ION NEUTRAL COUPLING IN THE HIGH LATITUDE THERMOSPHERE: PART I

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Measurements of the neutral wind in the polar F-region from Dynamics Explorer-2 (DE-2) have been used to illustrate asymmetries in the neutral circulation that are dependent on the sign of the B_y component of the interplanetary magnetic field (IMF). Individual DE-2 orbits and averaged data sets from different Universal times are presented. The data are categorized according to the sign of the hourly averaged IMF B_y component measured by ISEE-3 for the hour preceding the DE-2 measurement. The major features observed are: 1) an asymmetry in the polar cap neutral flow velocity with the region of most rapid anti-sunward flow shifting from the dawn-side to the dusk-side of the polar cap as B_y changes from positive to negative; 2) a shift in magnetic local time of the region of entry of neutral gas into the polar cap from a location on the dawn-side of the noon-midnight meridian for B_y positive to one more biased towards the dusk-side for B_y negative; 3) an enhancement in the velocities associated with the dawn, anti-clockwise neutral vortex for B_y negative relative to those observed for B_y positive. The B_y neutral wind asymmetries can be explained by similar asymmetries, previously observed, in the polar ion convection pattern. They imply a direct causal relationship between solar wind/magnetosphere coupling and neutral thermospheric dynamics.

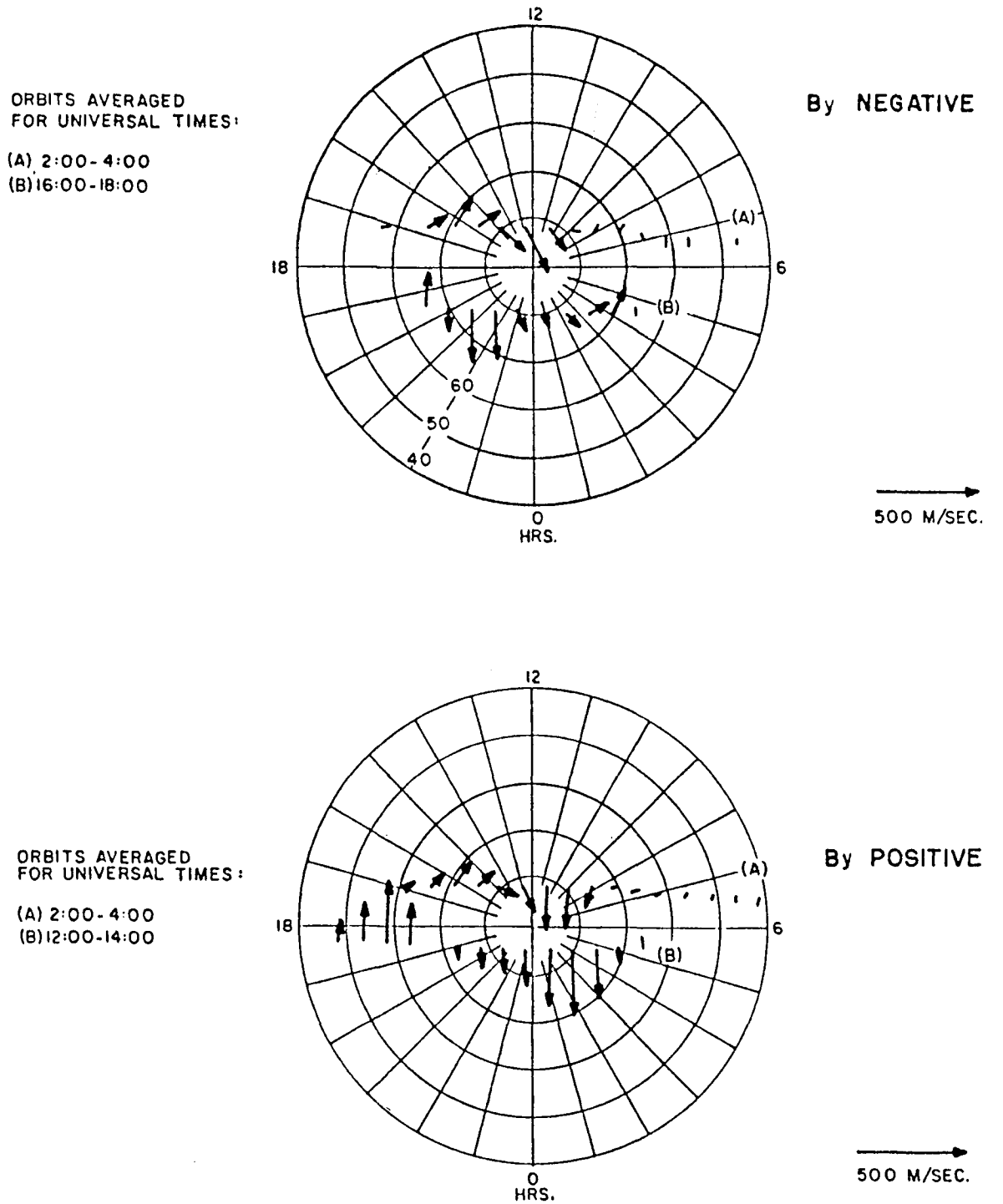

Figure 1. Average neutral wind vectors for December 1981 plotted in geomagnetic polar coordinates (magnetic latitude and local time) obtained for the specified UT intervals with a) B_y negative and b) B_y positive.

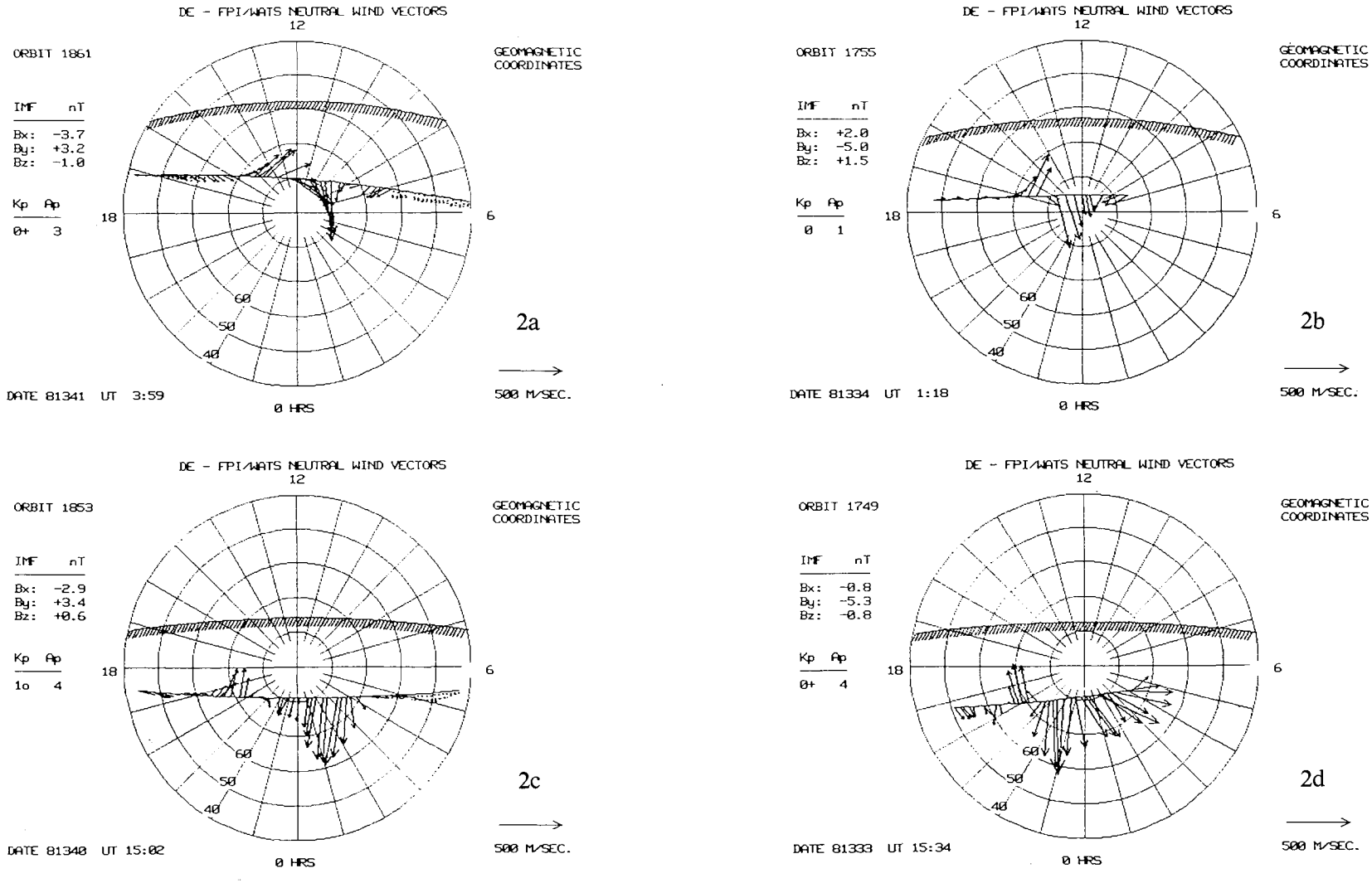

Figure 2. Vector neutral wind measurements for individual orbits of DE-2; a) orbit 1861, b) orbit 1755, c) orbit 1853 and d) orbit 1749. The winds are plotted in geomagnetic polar coordinates. The solar terminator is indicated by the curved hatched line. Where no FPI data are available, the WATS measurements are indicated by the bars plotted at right angles to the track of the satellite. The hourly averaged IMF values from ISEE-3 taken for the hour preceding the pass are shown at left with the Kp and Ap indices. The wind scale is given at bottom right.