



COSMIC-2 (Constellation Observing System for Meteorology, Ionosphere and Climate)

Bill Kuo
UCAR COSMIC Program

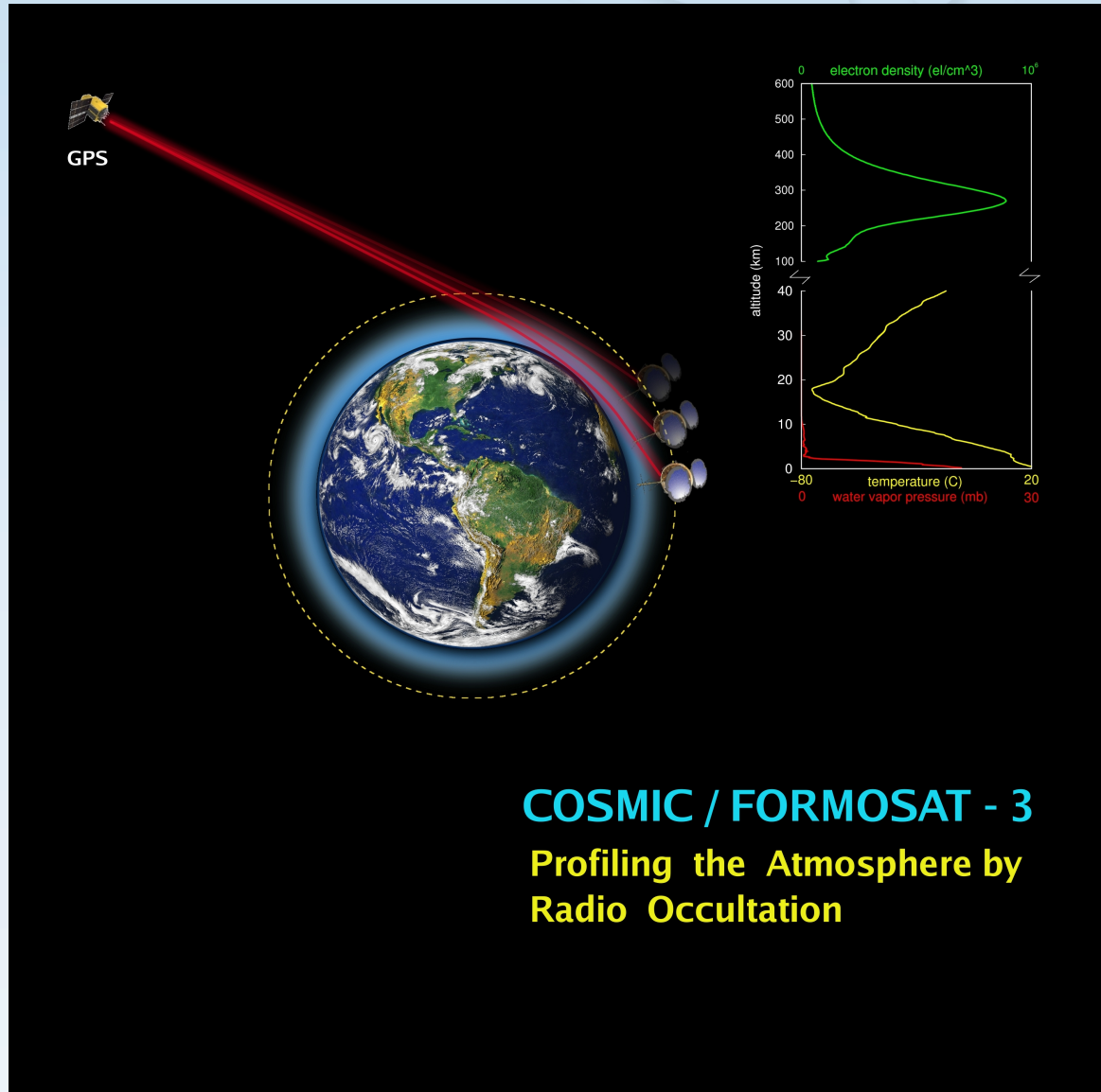
Radio Occultation

Radio Occultation (RO) was pioneered by NASA/JPL and Stanford in the 1960's to study planetary atmospheres.

GPS RO is a new method (**first** demonstrated in 1995 by UCAR) for performing atmospheric measurements on Earth.

As a satellite in low-Earth orbit carrying a radio receiver passes behind Earth (is **occulted** by Earth), the radio waves from a GPS satellite pass through the atmosphere and are slowed and bent along the way.

The amount of bending depends on the temperature and water vapor in the lower atmosphere and the electron density in the ionosphere.



COSMIC / FORMOSAT - 3
Profiling the Atmosphere by
Radio Occultation

COSMIC

- 6 Satellites launched in April 2006
- Global observations of:
 - Pressure, Temperature, Humidity
 - Refractivity
 - Ionospheric Electron Density
- Demonstrate impact of RO sounding on weather prediction
- Taiwan paid \$80M; U.S. \$20M
- Four out of six satellites are still operating after 9.5 yrs



Bulletin American Meteorological Society March 2008

www.digital-typhoon.org
2008-08-20 06:00 UTC
Typhoon 200812 (NURI)

Typhoon Nuri (2008)

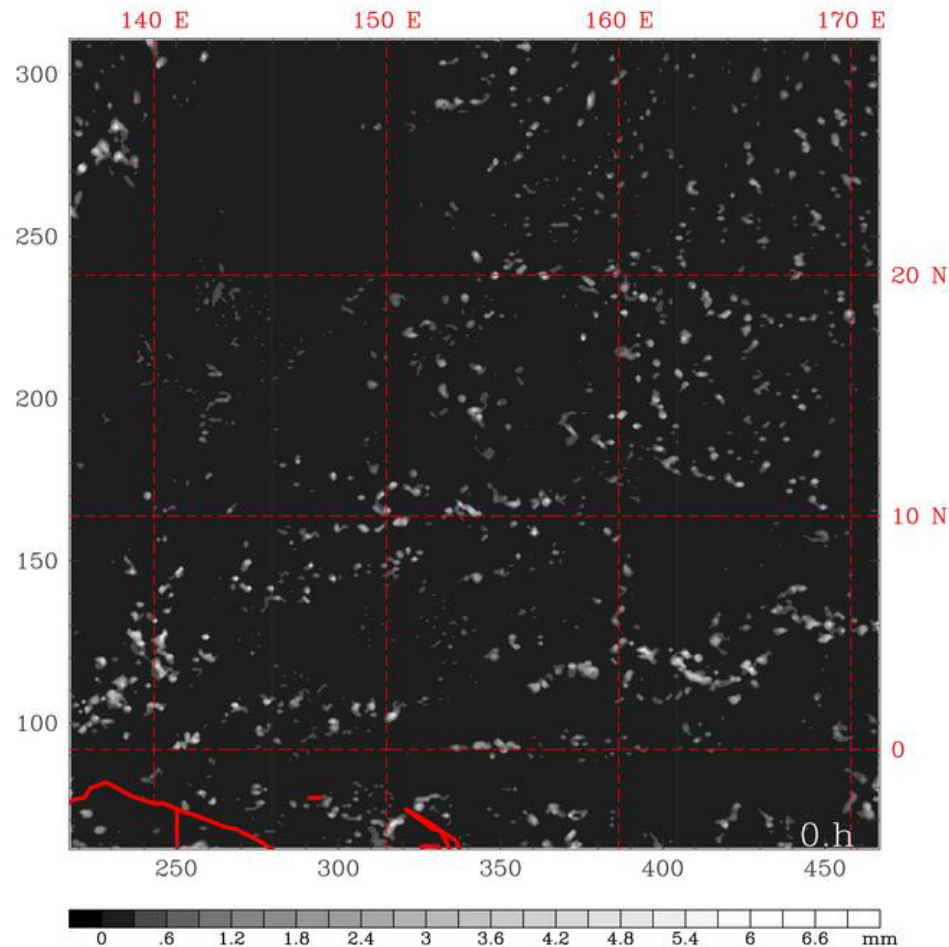
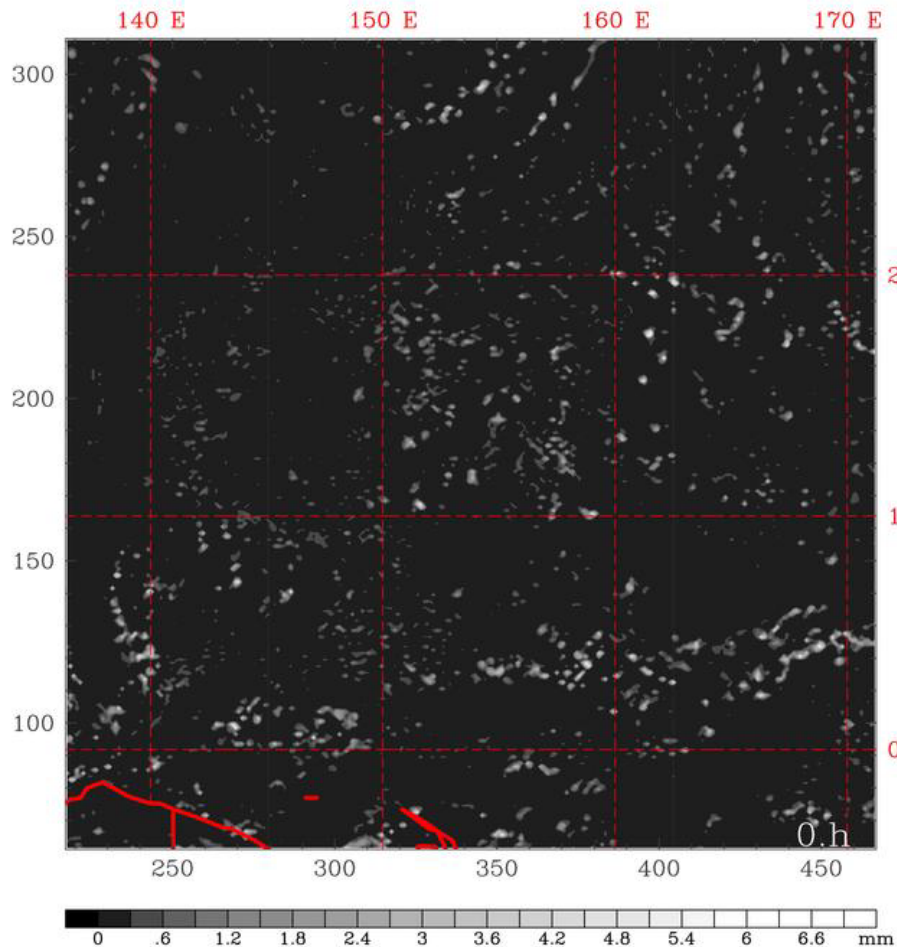
MTSAT-1R
ERI/IIS/U-Tokyo/Japan+Blue Marble

Processed by
National Institute of Informatics

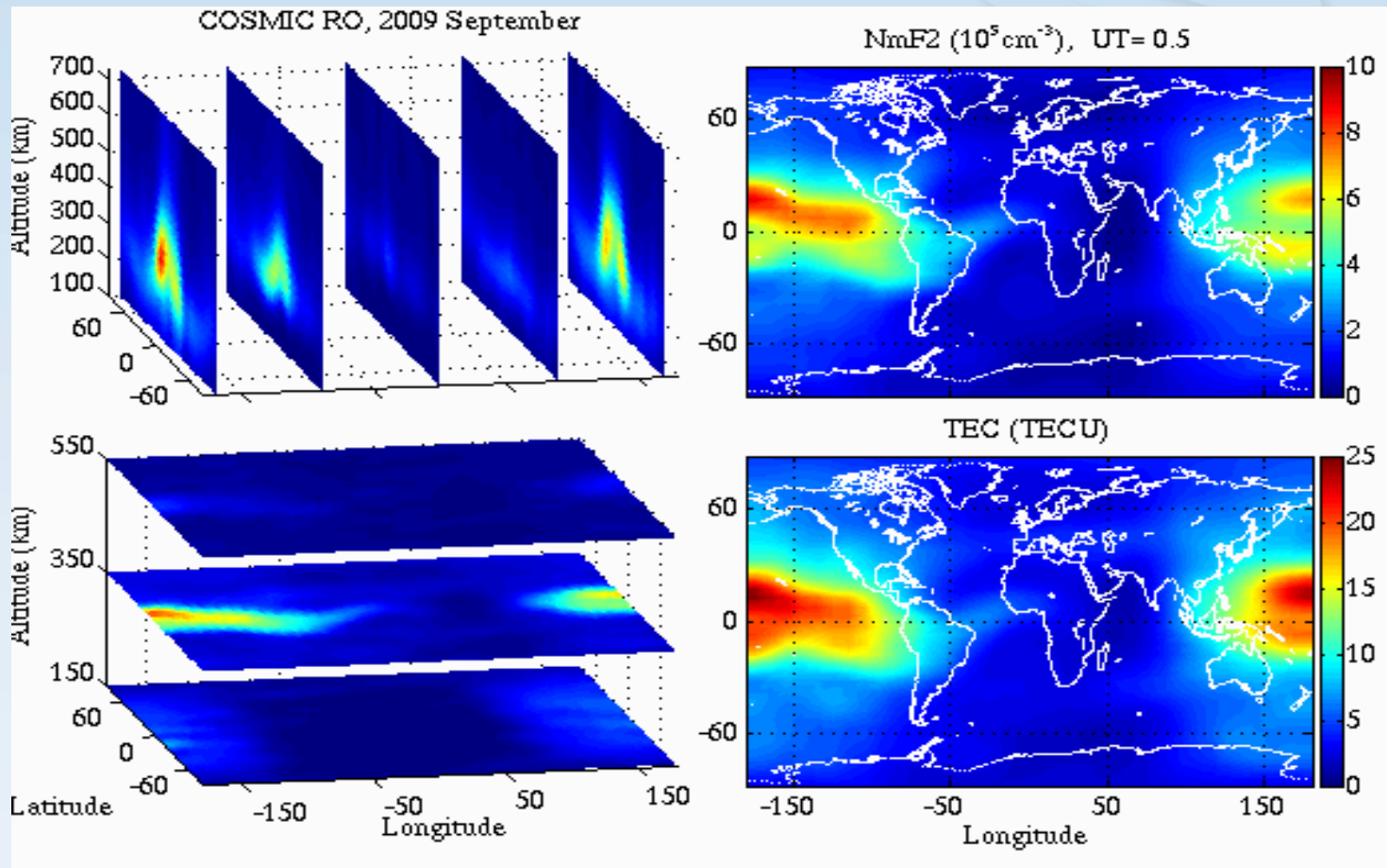
WRF Model Forecast After 3-day of Data Assimilation Starting at 1800 UTC 14 August 2008

No GPS RO Data

With GPS RO Data



The COSMIC TEC observations can be combined with other observations to generate an ionosphere reanalysis

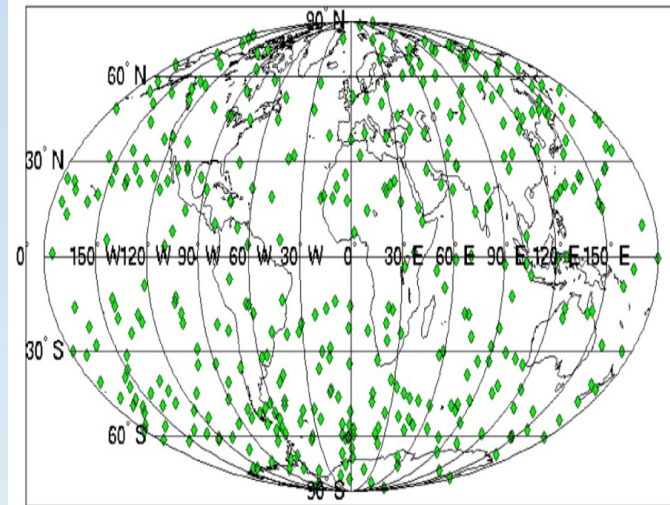


Monthly gridded analysis of electron density useful for scientific studies of the ionosphere climatology and space weather model development

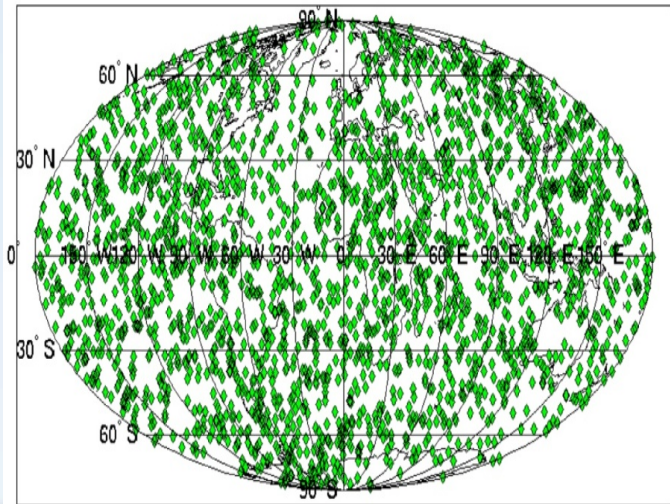
COSMIC-2

- Improved receiver and better antenna will improve data quality
- Making use of both GPS and GLONASS
- 5X number of soundings---10,000/day
- Greater impact on weather forecasts, including tropical cyclones
- Monitor rapidly changing pre-tornado environment
- Significant improvement in space weather observing and prediction
- Mitigate potential gap in U.S. polar orbiting satellites

COSMIC Occultations-3 Hrs Coverage

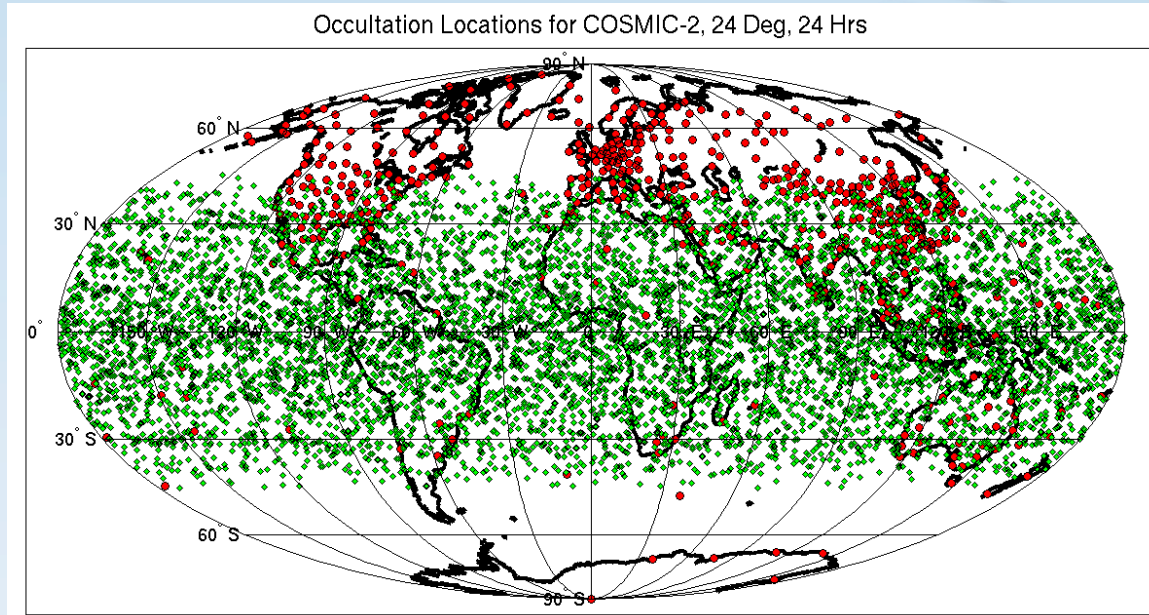


COSMIC-2 Occultations - 3 Hrs Coverage



Importance of C-2 Second Launch

1st Launch 2016



With 2nd launch
2019

