Polar-orbit Satellite Swath Snowfall Detection Prediction using Two-line Element and Weather Model Data

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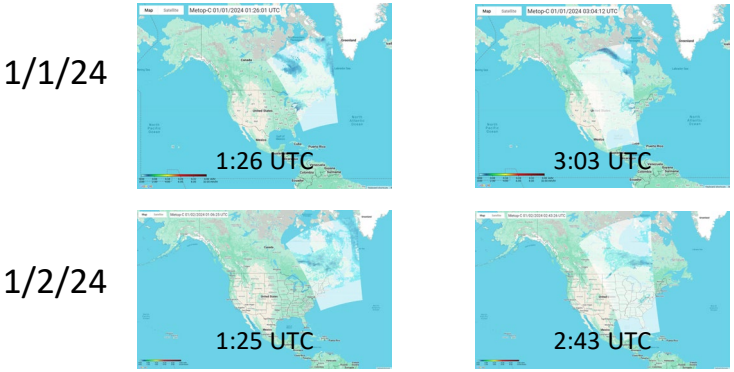
Motivation

- Snowfall Rate product (SFR): NOAA operational product https://sfr.umd.edu/?page=SFR-CONUS
- Polar-orbit satellite swath coverage is dynamic and changes over time. Accurate prediction of satellite location and spatial coverage is crucial for weather forecasters.



Objectives

- To develop a system to predict the swath location and crossing time over the CONUS
- To promote SFR product usage, we aim to provide forecasters with early information on satellite location and coverage, facilitating their integration into routine forecasting activities.

Method

- Use TLE data and the SGP4 model to predict satellite positions and determine swath coverage over the CONUS.
- Derive SFR from GFS data spatially and temporally matched to the satellite trajectory

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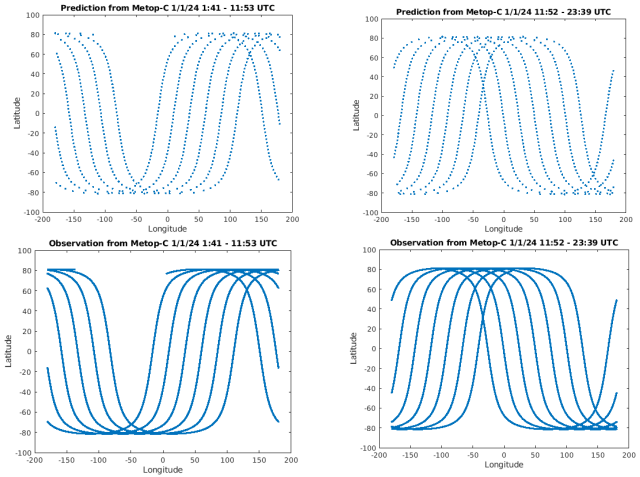
Track and Coverage Prediction

- Use TLE data and the SGP4 model to predict LEO satellite positions and coverage over CONUS
- validate satellite position predictions by comparing them with observational data
- Identify the times when satellites cross over CONUS

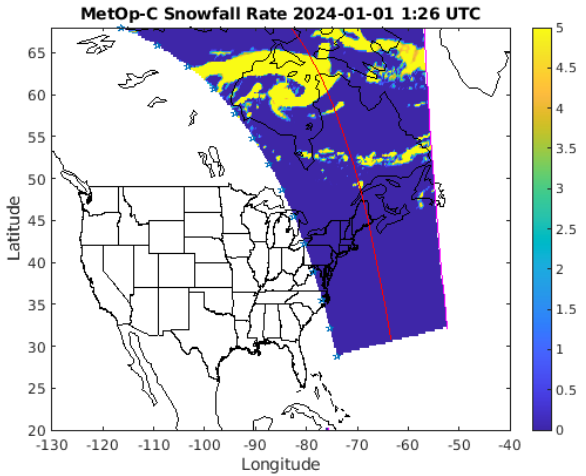
Prediction

Observation



GFS SFR in Satellite Swath

- PRATE and CPOFP model variables are obtained using wgrib2 from GFS
- The snowfall rate is calculated by multiplying the PRATE by the CPOFP



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Summary

- Tracked the satellite position using TLE data with SGP4 model
- Implemented algorithms to accurately determine satellite passing times and locations.
- Verified and validated the predicted satellite path and coverage.
- Derived SFR using forecast from NOAA's GFS model.
- The remote satellite sensing research field has been fun!