Investigating the Characteristics of FORMOSAT-7/COSMIC-2 Radio Occultation Data

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Daily atmospheric profiles

The FORMOSAT-7/COSMIC-2 constellation was launched on 25 June 2019 and the first data was received after three weeks.



Data density during one month



FS3 Mar. 2009

FS7 Mar. 2020

Introduction

- FORMOSAT-7/COSMIC-2 (FS7/C-2) provides lots of radio occultation (RO) soundings over the tropical and subtropical region where is mostly covered by ocean.
- The high vertical resolution and quality of GNSS RO data could help detect the atmosphere temperature and moisture.
- Because of the abounded RO observations from FS-7/ C-2, we attend to investigate the characteristics of FS-7/C-2 RO data in the troposphere, that could be useful for the future application of FS7/C-2 data in the numerical weather prediction.



Spatial Distribution and Penetration Depth



Height above topography

Data collection for verification Oct. 2019-Mar. 2020 (6 m.)



Impact of spatiotemporal distance

- Differences increase with spatial distance
- Insensitivity for temporal departure
- > Co-located window: \pm 3h and \pm 100 km



Verification against Metop, KOMPSAT-5, radiosonde



Bias – solid line RMSE – dashed line 國立中央大學全球定位科學與應用研究。 GPSARC GPS Science and Application Research Center

Verification against global analysis (ERA5, NCEP fnl), satellite radiance (JPSS-1, SNPP)



Bias and RMSE in temperature (vertical average: sfc.-200 hPa)



Bias and STD in vapor pressure (vertical average: sfc.-500 hPa)



Independent verification against dropsonde and radiosonde







TROPS FS7 Verification (Metop, KOMPSAT-5, radiosonde)



Summary

- From the statistics, FS7 RO soundings have better penetration depth than FS3, i.e., FS7 provides more than 80% of RO soundings below 1 km, and it is about 40% for the FS3.
- The verifications against multiple soundings show consistent characteristics with a positive temperature bias of 0.5 K and a negative moisture bias of 2 hPa in the troposphere. In comparison, the verification against global analyses have smaller differences with FS7.
- The verifications against individual observations over ocean also show a promising data quality in FS7.

Thank you!

