I. Introduction

National Meteorological Satellite Center (NMSC) which belongs to Korea Meteorological Administration (KMA) has been operating two geostationary meteorological satellites, COMS and GKD2A, since 2011 and 2019 respectively.

- COMS: Communication, Ocean, and Meteorological Satellite (The 1st satellite of the KMA)
  - Operation Orbit: 128.15E / 35.800 km above the Equator
  - Meteorological Imager (MI), one of 3 payloads has 1 visible (1km) and 4 infrared (4km) channels
  - 16 baseline products from the COMS MI observation

- GKD2A: GEO-Korea Multi-Purpose Satellite - 2A (The 2nd satellite of the KMA)
  - Operation Orbit: 128.15E / 35.800 km above the Equator
  - Advanced Meteorological Imager (AMI) has 16 channels (500km & 1km for VIS, 2km for IR)
  - 52 baseline products from the GKD2A AMI observation

Also, NMSC has been supporting satellite data to KMA’s NWP system for data assimilation since 2011. As a part of data support, NMSC has been studying about processing data and application to NWP system.

- GNSS RO Data Processing Techniques
  - NMSC is studying RO data processing techniques for better understanding and utilization

- GNSS RO Data Application
  - NMSC provides GNSS RO data to Numerical Modeling Center of KMA for the NWP application

II. GNSS Radio Occultation Techniques at KMA

A. Basic theorems of retrievals using GNSS RO data

1. Bending Angle from Geometric Optics
   - Bourger’s rule

2. Refractivity from Bending Angle
   - Abel transform

3. Atmospheric profile from Refractivity

NMSC has been investigating and working on the processing of GNSS RO raw data to secure its preprocessing technology before calculation of bending angle and refractivity.

B. Development of frequency downward transformation and phase-evaluation technique using Climate Model (MSIS) for Open Loop (OL) signal processing

- MSIS: Mass Specrometer and Incoherent Scatter neutral atmosphere model
- Processing level: Level2b = Level1a = Level1b

C. Data Quality Control

- Since water vapor is not included in the MSIS model, it is recalculated based on the amount of water (MSIS + QI)
- Recalculation of bending angle with new refractivity

D. Development of Frequency Downward Transformation and Phase-Evaluation Technique using Climate Model (MSIS)

IV. GNSS RO Data Monitoring System

NMSC has developed monitoring system for GNSS RO data of KOMPSAT-5 to monitor acquisition and to analyze data before transmission to NWP system.

V. Summary and Future Works

- NMSC also has been supporting satellite data to KMA’s NWP system for data assimilation since 2011. NMSC provides not only meteorological products of satellite but also ground and space based Global Navigation Satellite System (GNSS) data for NWP model. In addition, we have been studying on techniques of GNSS Radio Occultation (RO) to improve the accuracy in retrieving atmospheric vertical profiles. Also, we have developed monitoring system for GNSS RO data to monitor acquisition and to analyze data before transmission to NWP system. We are also studying about GNSS RO data preprocessing progress in order to understand principles more well for meteorological application. In this presentation, we will show some results on the KMA’s NWP model of the GNSS RO data.

KMA’s Numerical Modeling Center (NMC) utilizes GNSS RO data to assimilate to the NWP system for the numerical weather forecast.

- KMA’s NWP System
  - Numerical Model: UM for KMA (for Global)
  - Spatial resolution: N1280 (50km, 15L) / N768 (100km, 30L)
  - Target length: 208 hours (00, 12 UTC)
  - Analysis Cycle: 12 hours
  - Assimilation Window: 3 hours
  - Observation Window: 3 hours

- RO data contribution
  - GNSS-RO data obviously contributes for reduction in forecast error.
  - GNSS-RO data is worthy of notice for the KMA’s NWP system.

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