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Exigent forecasting of extreme weather

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A forecast of a very large specific impact on people or property or nature might result from a particular but plausible perturbation, i.e., one that is consistent with known uncertainty or errors in observations and the model background field. Examples of interest include forecasts of aircraft icing at a particular airport, of freezing conditions in an area devoted to citrus growing, of precipitation for a Formula 1 race track, etc. Henderson et al. (2005) call these "exigent" forecasts because of the requirement of precision in the forecast and urgency in the response. Exigent forecasts can be determined with modified forms of 4d-VAR similar to our damage cost function experiments. Exigent 4d-VAR may be considered to be a nonlinear form of singular vector analysis. In general the damage cost function for this purpose measures the costs minus benefits for a particular interest (i.e., customer) resulting from the forecast. It is critical that accurate forecast error statistics are used in the definition of the background term so that the increments determined would be consistent with our knowledge of the atmosphere and associated uncertainty.

Exigent forecasts may benefit operational forecasters by identifying minor changes to model initial conditions that would strongly influence the weather in their forecast regions. Also, this technique might help to identify model or analysis system deficiencies when applied to poorly predicted historical cases. The sensitivity of hurricanes to slight changes in the SST or environmental flow, their complex dynamics, and their relatively compact size, make them an interesting candidate for study from the weather control or exigent forecasting perspective, and a number of hurricane simulation experiments will be presented. In one example we determine the perturbations required cause a simulation of Hurricane Iniki to track west of Kauai and in another we determine the perturbations so that a simulation of Hurricane Andrew causes greatly

reduced wind damage at landfall.

J. M. Henderson, R. N. Hoffman, S. M. Leidner, T. Nehrkorn, and C. Grassotti. A 4D-VAR study on the potential of weather control and exigent weather forecasting. *Q. J. R. Meteorol. Soc.*, **131**, 3037-3052, 2005. [http://dx.doi.org/10.1256/qj.05.72]