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2D O+ and H+ density profile in the magnetospheric equatorial plane

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The CODIF instrument onboard the Cluster spacecraft measures the magnetospheric O+ and H+ density since more than one decade. We map these densities along magnetic field lines to produce 2D maps of the O+ and H+ density in the magnetospheric equatorial plane for various geomagnetic conditions (represented by the Kp index) and solar activity (represented by the F10.7 index). We validate the mapping technique by comparing it with in-situ observations from Cluster in the 15-19 RE plasmasheet (Mouikis et al. 2010) and from GOES near geostationary orbit (Young et al. 1982).
These maps reveal the large scale spatial distribution of O+ and H+ ions in the plasmasheet. They confirm that the proportion of O+ ions is higher at low geocentric distances and that increasing geomagnetic and solar activity enhance the O+/H+ density ratio. In the mid/far tail this ratio is mainly driven by geomagnetic activity while in the near Earth regions it strongly depends on the solar activity. These results suggest that there is a significant entry of O+ ions in the plasmasheet at low geocentric distance and that the O+ ion content in the mid/far tail is mainly driven by the O+ transport and energization while in the near Earth regions it is rather linked to ionospheric variations due to changes in the solar EUV flux.