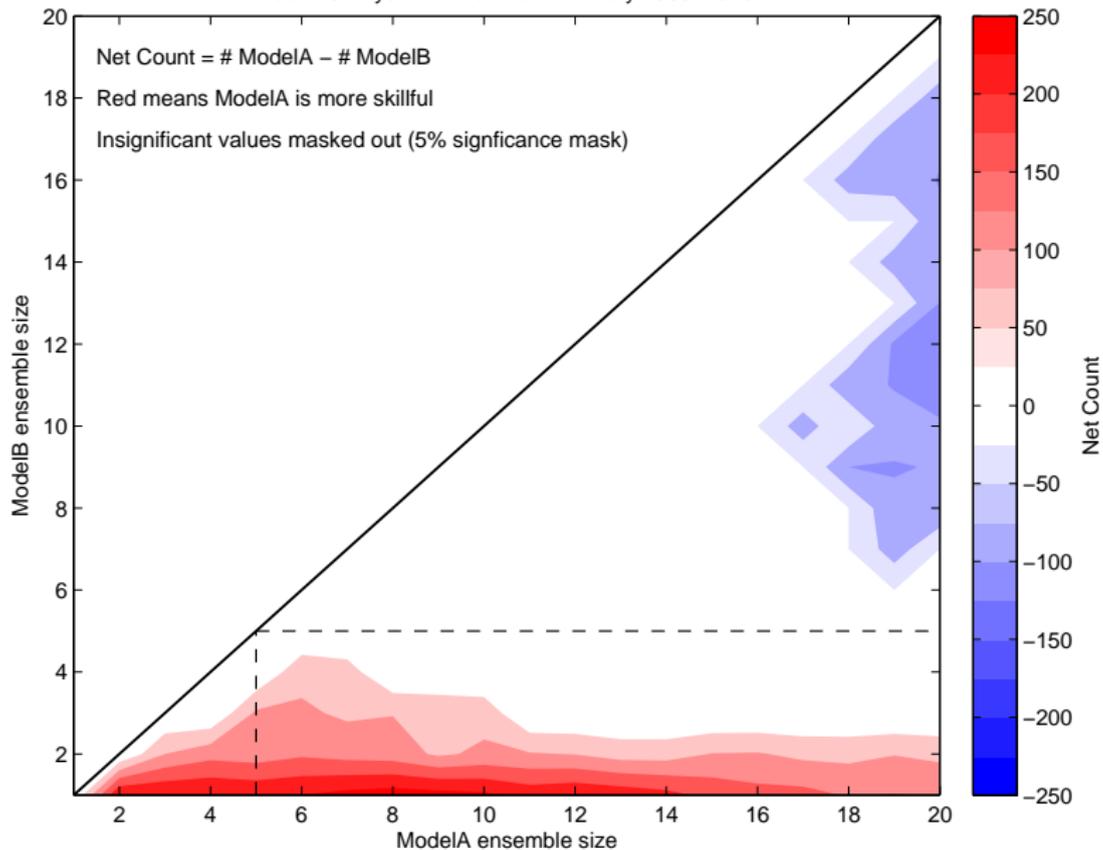
# Random Walk Test

Identify Events When Forecast H has more skill than Forecast T.

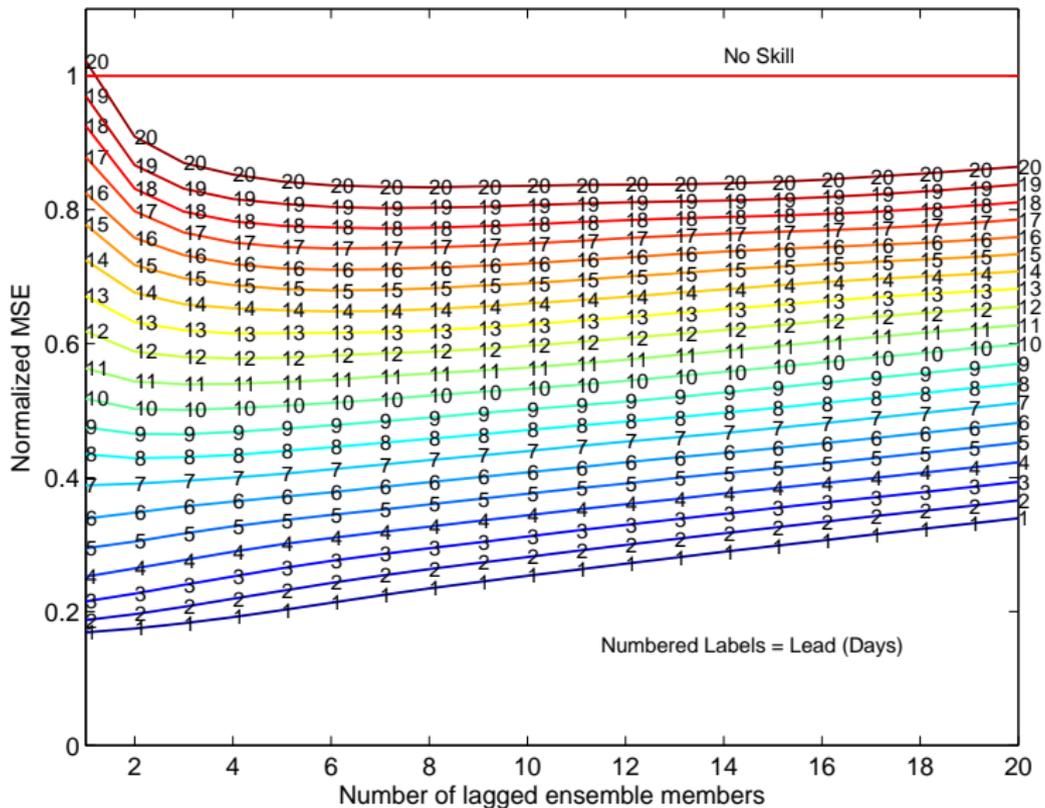


Null hypothesis: Counts follow a binomial distribution with  $p=1/2$ .

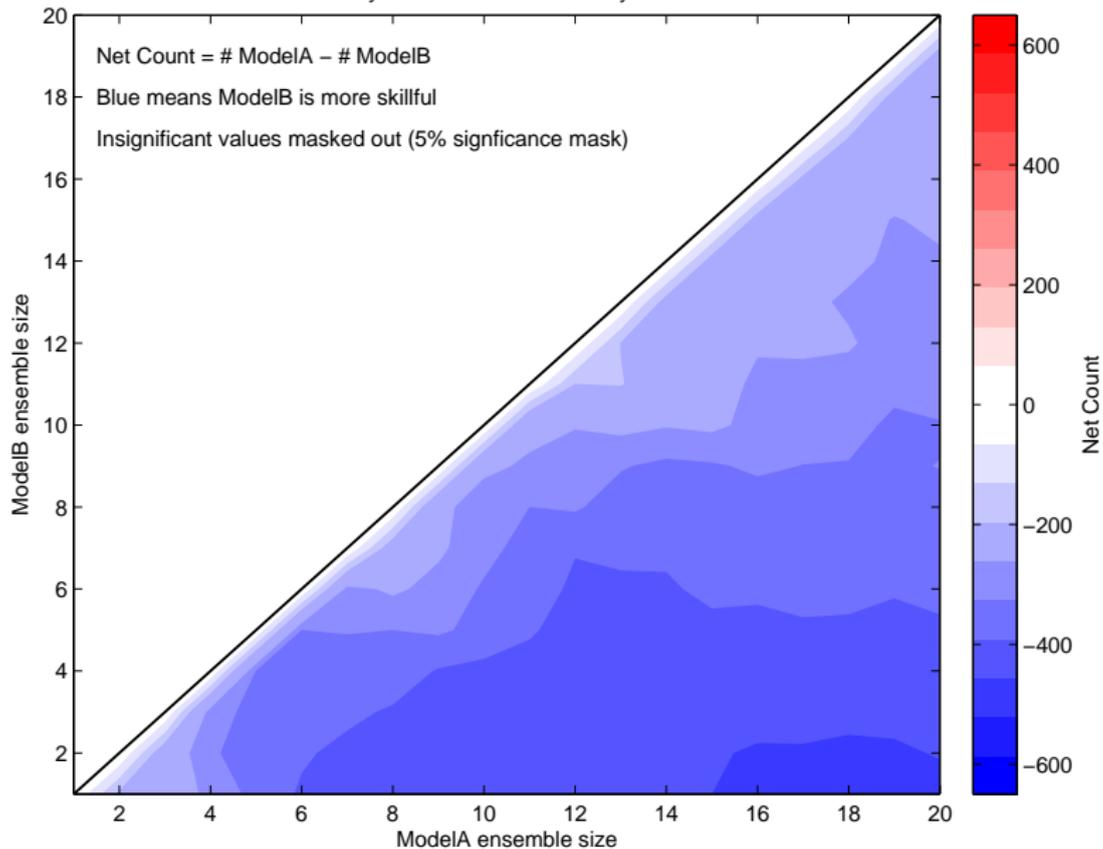
Sign test results for CFSV2 hindcast of MJO  
Lead 20 Days -- November-February 1999-2010



MSE of CSFV2 hindcast of MJO  
November–February 1999–2010



Sign test results for CFSV2 hindcast of MJO  
Lead 2 Days -- November-February 1999-2010



# Progress on Subseasonal NMME Forecasts: Skill, Predictability, and Multi-model Combinations

1. Introduced new, rigorous methods for comparing skill over common periods (e.g., sign test).
2. Computed mean square error of CFSv2 hindcasts of MJO (Nov.-Feb., 1999-2010).
  - ▶ Skill exists even at 20 days leads.
  - ▶ For leads  $< 7$  days, 1-member ensemble has most skill.
  - ▶ For leads  $> 12$  days, 5-member ensemble has near-max skill.
3. Sign test confirms MSE comparisons.
4. **Not discussed:** CFSv2 was able to predict features of a 2013 flooding event in Saudia Arabia up to 10 days in advance.