#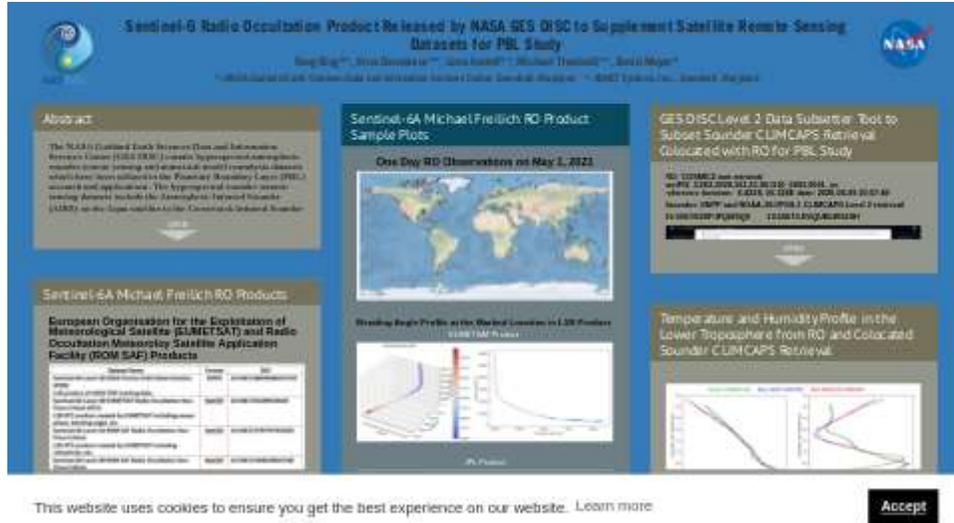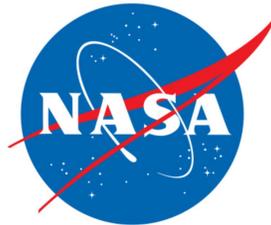 Sentinel-6 Radio Occultation Product Released by NASA GES DISC to Supplement Satellite Remote Sensing Datasets for PBL Study

Feng Ding^*, Irina Gerasimov^*, Lena Iredell^*, Michael Theobald^*, David Meyer^

^: NASA Goddard Earth Sciences Data and Information Services Center, Greenbelt, Maryland   *: ADNET Systems, Inc., Greenbelt, Maryland

PRESENTED AT:

ABSTRACT

The NASA Goddard Earth Sciences Data and Information Services Center (GES DISC) curates hyperspectral atmospheric sounder remote sensing and numerical model reanalysis datasets which have been utilized in the Planetary Boundary Layer (PBL) research and applications. The hyperspectral sounder remote-sensing datasets include the Atmospheric Infrared Sounder (AIRS) on the Aqua satellite to the Cross-track Infrared Sounder (CrIS) on Suomi--National Polar-orbiting Partnership (NPP) and National Oceanic and Atmospheric Administration -20 (NOAA-20)/ Joint Polar-orbiting Satellite System -1 (JPSS-1). The Modern-Era Retrospective analysis for Research and Applications Version 2 (MERRA-2) global reanalysis product provides a data record commencing in 1980. The sounder remote sensing and reanalysis datasets is also available from the GES DISC. COSMIC Global Navigation Satellite System (GNSS) radio occultation (RO) measurement seasonal and annual PBL height climatology dataset from June 2006 to December 2015) include temperature, water vapor, and trace gas profile down to the PBL, and also have a derived PBL height as well. A nearly 10-year (June 2006 to December 2015) seasonal and annual PBL height climatology dataset from COSMIC Global Navigation Satellite System (GNSS) radio occultation (RO) measurement is also available from the GES DISC.

In collaboration with Sentinel-6 Project, the GES DISC is implementing curation activities for GNSS RO products from the Sentinel-6A/Sentinel-6 Michael Freilich satellite launched on November 21, 2020. Sentinel-6A RO products provide refractivity, temperature, and humidity profile with finer vertical resolution, leveraging PBL research and application as a supplement to the hyperspectral sounder remote sensing and reanalysis products. In this presentation, we introduce all Senitnel-6A products and services, and demonstrate use cases studying the PBL by combining these products with other GES DISC archived data products.

SENTINEL-6A MICHAEL FREILICH RO PRODUCTS

European Organisation for the Exploitation of Meteorological Satellite (EUMETSAT) and Radio Occultation Meteoroloy Satellite Application Facility (ROM SAF) Products

Dataset Name	Format	DOI
Sentinel-6A Level 1B GNSS Precise Orbit Determination (POD): L1B product of GNSS POD tracking data	RINEX	10.5067/Q8FMQ8GO71D5
Sentinel-6A Level 1B EUMETSAT Radio Occultation Non-Time-Critical (NTC): L1B NTC product created by EUMETSAT including excess phase, bending angle, etc.	NetCDF	10.5067/4GIJ09OJ0L6R
Sentinel-6A Level 2A ROM SAF Radio Occultation Non-Time-Critical: L2A NTC product created by EUMETSAT including refractivity, etc.	NetCDF	10.5067/UT9VTX7KOZKD
Sentinel-6A Level 2B ROM SAF Radio Occultation Non-Time-Critical: L2B NTC product created by EUMETSAT including temperature, humidity, etc.	NetCDF	10.5067/AWBIJ3BDCVQE

NASA Jet Propulsion Laboratory (JPL) Products

| Dataset Name	Format	DOI
Sentinel-6A Level 1B GNSS Radio Occultation POD: L1B product of GNSS POD tracking data for RO	RINEX	10.5067/WO228VAW5RQU
Sentinel-6A Level 1B GNSS Radio Occultation Near-Real-Time (NRT): L1B NRT product created by JPL including excess phase, bending angle, etc.	NetCDF	10.5067/BRVCFYLKTSI2
Sentinel-6A Level 2 GNSS Radio Occultation Near-Real-Time: L2 NRT product created by JPL including refractivity, temperature, humidity, etc.	NetCDF	10.5067/RVP3XBGSHNEM
Sentinel-6A Level 1B GNSS Radio Occultation Non-Time-Critical: L1B NTC product created by JPL including excess phase, bending angle, etc.	NetCDF	10.5067/51A9FYX50AN1
Sentinel-6A Level 2 GNSS Radio Occultation Non-Time-Critical: L2 NTC product created by JPL including refractivity, temperature, humidity, etc.	NetCDF	10.5067/I6S2B8X78ZFQ

SENTINEL-6A MICHAEL FREILICH RO PRODUCT SAMPLE PLOTS
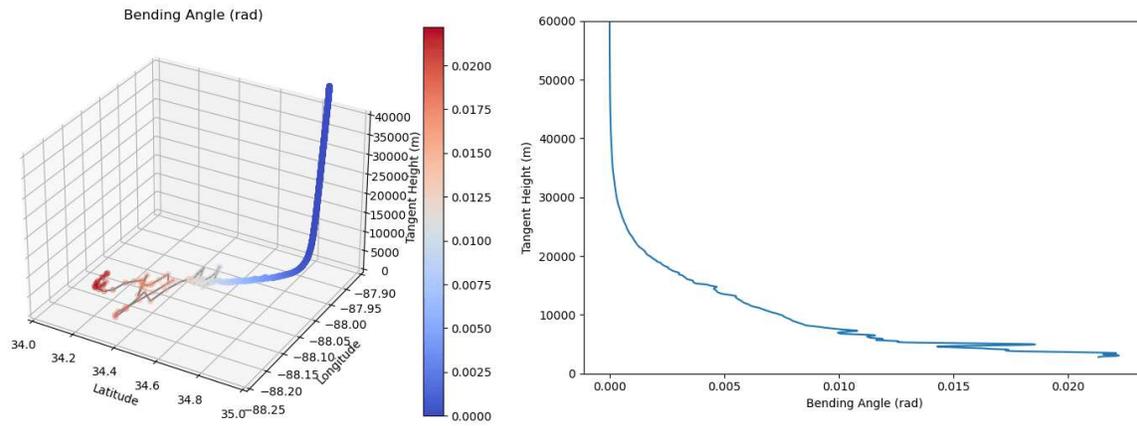
One Day RO Observations on May 1, 2021
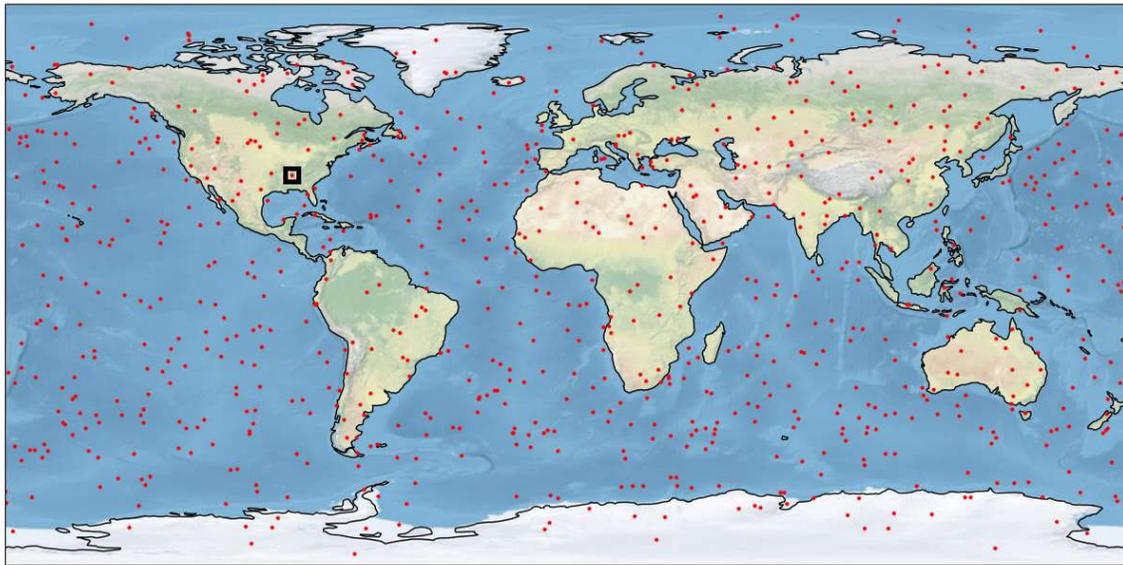
Bending Angle Profile at the Marked Location in L1B Product

EUMETSAT Product
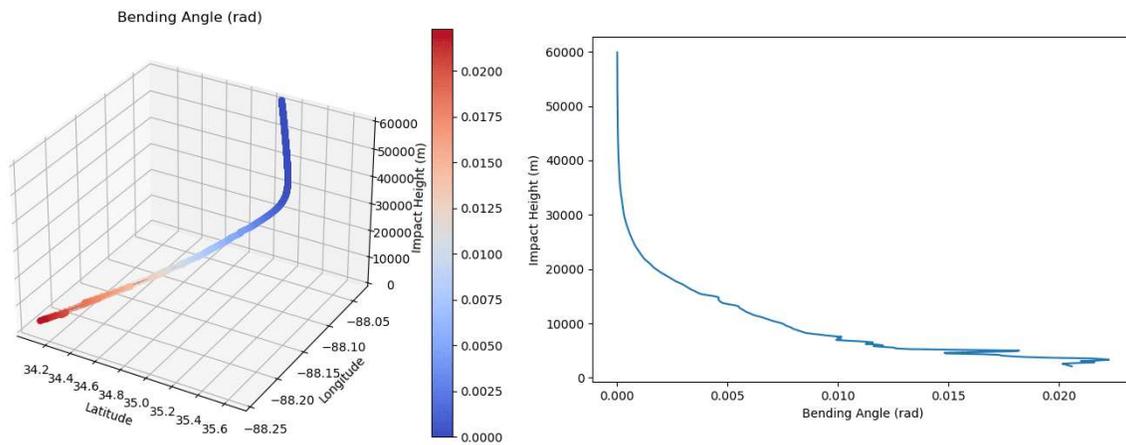
JPL Product

Plots are created from the sample products for demonstration purpose. Final products may be different from the samples.

GES DISC LEVEL 2 DATA SUBSETTER TOOL TO SUBSET SOUNDER CLIMCAPS RETRIEVAL COLOCATED WITH RO FOR PBL STUDY

RO: COSMIC2 wet retrieval   wetPf2_C2E2.2020.161.21.00.G10_0001.0001_nc
reference loctaion: 6.432S, 56.326E date: 2020-06-09 20:57:49

Sounder: SNPP and NOAA-20/JPSS-1 CLIMCAPS Level 2 retrieval

10.5067/62SPJFQW5Q9 (https://disc.gsfc.nasa.gov/datasets/SNDRSNIML2CCPRET_2/summary)
10.5067/LESQUBLWS18H (https://disc.gsfc.nasa.gov/datasets/SNDRJ1IML2CCPRET_2/summary)

**Colocated SNPP Sounder Pixel: 6.295S, 56.103E, ~28.95km,**

   2020-06-09 21:12:00 to 21:18:00 6-min granule

Colocated NOAA-20/JPSS-1 Sounder Pixel: 6.519S, 56.035E, ~33.62km,

2020-06-09 22:00:00 to 22:06:00 6-min granule

How to Subset Level 2 Data (https://disc.gsfc.nasa.gov/information/howto?
keywords=subsetter&title=How%20to%20Subset%20Level-2%20Data)

TEMPERATURE AND HUMIDITY PROFILE IN THE LOWER TROPOSPHERE FROM RO AND COLOCATED SOUNDER CLIMCAPS RETRIEVAL

Green: COSMIC2 RO   Blue: SNPP CLIMCAPS   Red: NOAA-20 CLIMCAPS
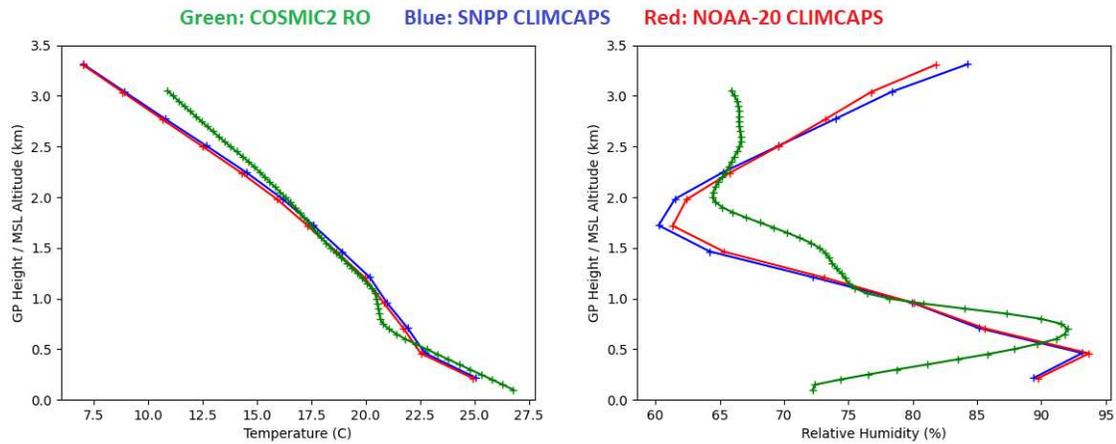
SUMMARY

1. Sentinel-6A Michael Freilich RO products will be released in GES DISC.

2. GES DISC provides services to combine RO product with hyperspectral sounder remote sensing data, renanlysis data for the PBL study.

ABSTRACT

The NASA Goddard Earth Sciences Data and Information Services Center (GES DISC) curates hyperspectral atmospheric sounder remote sensing and numerical model reanalysis datasets which have been utilized in the Planetary Boundary Layer (PBL) research and applications. The hyperspectral sounder remote-sensing datasets include the Atmospheric Infrared Sounder (AIRS) on the Aqua satellite to the Cross-track Infrared Sounder (CrIS) on Suomi--National Polar-orbiting Partnership (NPP) and National Oceanic and Atmospheric Administration -20 (N NOAA-20)/ Joint Polar-orbiting Satellite System -1 (JPSS-1). The Modern-Era Retrospective analysis for Research and Applications Version 2 (MERRA-2) global reanalysis product provides a data record commencing in 1980. The sounder remote sensing and reanalysis datasets include temperature, water vapor, and trace gas profile down to the PBL, and also have a derived PBL height as well. A nearly 10-year (June 2006 to December 2015) seasonal and annual PBL height climatology dataset from COSMIC Global Navigation Satellite System (GNSS) radio occultation (RO) measurement is also available from the GES DISC.

In collaboration with Sentinel-6 Project, the GES DISC is implementing curation activities for GNSS RO products from the Sentinel-6A/Sentinel-6 Michael Freilich satellite launched on November 21, 2020. Sentinel-6A RO products provide refractivity, temperature, and humidity profile with finer vertical resolution, leveraging PBL research and application as a supplement to the hyperspectral sounder remote sensing and reanalysis products. The public release of Sentinel-6A RO products is scheduled for mid-October of 2021. In this presentation, we will introduce all Senitnel-6A products and services, and demonstrate use cases studying the PBL by combining these products with other GES DISC archived data products.