Observation Sensitivity Experiments (OSEs) at ESRL

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NOAA overarching research question 4: What improvements to observing systems...will allow us to better analyze and predict the atmosphere...?

Why perform OSEs?
• The government is being asked to purchase or deploy new observational data systems.
• Will these systems improve relevant forecasts? Where should NOAA invest its resources?
• ESRL is helping NOAA make these decisions.

We use the RUC model. Why?
• It is a NOAA operational model
• Has been used for previous OSEs (wind profiler, AMDAR, GPS precipitable water)
• It ingests most currently available data, so new data are tested in a realistic context

Example 1: TAMDAR
• A system that measures wind, temperature, relative humidity (not often measured in-situ) from regional commercial aircraft
• It provides data between major hubs already served by major airlines providing weather data
• Are the data provided by TAMDAR useful enough for the government to purchase?

Example 2: Relative Impact of Data Sources
• Current NWP models assimilate a wide variety of data.
• Are all these data sources helpful?
• In what circumstances are they helpful?
• We tested the impact of 9 data sources
• We considered impact over...
  • summer and winter seasons
  • National and Midwest (a particularly data-rich region)
  • Multiple altitude ranges
• Results:
  • ALL current data sources add value to forecasts, in differing situations

Results:
• TAMDAR improves short-term forecasts of relative humidity, temperature and wind in the region* where TAMDAR flew ("U.S. Midwest; New TAMDAR fleets now cover most of the Eastern U.S. and some of the West Coast and Alaska.)

Data Impact on Winter Forecasts
(bar height indicates impact*)

RAOBs have the most impact for RH forecasts in the lower atmosphere.

Aircraft have the most impact on wind forecasts < 12h at flight levels.

Surface data (primarily METAR) have the most impact on wind forecasts < 12h in the lowest 200 mb of the atmosphere.

Impact
• This work justified NOAA’s acquiring TAMDAR data as an operational data source for NWS — used in NWP models and directly by forecasters, improving short-term weather forecasts
• OSEs showed the forecasts for which each data source adds value, allowing policy-makers to better determine costs and benefits.