NOAA ROSES Semi-Annual Report

Reporting Period: September 2020 – February 2021 (1st report)

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Project Title: Determination of Exospheric Neutral Hydrogen Density from GOES-R

Executive Summary (1 paragraph max)

Objectives:

1. Determine how to derive the exospheric hydrogen (H) density on a daily basis from GOES-R measurements.
2. Provide operational GOES-R product of daily neutral hydrogen (H) density profiles of the terrestrial exosphere down to the exobase.
3. Provide a scientific quality Lyman-a product with 1-minute cadence for GOES-14 and -15.
4. Examine space weather impacts on the terrestrial exosphere.

Progress toward FY20 Milestones and Relevant Findings (with any Figs)

Objective 1:

- Bhattacharyya worked with a Monte Carlo model to simulate the velocity distribution of neutral H atoms in the geocorona. This model will be a tool in the conglomerate of models which will be used to determine the exospheric H density at Earth. This Monte Carlo model was previously used to study the exospheres of Moon, Mercury and Mars. She has now adapted this model to simulate the exospheric properties of Earth.
- Thiemann inspected sample occultation measurements for suitability. He identified needed coordinate information (Geographic Solar Ecliptic coordinates of the spacecraft) in order to process the occultation measurements. CIRES team is in the process of providing these data for each occultation measurement.
- Machol worked closely with CU/NOAA team on (1) the GOES-R EUVS science quality datasets and (2) the L2 processing codes for the EUVS data that will be required for this project

Objective 3:

- Machol made detailed workplan for reprocessing GOES-14/-15 Lyman alpha measurements. Primary person on this project will be a new employee (Allyssa Riley) who starts work on 1 Feb 2021.
- Snow and Carande compared SORCE SOLSTICE Lya mini-scan coefficients as a function of angle. A solar cycle component of 0.5% has been applied to version 18, L3 data. Corrections were applied year-by-year up through 2012, then applied some

average value to the later year. This work was performed primarily for the SORCE mission program, but will be greatly beneficial to the recalibration of the GOES 14/15 and GOES-R Lyman alpha data. (Also for Objective 1)

Plans for Next Reporting Period

Bhattacharyya:

- Use the Monte Carlo model to generate velocity distributions for thermal and/or thermal + non-thermal populations of H atoms which will then be used to model GOES-R observations.
- To work closely with other project team members (Ed Thiemann) to streamline the MC model which will allow for simulations of GOES-R observations and comparison with actual data (Objectives #1 & 2).

Thiemann:

- Adapt MAVEN EUVM H occultation code to GOES to retrieve H density from a small set of sample profiles. This includes interfacing with Co-I Bhattacharyya to implement her line shapes in the model and establish efficient method for iterating line-shapes.

Machol:

- Create satellite location files at 1 minute cadence for the GOES-R satellites and GOES 13-15 satellites.
- Create netcdf files of GOES-14/15 Lyman alpha through 2016 to use until data can be reprocessed.
- Assist in the release of the GOES-R EUVS data and documentation.
- Begin reprocessing of GOES 14/15 Channel E counts into Lyman-alpha irradiances.
- Layout workplan and code optically thin model.