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## Information flow in complex high-dimensional systems

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*Knowledge on how information flows in complex Earth system models would be of great benefit for our understanding of the system Earth and its components. In principle the Kolmogorov or Fokker-Planck equation can be used to estimate the evolution of the probability density. However, this is not very practical since this equation can only be solved in very low dimensional systems. Because of that, mutual information and information flow have been used to infer information in complex systems. This usually involves integration over all state variables, which is generally numerically too expensive. Here we introduce an exact but much simpler way to find how information flows in numerical solutions that only involves integrations over the local state variables. It allows to infer both magnitude and direction of the information flow. The method is based on ensemble integrations of the system, but because the calculations are local the ensemble size can remain small, of  $O(100)$ .*

*In this talk we will explain the methodology and demonstrate its use on the highly nonlinear Kumamoto-Sivashinsky model using a range of model sizes and exploring both 1-dimensional and multi-dimensional configurations.*