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Plasma convection is a fundamental process of mass and energy transport within our solar system. In Earth's magnetosphere, the convection models often fail to identify or underestimate the contributions of dynamic mesoscale (10s-100s km) structures that are responsible for significant energy transfer within the magnetosphere-ionosphere coupled system. The most commonly used convection model relies on data from radars, which operates on spatial scales of approximately 50 km, with a temporal resolution of 2 minutes. In contrast, modern red-line all-sky cameras have a spatial resolution on the order of 1 km and temporal resolution of 3 s. These cameras respond to low energy precipitating electrons, which makes them ideal tracers of magnetospheric convection, and sensitive to mesoscale structures that may be missed by radars. In recent years, the deployment of new cameras has expanded the coverage to include most of the auroral oval and polar cap above the North-American continent. Despite their potential for monitoring and studying ionospheric convection, currently only rudimentary techniques have been applied to measure the motion of these optical structures. Here we show initial results of optical flow calculations to analyze the motion of optical structures observed with the new red-line all-sky cameras. Optical flow calculations represent the apparent motion of objects in consecutive frames. The result of this technique provides two-dimensional flow fields, which has enabled us to enhance our understanding of ionospheric electric fields and neutral winds. In addition, we utilize the optical flow technique to trace solar wind structures by using STEREO COR1 data.
Presentation file
gallardo-aug2021.pdf
YouTube link
https://youtu.be/gPA0ZA5eZrU?t=1136