

500 hPa Geopotential Height / Relative Vorticity / Winds: These quantities are fields generally used to assist in diagnosing the mid-to-upper tropospheric atmospheric conditions and flow and the presence of traveling meso-a scale ‘short’ waves moving through the mean flow.

The geopotential height (values in meters) represents the height of the 500hPa pressure surface in the free atmosphere. Areas of low height tend to be associated with a relatively cold column of air between the surface and 500 hPa, while areas of high height are associated with relatively warm columns of air. Flow at 500hPa can often be well approximated by quasi-geostrophic theory, and thus is often assumed to be approximately parallel to the height contours.

The vertical component of the relative vorticity (units of $10^{-5}/\text{sec}$) is a measure of the rotational component of the flow in the quasi-horizontal plane that the 500 hPa pressure surface represents. Positive relative vorticity is indicated in the red shades, negative values are in the blue shades. Vorticity advection patterns can be related in quasigeostrophic theory to vertical motions and are often used in that context; further, vorticity centers are often the clearest signature of upper level wave disturbances that travel through and are roughly ‘steered’ by the mid to upper tropospheric flow.

On smaller scales, mid to upper tropospheric vorticity maxima and minima can be associated with hurricanes, squall lines and other mesoscale convective systems but these are rare concerns over our high-latitude area of interest.