Large-scale dynamics derived from a longitudinal chain of northern hemisphere SuperDARN radars

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Although particular tidal and planetary wave modes are known to structure the ionosphere, wind observations from a single station produce a time-series from which only the total tidal harmonics can be detected. Similarly, long time-series from a single station can only give the net period and wind perturbation of the superposed spatial wavenumber components. While satellite data can give both temporal and spatial components, the time and spatial information is generally not separable without assuming stationarity. Here, hourly mean meteor wind data from a longitudinal chain of 8 mid-latitude northern hemisphere SuperDARN radars have been combined in order to provide the spatial tidal and planetary wave components as a function of time. This has been used to extract the migrating and non-migrating components of the semidiurnal tide, as well as the S1 and S2 planetary wave components in the lower thermosphere meridional wind between 1995 and 2016. Unlike in the southern hemisphere, the semidiurnal tide is dominated by the migrating (W2) component, though small but significant W1 and W3 contributions to the semidiurnal tide are measured, especially around the equinoxes. The large planetary wave amplitudes in the northern hemisphere can also couple into these tidal components. Data analysis and validation will be presented, together with initial results on the inter-annual variability of the tidal and planetary wave components and their possible coupling to the ionosphere.

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