USE OF NASA DATA IN THE JOINT CENTER FOR SATELLITE DATA ASSIMILATION

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Weather in its many manifestations continues to have a very substantial impact on many aspects of modern life. The majority of natural disasters affecting the United States and many other countries around the world are weather related, and also more routine weather phenomena affect many different sectors of the economy in less spectacular but nonetheless very measurable ways. Transportation – via land, sea or air - construction, agriculture, fishing, production and distribution of energy are only a few examples of activities that are heavily dependent on or influenced by weather on a daily basis.

The perhaps surprising fact that even in our modern era both human life and human activities remain highly vulnerable to weather means that there is a large and increasing demand for weather forecast information both from the general public and from specific sectors and interest groups. This demand is met by output from advanced data assimilation and numerical weather prediction systems routinely operated by NOAA and other agencies here and abroad. The skill of these systems has now reached a general level that allows the users to make decisions involving losses or gains measured in millions of dollars based on their output at forecast ranges of up to 7 days or more.

The timely availability of observations from all over the globe is a necessary prerequisite for any kind of quantitative weather prediction activity at a range or more than one or two days. The World Meteorogical Organization coordinates the acquisition and routine exchange of observations made by a heterogeneous mix of surface-based, airborne and space-borne sensors through its World Weather Watch and Global Observing System. WMO also monitors the impact on forecast skill of the various sub-components of the GOS, primarily through a series of dedicated Workshops to which experts from all the primary global numerical weather prediction centers are invited (e.g. WMO, 2004).

When measured by impact on forecast skill, the GOS was totally dominated by the balloon-borne radiosonde network in the period up to around 1998-2000. While of limited extent – only around 600 sonde stations world-wide provide routine observations, and most of these only take two measurements per day – the high vertical resolution and generally high quality of these measurements allowed their impact to dominate over that of the far more prolific satellite data.

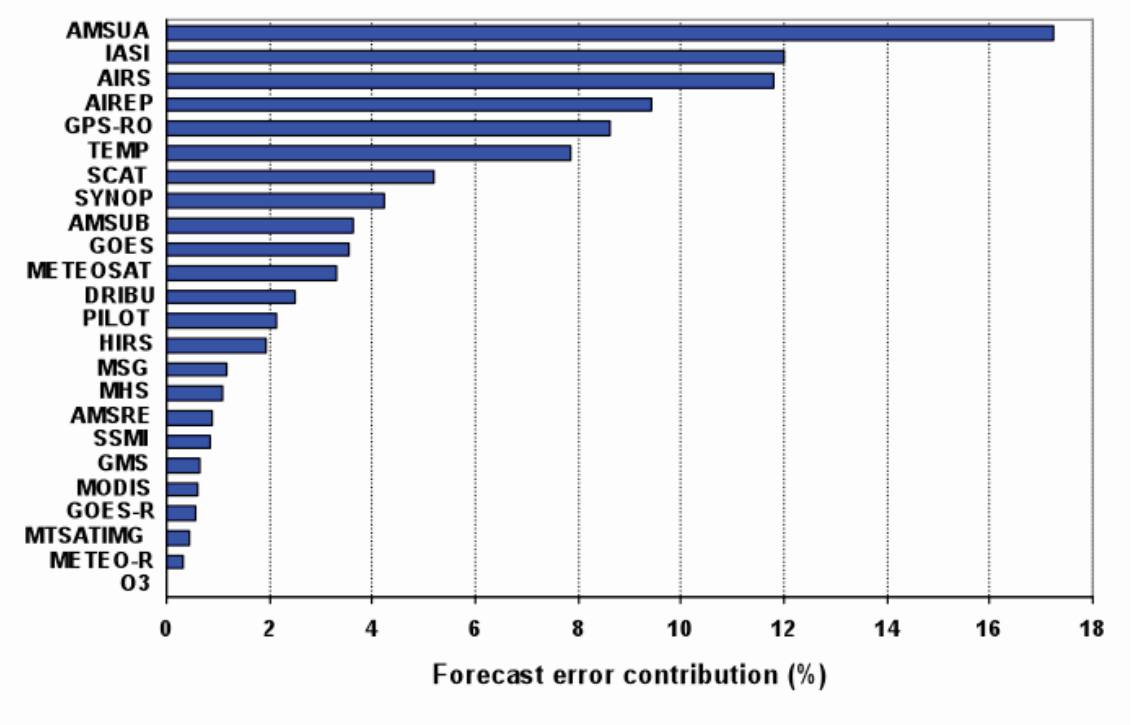

Figure 1. Contribution to reduction of the short-range (24 h) forecast error in the ECMWF system of various components of the Global Observing System *(figure courtesy of C. Cardinali and E. Andersson, ECMWF).*

In recent years this picture has changed dramatically. As shown e.g. in the work by Cardinali (2009), the satellite data are now totally dominant in terms of impact. The radiosonde network has in fact dropped to sixth place in terms of its importance for the ECMWF global forecast skill at the short range, and four of the first five spots are occupied by satellite data (see figure 1).

NASA has a long history of developing pioneering sensors and satellites for weather prediction purposes, and this history is continuing into the EOS era and beyond. Two of the most important research sensors for weather prediction skill are NASA's AIRS and MODIS instruments, and also sensors like Quikscat and AMSR-E have been shown to have sizeable impacts on forecast skill. Furthermore, data from e.g. MISR, Cloudsat and CALIPSO have been tested or are being used for validation and model development.

In this presentation we will show how modern data assimilation systems make use of satellite data and highlight the unique role of NASA's satellite data and NASA research in maintaining and improving the skill of the nation's operational forecast systems via the agency's involvement in the Joint Center for Satellite Data Assimilation. We will also briefly discuss the plans for testing and transitioning to operations some of the most important future NASA satellite missions.

References:

Cardinali, C., *Monitoring the observation impact on the short-range forecast,* Q. J. Roy. Meteorol. Soc.,135, 2009, 239-250.

Third WMO Workshop on the Impact of Various Observing Systems on NWP in Alpbach (Austria) March 9-12 2004; WMO Geneva, 2004.