CGMS

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NOAA Report on Global Positioning System (GPS) Radio Occultation Measurements

In response to CGMS Action 36.17 (WMO and the GCMS Secretariat to initiate the formation of the small group (J. Lafeuille [WMO], M. Goldberg [NOAA] and J. Schmetz [EUMETSAT]) to consider the role of a new international Radio-occultation Working Group under CGMS, to elaborate its draft terms of reference).

NCEP started assimilating COSMIC observations into its Global Data Assimilation System in May 2007. Since then, several impact studies have shown the benefits of incorporating GPS RO observations into the observing system. The use of COSMIC observations results in a significant improvement in model forecast skill, mostly due to the fact that GPS RO observations do not oversample, are unbiased and very accurate, have similar accuracy over land than over ocean, and are minimally affected by clouds and precipitation.

The number of applications of GPS RO observations within NOAA is steadily increasing. These applications include the use of the data in regional models, profiling the lower troposphere and understanding how the use of RO data improves the use of nadir satellite radiances. In addition, NCEP is also assimilating GPS RO observations into its reanalysis system. NOAA is also working on the design of GPS RO OSSE experiments within the international Joint OSSE project. Finally, A GPS RO follow-on capability mission is under current evaluation at NOAA.

NOAA Report on Global Positioning System (GPS) Radio Occultation System

NOAA has been assimilating observations from the COSMIC mission into its Global Data Assimilation System since May 2007. The incorporation of COSMIC into the operational system was shown to produce significant impact in model forecast skill. The GPS RO observations are shown to provide information of the atmospheric state not contained in other satellite sensors. This is primarily due to the fact that the GPS RO observations are a very accurate measurement of temperature and water vapor not requiring calibration and can be assimilated into the model without a bias correction scheme. In addition, the data has equal accuracy over land than over ocean and it is minimally affected by clouds and precipitation.

NOAA has recently updated the assimilation of the COSMIC observations into NCEP's Global Data Assimilation System. The changes include the use of a more accurate forward operator, updated quality control procedures (which enable the use of many more observations, in particular in tropical latitudes) and more optimal observations error structure. The benefits of using the improved assimilation algorithm versus the current operational code are shown in Fig.1. The figure also shows the benefits of using COSMIC on top of all the other observations being assimilated operationally.

NCEP is currently evaluating the use of the GPS RO observations into its Mesoscale Global Data Assimilation system for future implementation in operations. Furthermore, work on the use of the COSMIC observations in order to retrieve Planetary Boundary Heights (PBL) and to understand how the use of these observations affect the bias correction of the other satellite data is under current investigation. The addition of other GPS RO sensors such as GRAS (the RO instrument on Metop) has been recently investigated and the data should start being assimilated operationally in the near future.

In addition, considerations on the optimal number of LEO satellites to be deployed and adequate coverage are being addressed as a result of the CEOS Category I, Action WE-07-03. The action assessed the requirements needed to perform Observation System Simulation Experiments (OSSEs) to compare operational benefits of the various constellation options. Some funding is available at NOAA to perform Observing System Simulation Experiments (OSSEs) with RO measurements. The experiments will provide answers on the optimal number of LEO satellites and orbit configuration to ensure maximum benefit from the RO observations.

With respect to future missions, NOAA is working on requirements for a COSMIC follow-on. This mission is likely to be an enhancement of the current COSMIC 6 satellite constellation, with respect to measurement accuracy and global coverage (current plan is to deploy 12 satellites).

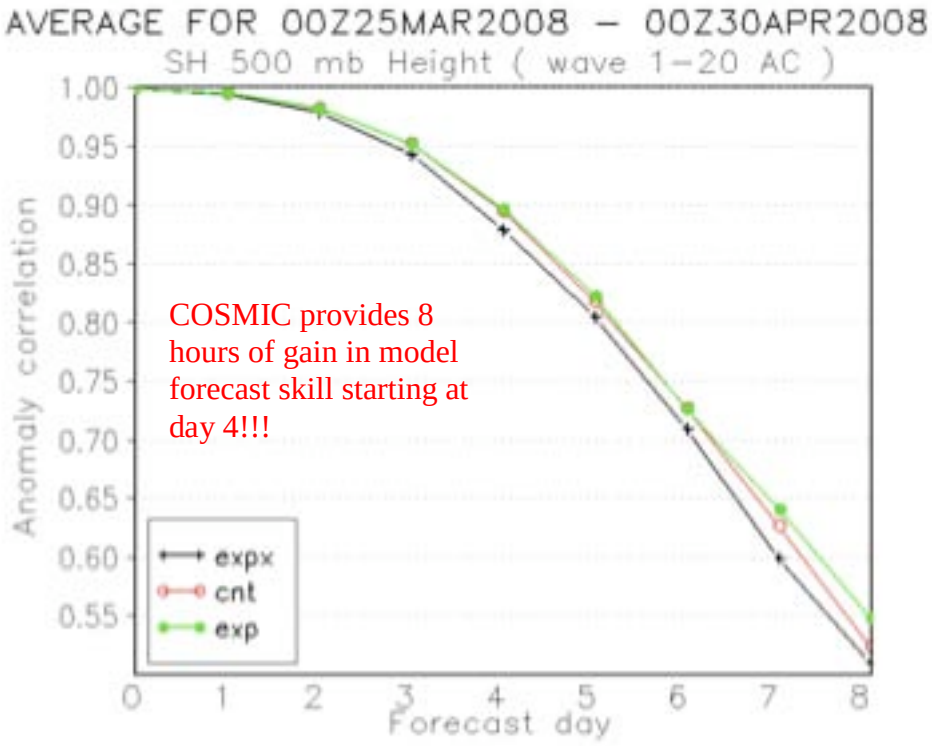

Fig.1. Anomaly correlation scores for the 500-hPa geopotential heights as a function of the forecast length for the Southern Hemisphere extratropics. The different experiments are *expx* (no COSMIC), cnt (includes COSMIC with the operational assimilation code) and *exp* (includes COSMIC with the updated assimilation code).