

## Working Group VII: Stochastic Parameterization

### Research Overview:

Nonlinearities in the equations of motion and the finite resolution of weather/climate models result in the need for a representation of the effect of subgrid-scale processes on dynamics of resolved scales.

In the presence of a large scale separation between resolved and unresolved scales, we expect that these can be formulated as deterministic functions of the resolved variables. Such classical **deterministic parameterizations** are present in all weather and climate models.

In the absence of a scale separation, these upscale effects should be represented probabilistically, conditioned on the resolved state. These **stochastic parameterizations** are increasingly being used in operational models.

### Open Questions:

- When are explicitly stochastic parameterizations needed?
- How are these to be formulated?
  - Role of observations ?
  - Role of high-resolution models?
  - Role of systematic approaches such as stochastic reduction?
  - How can we adapt tools from other subjects (e.g. DA)?
- What are good candidates for stochastic subgrid-scale parameterizations?

Fundamental progress in addressing these questions can be made using simplified systems such as low-order models or single-column models

The Statistical and Applied Mathematical Sciences Institute

**samsi**  
NSF•Duke•NCSU•UNC