

Science and Implementation Strategy

Key Science Questions

“How does one ‘describe’ the total uncertainty and variability of the atmospheric/hydrologic system such that it can be described probabilistically and be useful for the generation of useful ensembles?”

This results in a sub-questions

- How to compare ensemble-based pdfs with empirical pdf at different time and space scales” (How many samples are needed, are they independent ensembles—how to generate the ensembles?
- How will seasonal variability influence the characterization of this uncertainty?

Overarching Implementation

Test-beds.

Design an intercomparison experiment/s that would include

- (i) intercomparisons of methodology of ensemble generation, including the representation different types of uncertainty (input, initial conditions, model etc),
- (ii) ensemble processing that includes downscaling and bias corrections, and
- (iii) development of ensemble-based forecasts in hydrologic models.

Meteorological/climate ensembles

“Are ensemble-based forecasts based on two-way coupled systems superior than those based on one-way coupled systems, and can this be quantified?”

Step 1: Develop ensemble-based forecasts based on one-way coupled systems, and determine their value.

Step 2: Extend to two-way coupling and compare to one-way coupling.

Users applications

“How do we demonstrate that ensembles, and ensembles-based predictions, are useful for hydrological applications, and how can this be measured?”

Need case retrospective studies, to quantify case studies

Initial hydro/land conditions

“How does data assimilation constrain the generation of ensembles, and how do the ensembles relate to their use in an assimilation system?”

Hydrological models and hydrological ensembles

Can we attribute and quantify the sources of uncertainty?

“How do we generate consistent ensembles that reflect the total uncertainty of the system, including space-time correlations, and the uncertainty that comes from hydrologic initial states, parameters, and model structure.?”

How do we estimate and represent the uncertainty in hydrologic models and their initial conditions?”

“If we use equally probable ensembles for the inputs, what is the respective probability distribution of the resulting hydrologic outputs?”

What data could be used to evaluate the limits of predictability?

How do we validate hydrologic ensembles for extreme events, with small sample sizes?

Need set of systematic sensitivity studies at various space-time scales, and various climatic regimes.

User requirements

“How do you verify the performance of an ensemble-based forecast modeling systems, and its evaluation relative to benchmarks, such as a statistically-based forecast system?”