GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS) RADIO OCCULTATION (RO) MISSION AND GROUND SYSTEM PLANNING

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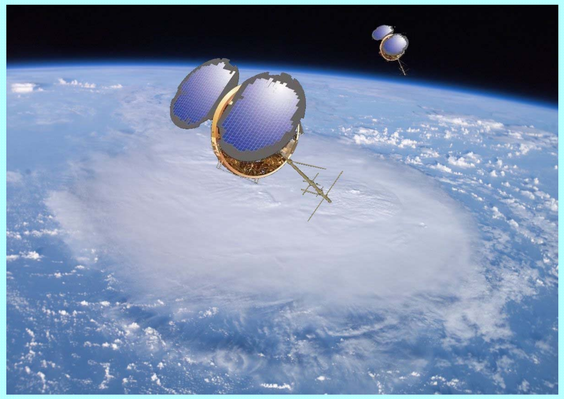
COSMIC Heritage:

COSMIC is a joint U.S.-Taiwan 6-microsatellite demonstration mission that was launched in April 2006. Its mission is to demonstrate the value of near-real-time GPS Radio Occultation (GPS-RO) data to global users. It is the world's first operational GPS-RO mission for global Earth weather forecast; climate monitoring; atmospheric, ionospheric, and geodetic research. The satellite system is currently operating with high reliability and providing global data in near-real-time to over 1,000 users worldwide. The GPS-RO data has been demonstrated to be valuable to the climate, meteorology, and space weather communities. These communities include both real-time forecasting users, as well as U.S. and international research communities.



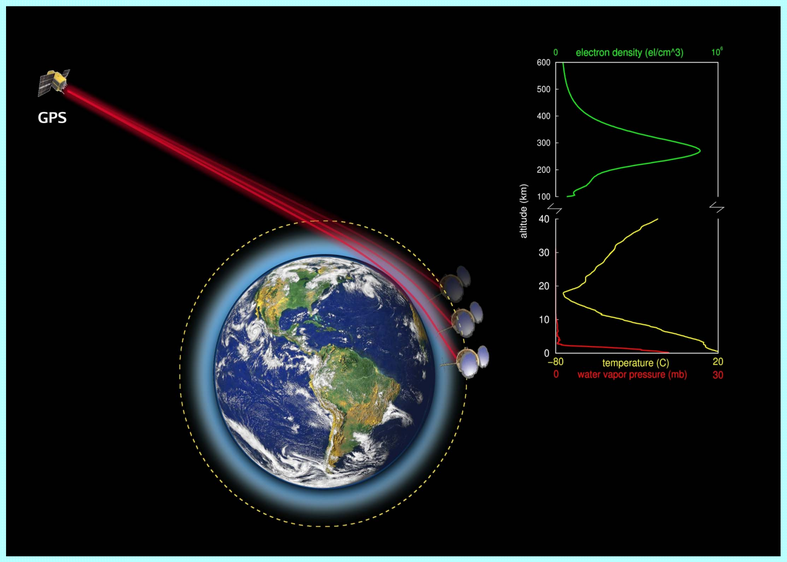
COSMIC-2 Objective:

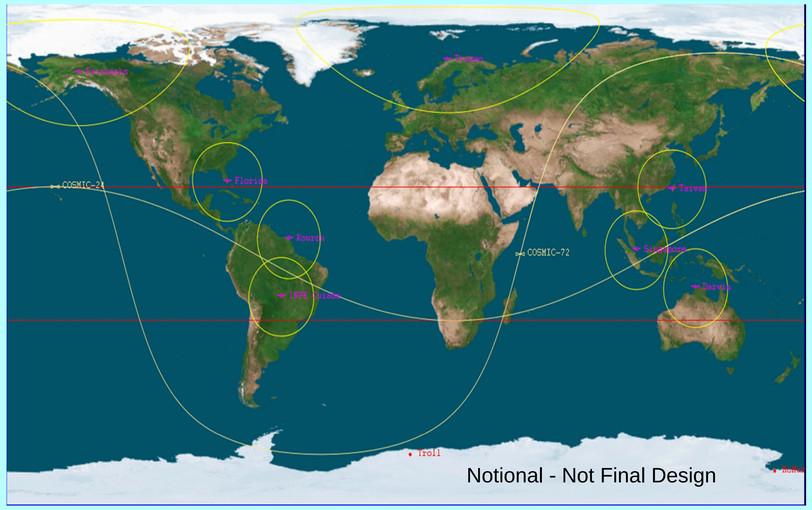
The objective of COSMIC-2 is similar to that of COSMIC: to collect a large amount of atmospheric data for meteorological, climatic, ionospheric, and geodetic research, as well as for weather forecasting and space weather monitoring. Additionally the system will allow scientists to collect data over un-manned and remote regions (such as the poles and oceans) in support of research in these areas.

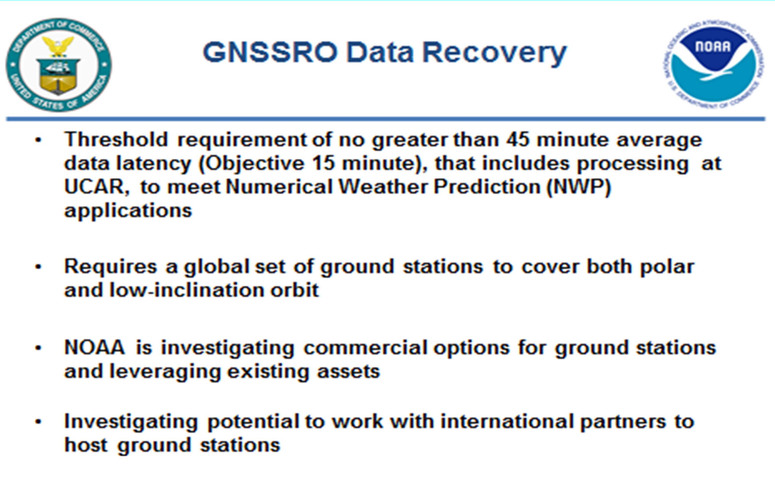
How does COSMIC-2 plan to meet this objective?

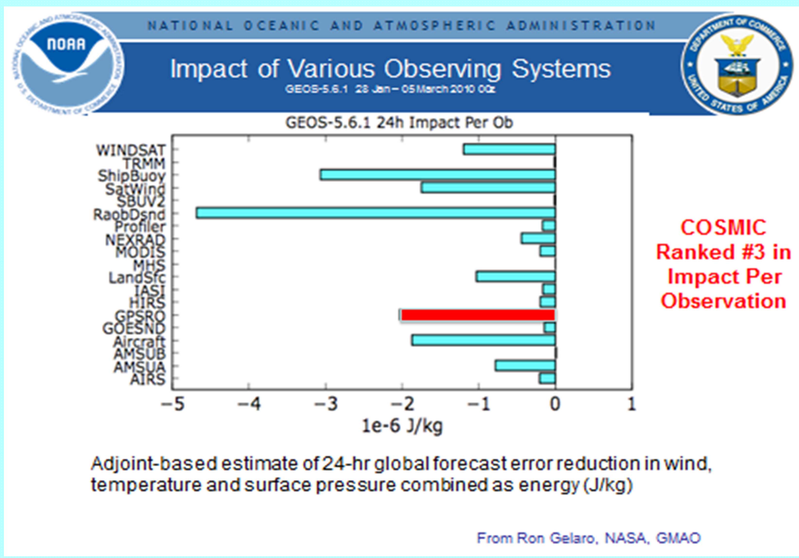
By intercepting GPS, GLONASS, and Galileo signals with a satellite-based receiver and inferring the deviations in each signal's straight-line path caused by temperature and moisture gradients

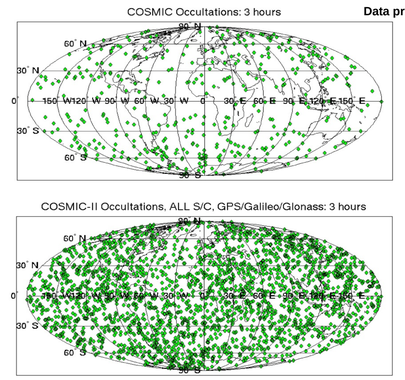
- GNSSRO data provides valuable information on moisture in the tropics, which is important to hurricane track and intensity forecasts. Based on data assimilation research experiments using the current COSMIC data on five 2008 West Pacific typhoons, 48 hour track errors were improved by approximately 11 percent. Increases in forecast performance will impact evacuation and preparedness decisions that directly correlate to saving lives and mitigating the impact of property damage.
- Based on a study by Cucurull, Derber, 2008, documented benefits of COSMIC and other GNSSRO observations on the European Metop satellite include a reduction in total global forecast error of approximately 9 percent.







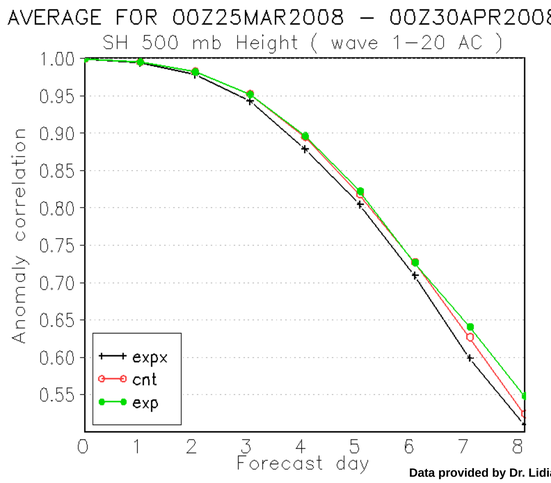




This figure illustrates the comparison of sounding distribution over a three hour period between COSMIC and COSMIC-2. The COSMIC-2 constellation will produce more then 8,000 soundings per day, compared to the approximate 2,000 soundings per day currently produced by COSMIC.

Where are we now?

- COSMIC satellites are past engineering design life and beginning to fail
- Partnership for COSMIC-2:
  - Taiwan to provide 12 satellite buses and integration of instruments, and ground system command & control
  - USAF to provide instruments and provide the launch services
  - NOAA to provide complete ground system, and data processing and distribution
- Launches planned for FY2016 and FY2018
  - First launch of 6 to 24 degree equatorial orbit
  - Second launch of 6 to 72 degree polar orbit
- System expected to provide:
  - 8000+ worldwide atmospheric soundings
  - 10,000+ worldwide ionospheric soundings per day
  - All weather
  - Uniform coverage over oceans and land
- NOAA requesting funding in FY13 Sandy Supplemental
- AIT/TECRO International Agreement with Taiwan has been signed
- Preliminary Level 1 Requirements Document complete



COSMIC provides 8 hours of improvement in Weather forecast skill at day 4 and over 15 hours in day 7, with particularly significant improvement over the oceans. Analysis – COSMIC satellite degradation will cause significant NOAA forecast skill loss.