
What does the spread amongst ensembles tell us about forecast errors?

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Abstract

In 2020 a new data source of GNSS-RO (GNSS radio occultation) observations from COSMIC-2 and Spire became available, adding about 9000 additional occultations per day to the ECMWF data assimilation system. This dataset enables us for the first time to investigate how the relationship between the Ensembles of Data Assimilations (EDA) spread values and the forecast error statistics from Observing System Experiments (OSEs) changes as a function of number of "real" assimilated GNSS-RO measurements.

At 100hPa in the Tropics, the addition of COSMIC-2 and Spire shows the largest effect on reducing the EDA spread by about 13% and 7%, respectively. In this region the reduction in ensemble spread behaves linearly with the reduction in forecast error for an increase in GNSS-RO data numbers. In other geographical areas and height levels the relationship is not linear. However, it is important to highlight that it is not useful to derive a quantitative relationship between the two measures as limitations in the EDA experiments and OSEs can have a profound impact on those numbers. Nevertheless, the reduction in EDA spread can be used as a relative measure to estimate the reduction in forecast errors when adding GNSS-RO data.

Keywords: ensemble spread, observing system experiments, forecast errors, EDA

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