

Joint Exploration of 3-D Global Atmospheric Models and Related Remote Sensing Data Products with Temporal Displacements of Several Days

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Abstract

In support of proposed new remote sensors of the earth and its atmosphere, simulation experiments are conducted using global circulation models coupled with data obtained from satellite images. The model experiments are known as OSSEs (Observing System Simulation Experiments). These experiments involve long integrations (Nature Runs) of a 3-D numerical model (out to several days or months) which serve as the experimental truth. These files can be quite large, on the order of 4-5 Gbytes/day. In addition to model data, real data extracted from remote sensing products (e.g. multi-spectral images) are used to establish the basis for judging the realism of the Nature Run.

A typical exercise would be to use the Nature Run to simulate data from a new instrument (a wind lidar for example); add those observations to the conventional input data of another global model (the testbed model); and then assess the incremental impact of the new observations on the analyses and forecasts from the testbed model. The realism of the atmosphere is always an issue in the judging the credibility of the OSSE. To evaluate the realism, the remote sensing data can be used to supply statistics or phenomenological details appropriate to the questions being addressed.

Presently, the evaluation of the impacts and the assessment of the realism are limited to very simple inspections. What is really needed is the ability to search both the gridded model fields and the remote sensing data sets for complex patterns and relationships. The target patterns may be fuzzy descriptions of a phenomena (example: find and count all the "cyclones" resolved by the global model). The remote sensing data may be searched for the same phenomena, but with a differing set of fuzzy descriptors which are dependent upon the information content of the data set. A more demanding search is to look both at the forcings in the global model and at time delayed responses in the remote sensing imagery. This type of searching or data mining is currently beyond the capabilities of most researchers and may be a good candidate for a generalized relational search tool.