

# Orbital Equator Crossing Time Variation for Suomi-NPP, MetOp and JPSS-1 Sun-synchronous Satellites

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The orbital characteristics of Suomi-NPP/JPSS and the MetOp constellations have significant impacts on the satellite observations. While both are polar sun-synchronous satellites, Suomi-NPP is designed to have repeating ground cycle of 16 days (or 227 orbits) with an ascending equator local crossing time of ~13:30 (aka PM orbit), which in turn determines its altitude to be around 824 km. On the other hand, the MetOp-A/B satellites are designed to have 29 Days (or 412 orbits) with descending local equator crossing time of ~ 9:30 (aka AM orbit). The AM and PM orbits form a constellation for global coverage with complementary local time, solar zenith angles, and temporal coverage. During the satellite lifetime, the local equator crossing times of Suomi-NPP and MetOp satellites drift and correction in its inclination angle was periodically performed to maintain its equator crossing time around the designed value. The systematic changes of the local observation time during the life cycle are significant and should be accounted for when using multi-year time series of satellite products in long-term monitoring. In this poster, the impacts of such drift and correction of equator crossing time on the constellation configuration and global coverage by Suomi-NPP and MetOp series are evaluated. Furthermore, while the upcoming JPSS-1 satellite will preferably maintain similar orbit as that of Suomi-NPP, we investigate alternative orbits at higher altitude such as 866 km, maintaining the 16-day ground repeating cycle to address potential issues such as underlaps, and impacts on satellite-inclination angle, ground coverage, and equator-crossing times.