Project Details

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Project Title:
Predicting EUV Irradiance and Induced Upper Atmospheric Density Changes from EIT Solar Imagery

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Summary:
Since solar EUV radiation controls the temperature and composition of the upper atmosphere and ionosphere, the ability to predict the EUV irradiance is crucial for predicting the impact of space weather, as evidenced by upper atmosphere mass density effects on spacecraft drag, and ionospheric electron density effects on communications and navigation. The overall goal of the proposed work is the capability to forecast solar EUV irradiance and induced upper atmospheric density changes on time scales of days to weeks. The approach is to analyze the east limb portion of full-disk EIT images to extract information about active region EUV sources on the verge of becoming visible at the Earth. This approach is possible because sources of bright EUV emission are loop structures that extend up to a few solar radii above the visible surface of the disk. Bright EUV sources near the limb, but on the far side of the Sun, can thus be present in the field of view of the EIT EUV images. Since a bright active region has its maximum impact on EUV irradiance roughly 7 days after it appears on the limb, when it reaches the central meridian, we will be able to predict EUV irradiances on times scales of days to weeks from analysis of the EIT images. We will test the predicted EUV irradiances, determined from the EIT images, by direct comparison with the actual irradiances to quantify the probability that the predicted irradiances will fall within specified ranges. We will also compare the EIT-based predictive tool with the forward propagation of the primary power identified through statistical analysis of the irradiance time series. We will then use the newly developed predictive tool to forecast solar EUV-induced upper atmospheric density changes, and evaluate the space weather utility of the work. This will be accomplished by inputting the predicted irradiances to the NRLMSIS upper atmosphere density specification model (converted to the solar activity proxy that the model uses). The predicted total mass densities will be compared with actual mass density variations which we have derived in past work from the orbits of three Starshine spacecraft during the period from 1999 to 2003, with geomagnetic effects removed. Thus we will quantify the uncertainties of the EUV irradiance predictions in terms of induced density changes, and hence, orbital drag.

Publication References:

Summary: ''

Reference: J. Michael Picone / US Naval Research Laboratory-Predicting EUV Irradiance and Induced Upper Atmospheric Density Changes from EIT Solar Imagery