Geophysical Research Abstracts
Vol. 18, EGU2016-18202, 2016
EGU General Assembly 2016

Event attribution using data assimilation in an intermediate complexity atmospheric model

Sammy Metref (1), Alexis Hannart (1), Juan Ruiz (1), Alberto Carrassi (2), Marc Bocquet (3), Michael Ghil (4,5)

(1) IFAECI, CNRS/CONICET/UBA, Buenos Aires, Argentina (sammy.metref@cima.fcen.uba.ar), (2) Nansen Environmental and Remote Sensing Center – NERSC. Bergen, Norway, (3) CEREA joint laboratory École des Ponts ParisTech and EdF R&D, Université Paris-Est, Champs-sur-Marne, France, (4) École Normale Supérieure, Paris, France, (5) University of California, Los Angeles, USA

A new approach, coined DADA (Data Assimilation for Detection and Attribution) has been recently introduced by Hannart et al. 2015, and is potentially useful for near real time, systematic causal attribution of weather and climate-related events The method is purposely designed to allow its operability at meteorological centers by synergizing causal attribution with Data Assimilation (DA) methods usually designed to deal with large nonlinear models.
In Hannart et al. 2015, the DADA proposal is illustrated in the context of a low-order nonlinear model (forced three-variable Lorenz model) that is of course not realistic to represent the events considered. As a continuation of this stream of work, we therefore propose an implementation of the DADA approach in a realistic intermediate complexity atmospheric model (ICTP AGCM, nicknamed SPEEDY). The SPEEDY model is based on a spectral dynamical core developed at the Geophysical Fluid Dynamics Laboratory (see Held and Suarez 1994). It is a hydrostatic, r-coordinate, spectral-transform model in the vorticity-divergence form described by Bourke (1974).
A synthetic dataset of observations of an extreme precipitation event over Southeastern South America is extracted from a long SPEEDY simulation under present climatic conditions (i.e. factual conditions). Then, following the DADA approach, observations of this event are assimilated twice in the SPEEDY model: first in the factual configuration of the model and second under its counterfactual, pre-industrial configuration. We show that attribution can be performed based on the likelihood ratio as in Hannart et al. 2015, but we further extend this result by showing that the likelihood can be split in space, time and variables in order to help identify the specific physical features of the event that bear the causal signature.

References:
Hannart A., A. Carrassi, M. Bocquet, M. Ghil, P. Naveau, M. Pulido, J. Ruiz, P. Tandeo (2015) DADA: Data assimilation for the detection and attribution of weather and climate-related events, Climatic Change, (in press).
Held I. M. and M. J. Suarez, (1994): A Proposal for the Intercomparison of the Dynamical Cores of Atmospheric General Circulation Models. Bull. Amer. Meteor. Soc., 75, 1825–1830.
Bourke W. (1972): A multi-level spectral model. I. Formulation and hemispheric integrations. Mon. Wea. Rev., 102, 687–701.