Superposition of atmospheric states using information redundancy for Numerical Weather Prediction

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Atmospheric state analysis is a difficult scientific problem due to our limited ability in computation and observation, and analysed atmospheric states are fluctuating around the true state. The purpose of this paper is to analyse atmospheric state as a superposition of possible atmospheric states using information redundancy, and evaluate its accuracy in the context of numerical weather prediction (NWP). This atmospheric state analysis approach has two novel aspects. First, it uses only real atmospheric information, and no-artificial perturbations unlike existing ensemble based methods. Second, it does not require specific error structures of our knowledge of the atmosphere. We performed this method on a global numerical weather prediction system of Japan Meteorological Agency. The experimental results show the method can clearly reduce forecast root means square errors about 3-5% in average within 2 day forecast compared to existing methods (CNTL). Furthermore, forecast RMSEs of ensemble means of ensemble forecasts using only a few members generated by this method are significantly smaller than CNTL from the forecast initial time.

