The Joint Mesoscale Ensemble (JME): A Status Report

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Topics

- Some background
- Description of current real-time system
- Ongoing work

Big picture

- Current real-time system:
  - All members are WRF (ARW)
  - Multi-model (physics) approach
  - LBCs from 15-member NCEP global ensemble (part of Joint Global Ensemble)
  - 10 JME members running at AFWA

Big picture

- Current development:
  - Perturbations to initial SST
  - Perturbations to initial soil moisture
  - Exploration of further physics combinations; testing with 20 members at NCAR
  - Systematic varying of parameters
  - Add cycling of IC perturbations via ETKF, with 3DVar for the ensemble mean
  - Bias correction and postprocessing following the UW meso ensemble (Mass et al.)
  - Navy to run additional (COAMPS) members

Multi-model (physics)

- Chosen heuristically and for ensemble stability
  - Choose as many schemes that are fundamentally different as possible
  - Avoid combinations that fail frequently (impossible for WRF team to test all combinations for extended periods)

Testbed

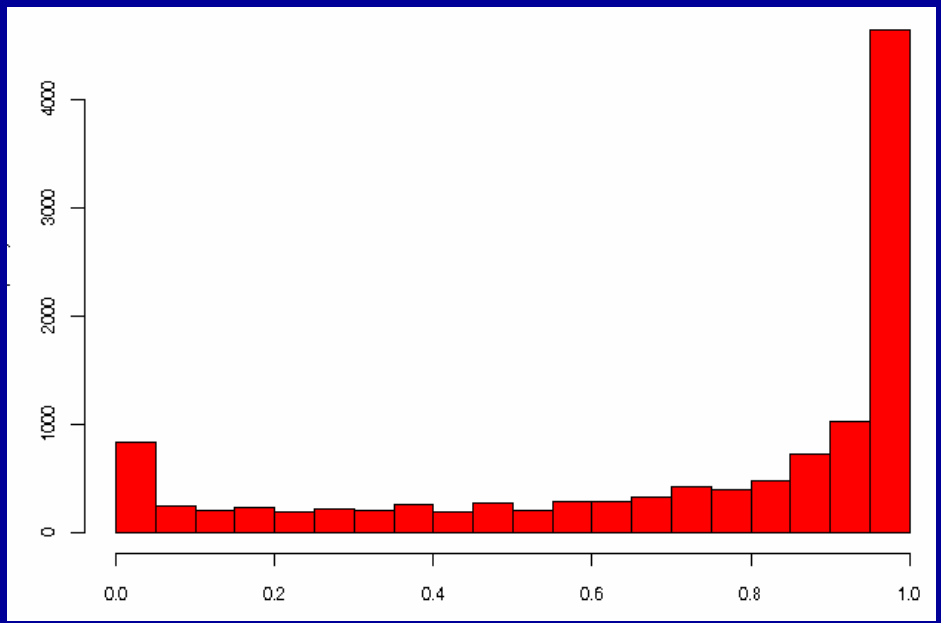
- October 2006, every other day
- 60-h forecasts from 00Z and 12Z
- 20 members
- 45/15 km grid spacing, 2-way nested

Baseline configuration is similar to current real-time system

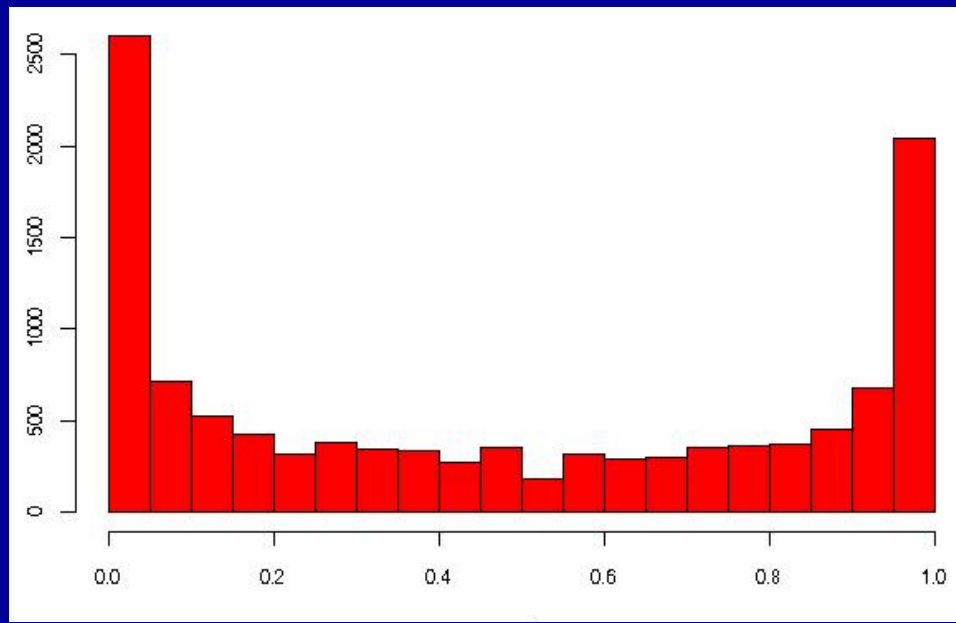
Surface wind speed 24 hours

Rank histograms

Raw forecasts



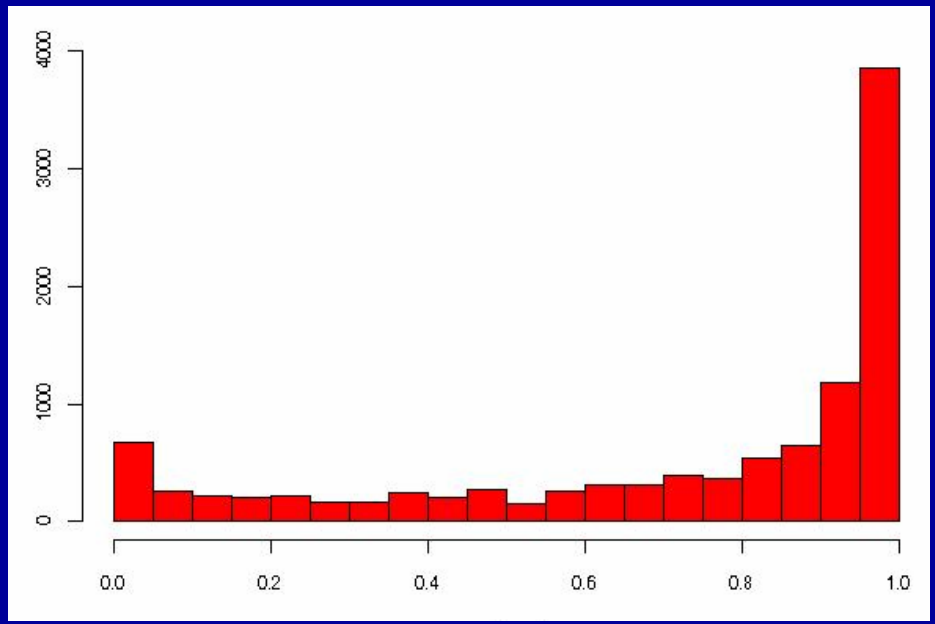
Bias corrected (individually)



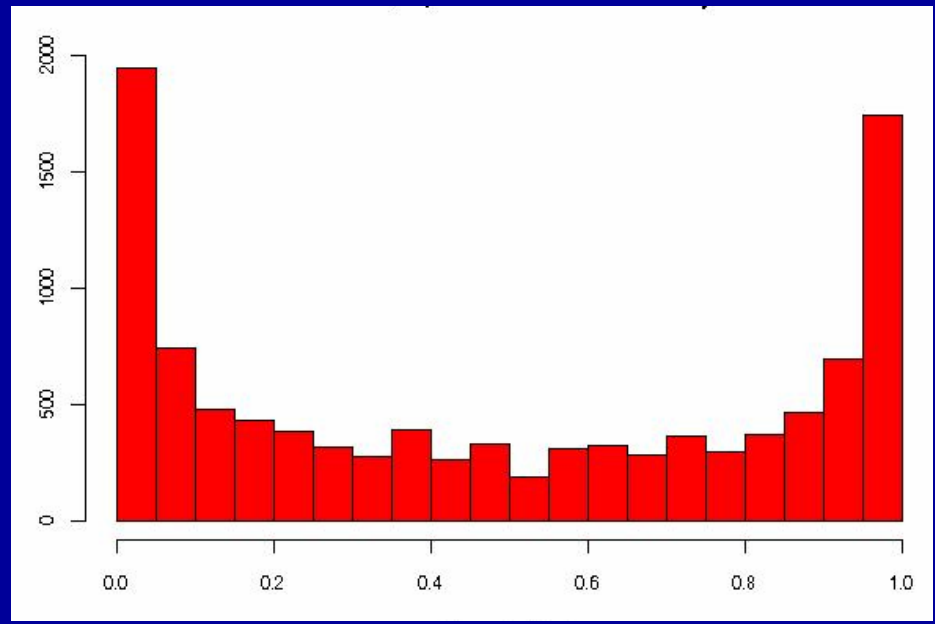
Surface wind speed 48 hours

Rank histograms

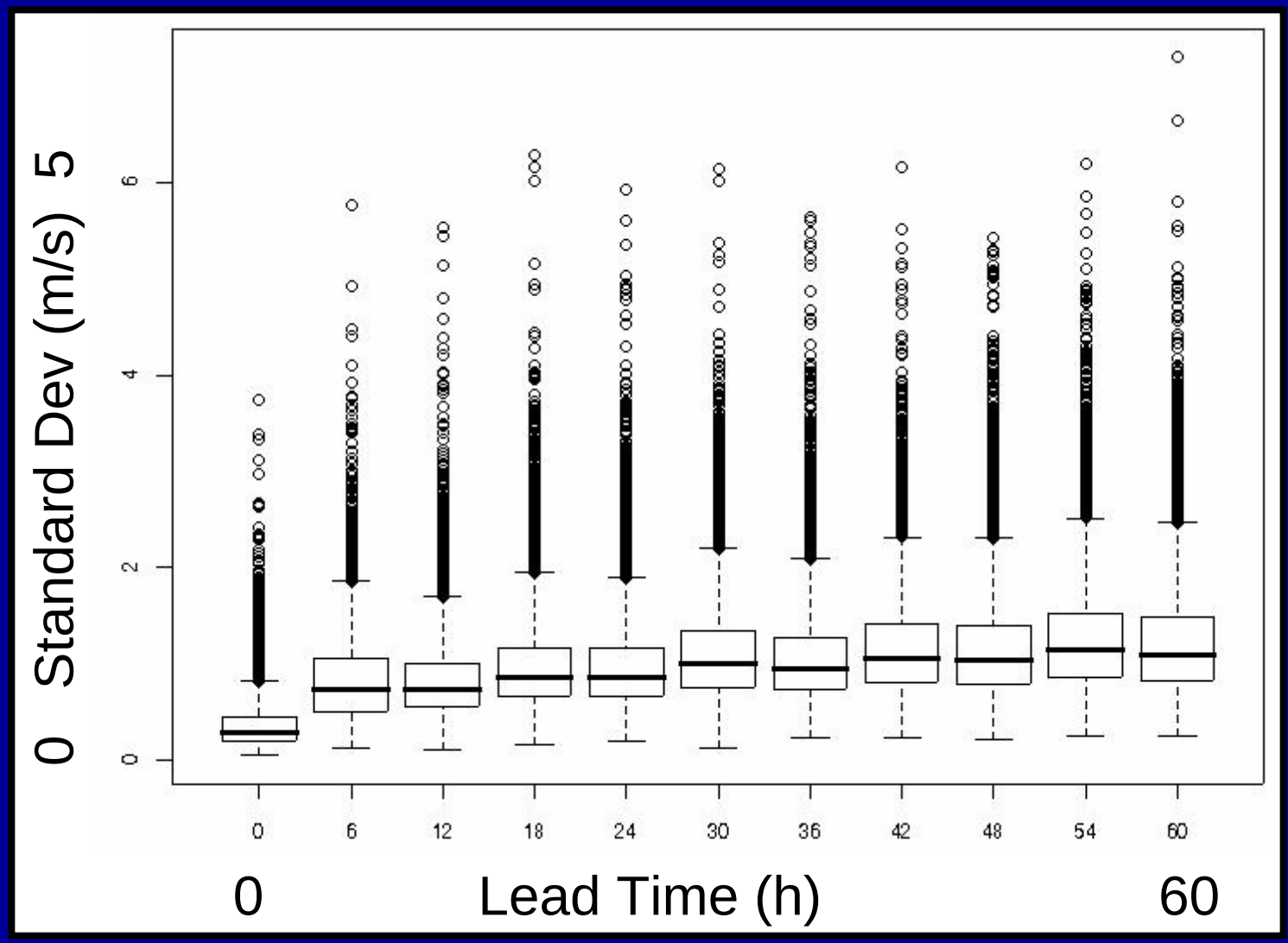
Raw forecasts



Bias corrected (individually)

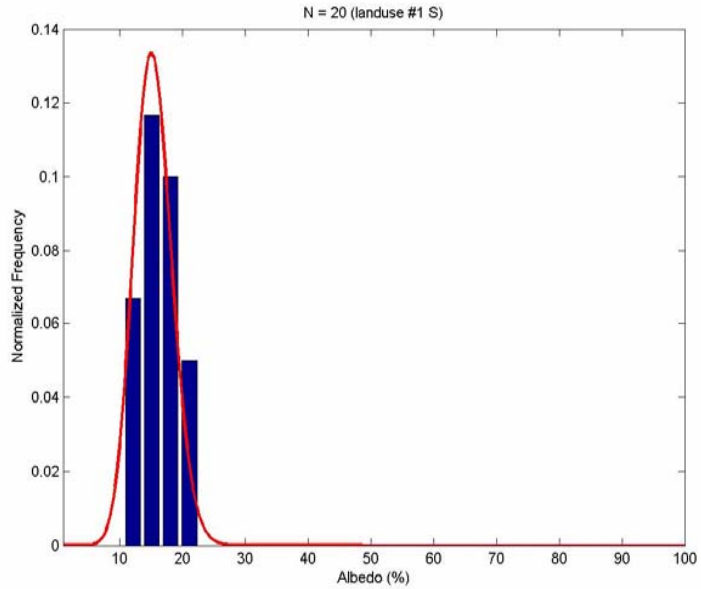


Ensemble spread in surface wind speed



Land-surface perturbation

Loop through LU categories:



Albedo (%)

Surface parameters are perturbed for each land use category, and have no spatial correlations other than what is already in the data.

Three land use parameters (albedo, roughness length, and moisture availability) are perturbed based on the gamma-like PDF (Eckel and Mass 2005).

$$f(x;\rho,\alpha,\beta,\zeta) = \frac{1}{\beta^{\alpha}\Gamma}\left(\frac{\rho(x-\zeta)}{\beta}\right)^{\alpha-1} \exp\left(\frac{\rho(x-\zeta)}{\beta}\right)$$

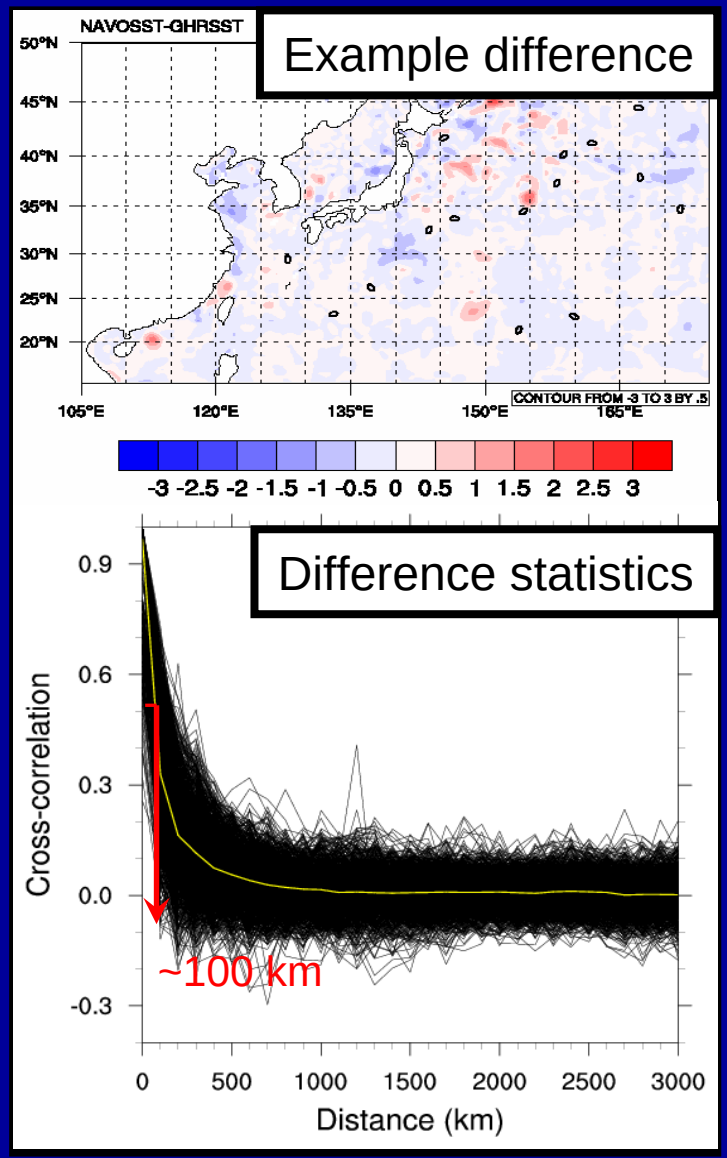
Random draws from the PDFs for each land use category constructed 20 different LANDUSE.TBLs.

SST perturbation

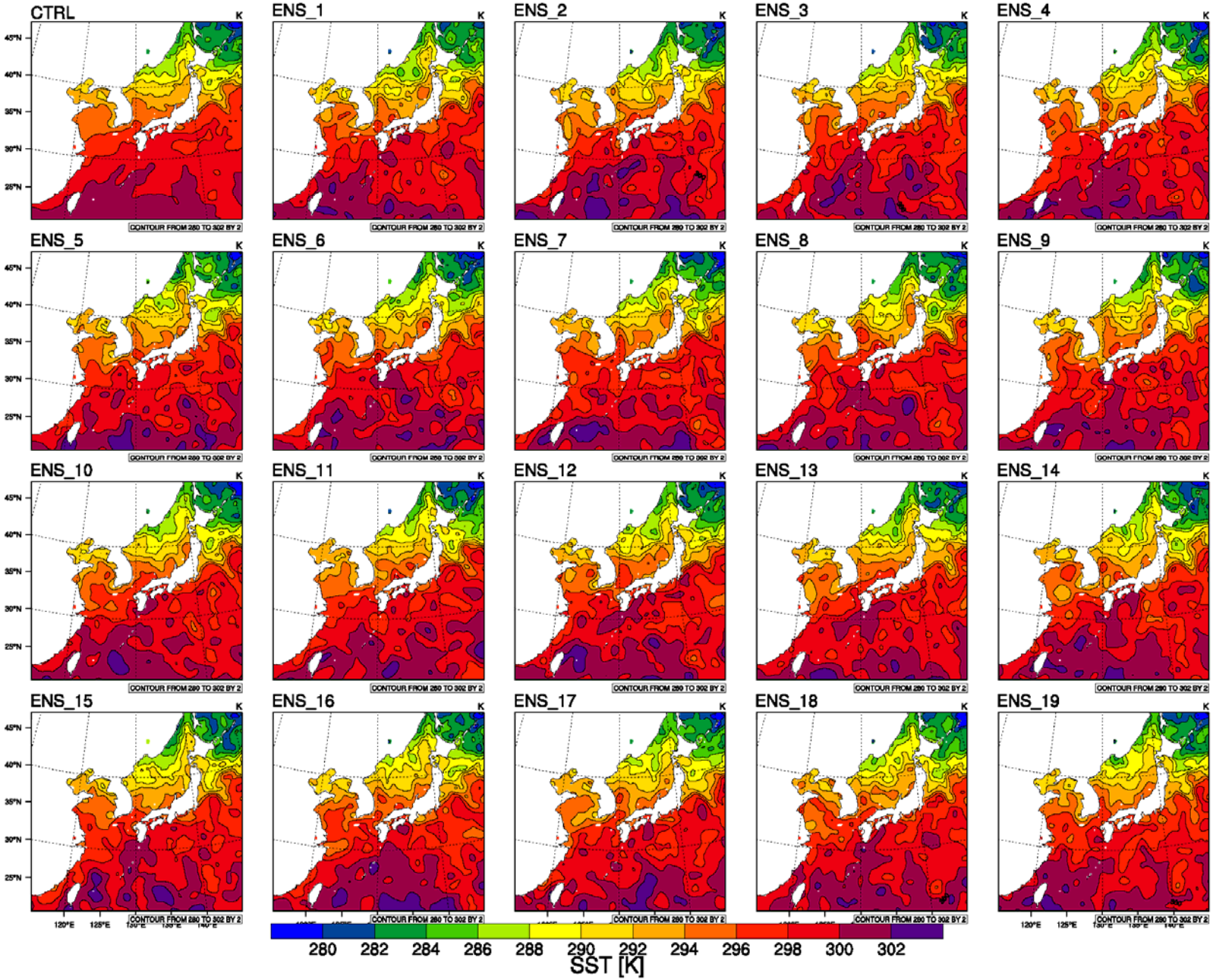
- Using the recursive filter in WRF 3DVAR.
- Length scale of the SST perturbations from statistics of the differences between two different SST analyses (NAVO SST and FNMOC high-res GHRSST) for one year (Jul 2005- Jun 2006).

➔ e-folding value of the averaged cross-correlations ~100 km.

- Magnitude of SST uncertainty: $\sigma \sim \pm 1.0$ K



SST (2006-10-21_00:00:00)



NCAR

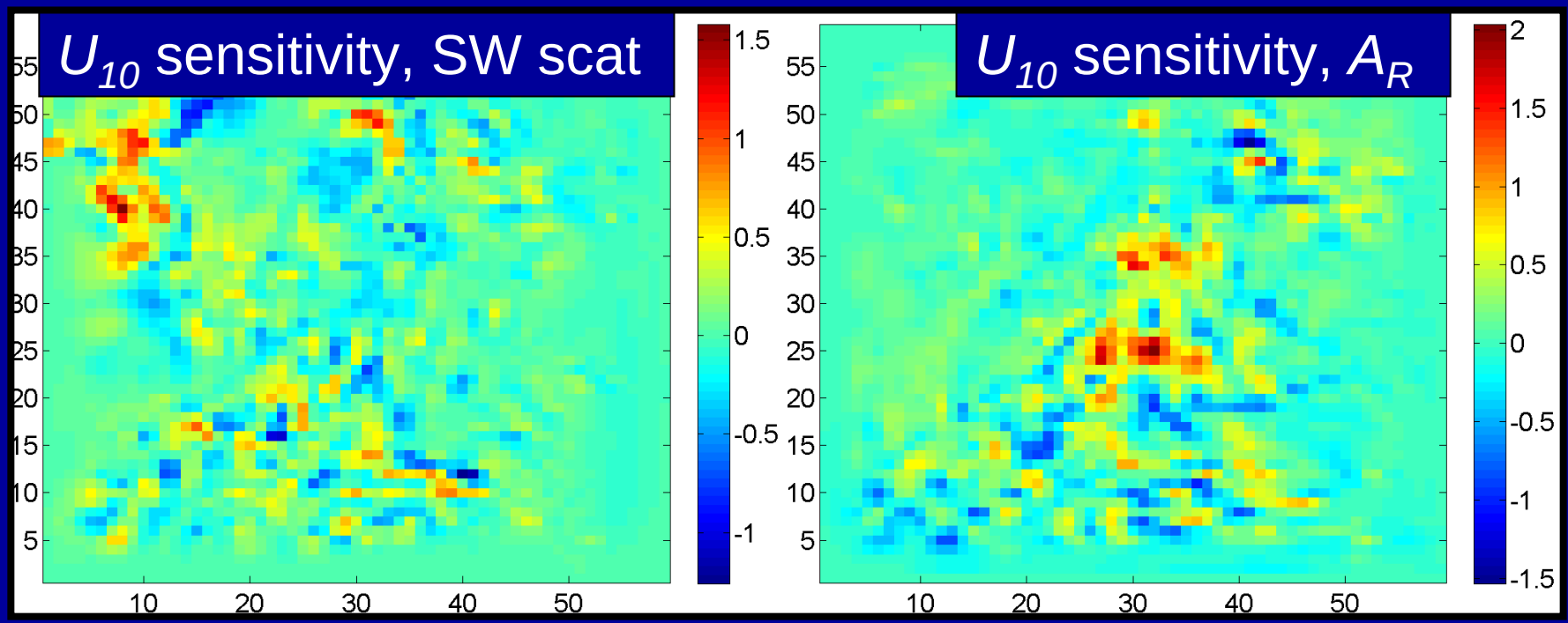
Multi-parameter ensemble

- An alternative to multi-physics ensembles
  - Only one configuration of the model to maintain
  - Ensemble filter results more likely to lead to physics improvements (only one configuration to improve)
  - Opens the possibility for parameter estimation

How does the ensemble variance/covariance compare to the multi-physics ensemble?

Multi-parameter ensemble

Parameterization	Parameter/Variable	Min	Mean	Max	Distribution
Cu (Eta KF)	Additive uncertainty on R	-300	0	300	$\beta(6,6)$
PBL (YSU)	A_R (Noh et al. 2003)	0.1	0.15	0.3	$\beta(2,6)$
Microphys (WSM 5)	N_0 for rain (M-P)	2E6	8E6	2E9	$\beta(1.5,6)$
Radiation (Dudhia)	Clear-sky SW scattering	0.2	1	2	$\beta(13.9,6)$



In closing

- The JME will be frozen in late summer and tested/used for a year
  - Exact configuration depends on performance during test period
  - Cycling with WRF-VAR and an ETKF (if successful in testing)