

**“Sculpted Ensembles: Exploiting a Modern Data Assimilation Technique to Enhance Early Warning of High Impact Events”**

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**ISF 2016, Santander, 19-22 June 2016**

<https://forecasters.org/isf/>

**Abstract**

Modern forecasting systems often employ ensemble approaches to aid in the quantification of the forecast sensitivity of simulation models to slight changes in initial conditions or in parameters. Traditionally, data assimilation has been deployed to determine (ensembles of) initial conditions for a forecast model given observations of the system. Modern data assimilation techniques, however, are sufficiently flexible that they can be applied to points in the future as well as those in the past. In this paper, pseudo-orbit data assimilation or PDA (see Du, H. and Smith, L.A. (2014) 'Pseudo-orbit data assimilation part II: assimilation with imperfect models', *Journal of the Atmospheric Sciences*, 71 (2), 483-495) is used to explore interesting potential futures, thereby clarifying the plausibility of high-impact events under a model's dynamics. This is achieved by sculpting a forward trajectory with the aim of allowing the model to produce events of interest (bigger storms, longer dry spells, ...) and including additional ensemble members generated in this way. While it is not possible to assign probabilities to such trajectories, they provide insight in to developing conditions to look out for; note that is it not possible to assign probabilities to current ensemble members either. A second, related application useful for melding multiple models with different strengths, cross pollination in time, will also be noted.