

Program on Mathematical & Statistical Methods for Climate and Earth Systems (CLIM)

Working Group V: Climate Prediction

Proposed Topics:

On the construction of climate predictions

- Can we increase the levels of comparison with observations? While reducing the data transmission. ([M Jaffrey](#)) Role of ensembles: Value of “ensemble of convenience”? Weight given to different models? ([M Wehner](#))
- Can the V&V methods (Validation and Verification) be adapted to CP challenges? ([B Oberkampf](#))
- Can we “marry the physics and statistics” happily? End-to-end chain to informing health &c, or saying why not? (++)
- Radical alternatives to CP, CP more predictive, identifying when to moving beyond complex models, no time line.(++)
- Does adding complexity improve probabilistic forecast skill? Can model complexity be reduced w/o loss? (++)
- Sensitivity, Uncertainty and “estimation”/selection of (important) parameters in an imperfect model structure. (++)

Identifying and Executing Methods to Build Confidence in CP

- What are the limitation to empirical evaluation posed by climate-like tasks? Are there alternatives? (++)
- Mathematical response/conclusion/forecast when two different analyses yield widely different outcomes?
- Can we clearly demarcate where/when models output is faulty to building confidence? Boundary of Application. (+ +)
- Emulation in CP; complexity of discrepancy (when to stop). “Best before” dates to CP. ([M Goldstein](#))
- Distinguishing “good as it gets” insights from “turn the crank”/“conditioned on “False” CP.
- How to distinguish/communicate lead times at which a given model is useful from where not. ([S Mason](#))

What are the current “limits to predictability” in CP? What are the ultimate limits? What poses today’s limit?

- What is predictability horizon? Could it be extended via (1) better use of obs (b) parameters? ([A Carrassi ++](#))
- Given CP target define “use by” date via inability to simulate a phenomena (monsoon, arctic ice). ([A Apte](#), [D Solsky](#))
- Quantifying lead-times when traditional method are not advantageous/identifying “adequate for purpose” CP Math Impacts: Structural Stability, Mixing, non-stationary; use of anomalies, skill in base state: EB models. (++)

How can the complexity of climate models for CP be justified?

- Assessing (Contrasting) the Skill of Simpler and Simplest Models; Decadal Prediction. ([C Forest](#))
- Stat Frame work for Confidence in Weather-like vs in Climate-like tasks: is complexity justified empirically? (++)
- Focus model development at point when skill is lost; establish which lead times demonstrate skill. ([B Rosner](#))
- Quantifying need for hi resolution (model quality) to get feedbacks on CP time scales ([M Wehner](#))
- Metrics to detect improvement (demonstrable improvement in processes) not reflected in ave stats. (5-10 km)
- Demonstrating right for the right reasons/embracing wrong for the right reasons. (++)

What are the best obs to make for CP: today and in 2040?

- How can we use short term data sets to gain confidence in long term CP (ice sheet discharge)
- Identifying how much information (on extremes) can be/is lost in data compression/observation ([D Nychka](#))

How to prepare/inform CP users when the best model is not adequate for CP?

- What can one take from model simulations to tell engineers/design specialists/health/DRR... ([K Kunkel](#)) Distinguish/identify/communicate what we can reliably compute from not? Unquantifiable uncertainty. ([D Tucket](#)) Changes in extreme precipitation; ([K Kunkel](#)) Targeting early warning rather than “climate-proof”. ([GLIMPSE](#))

Quantifying the Predictive Stability of Climate models ([D Hammerling](#))

- Code: Small changes in IC, compiler settings, sub-grid-scale parametrizations ([R Bower](#))...
- Theory: What space-time averaging OK PDEs; Translation from model-land to reality); downscaling; anomalies

Communication:

- Qualifying Confidence in CP: Prob (X| model simulation) [? Something like a Prob(Big Surprise)?]
- The implications of non-stationarity (working with health professionals/engineers) ([K Kunkel](#))
- Defining the “100 year event” in a nonstationary climate; 20 year return events; extreme precipitation
- Better Uncertainty Guidance IPCC ([BUG](#)); Guidance for Disaster Risk Reduction (months to decades) ([D Tucket](#))
- SAMSI view/list of mathematical/statistical questions posed to IPCC in final governmental review. ([A Petersen](#))

SAMSI Jargon Normalization: “predictive intervals” vs “credible intervals. “100 year event”. “UQ, UG, Uncertainty

Can Surrogate Physical Systems inform CP or our confidence in it? Proof of concept test bed. ([C Forest](#))