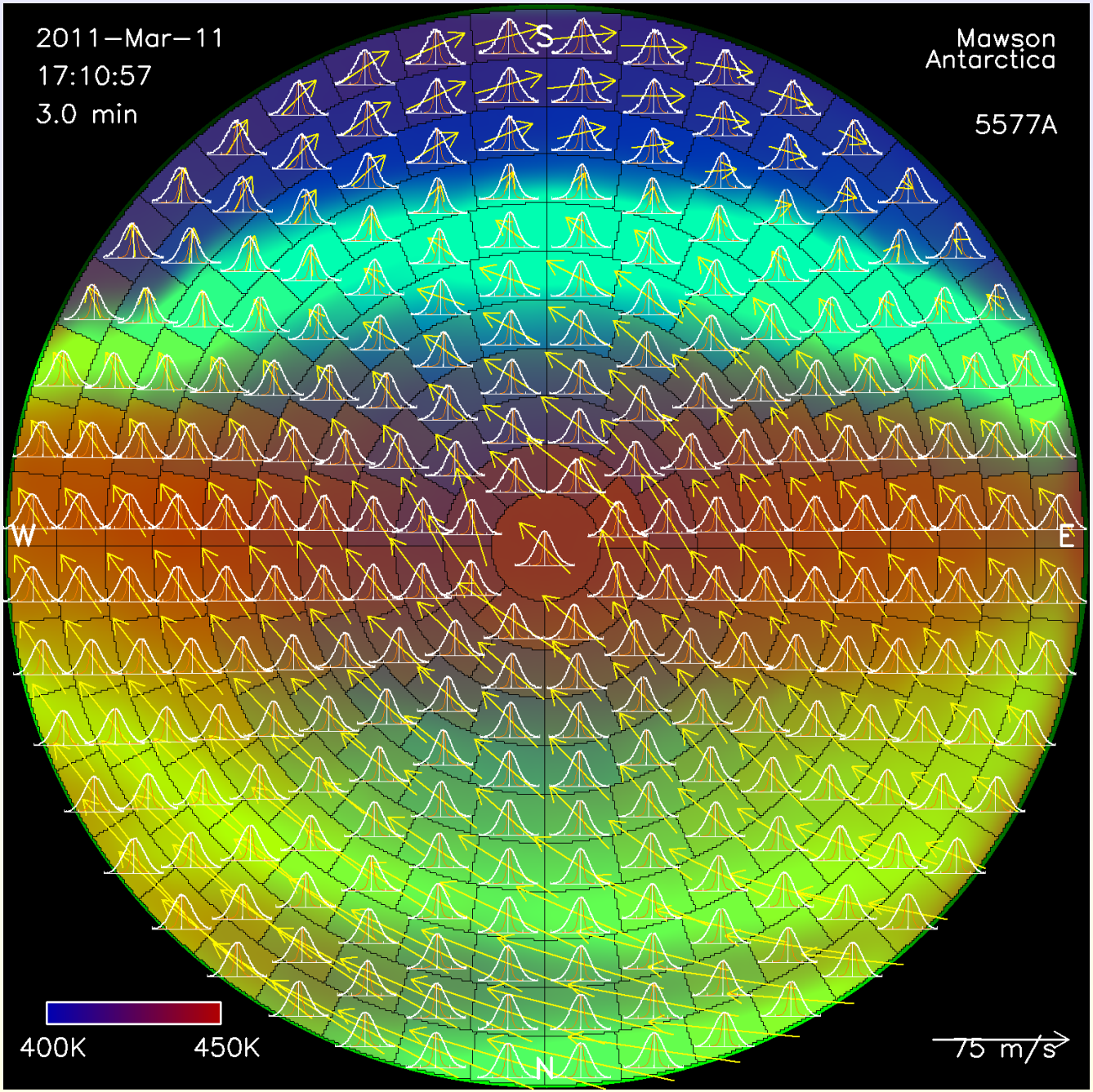
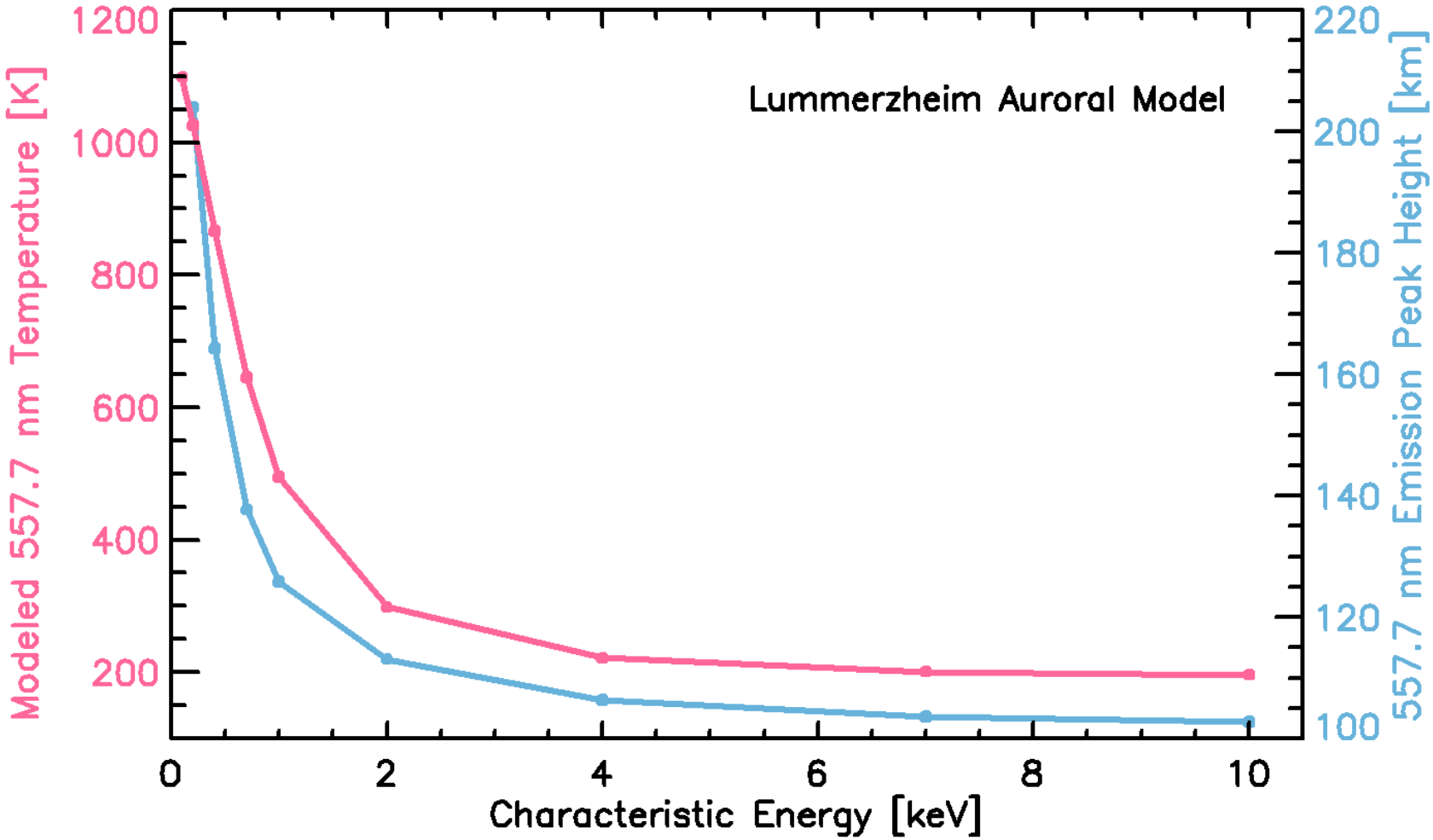
557.7 nm Neutral Winds in the Auroral Zone



In this talk I will discuss:

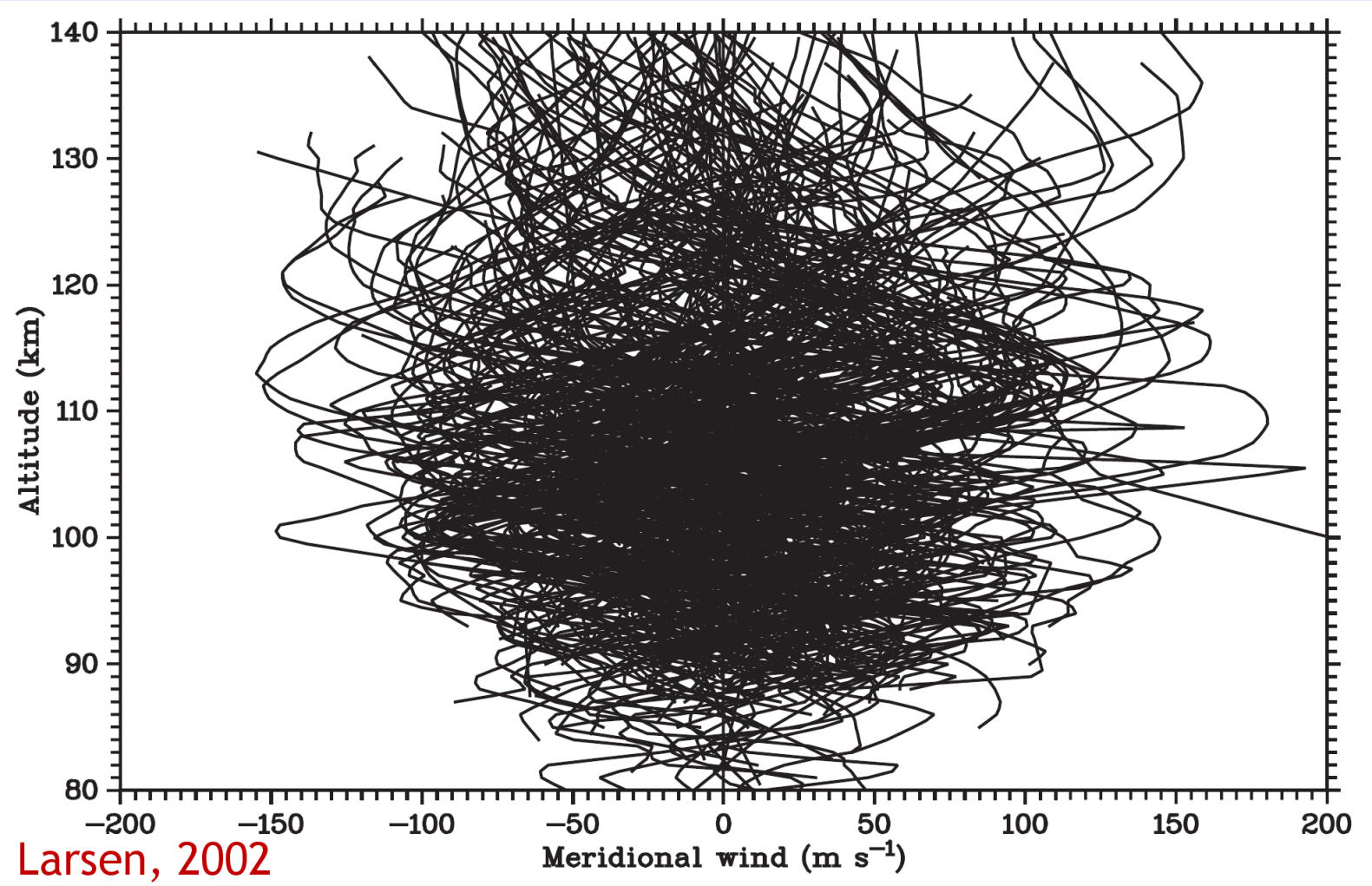
- Height variation of aurorally excited 557.7 nm emission
- How this might affect winds determined from it
- What we actually get from using the 557.7 nm emission to determine winds
- Some puzzles

Auroral Excitation of the 557.7 nm Emission



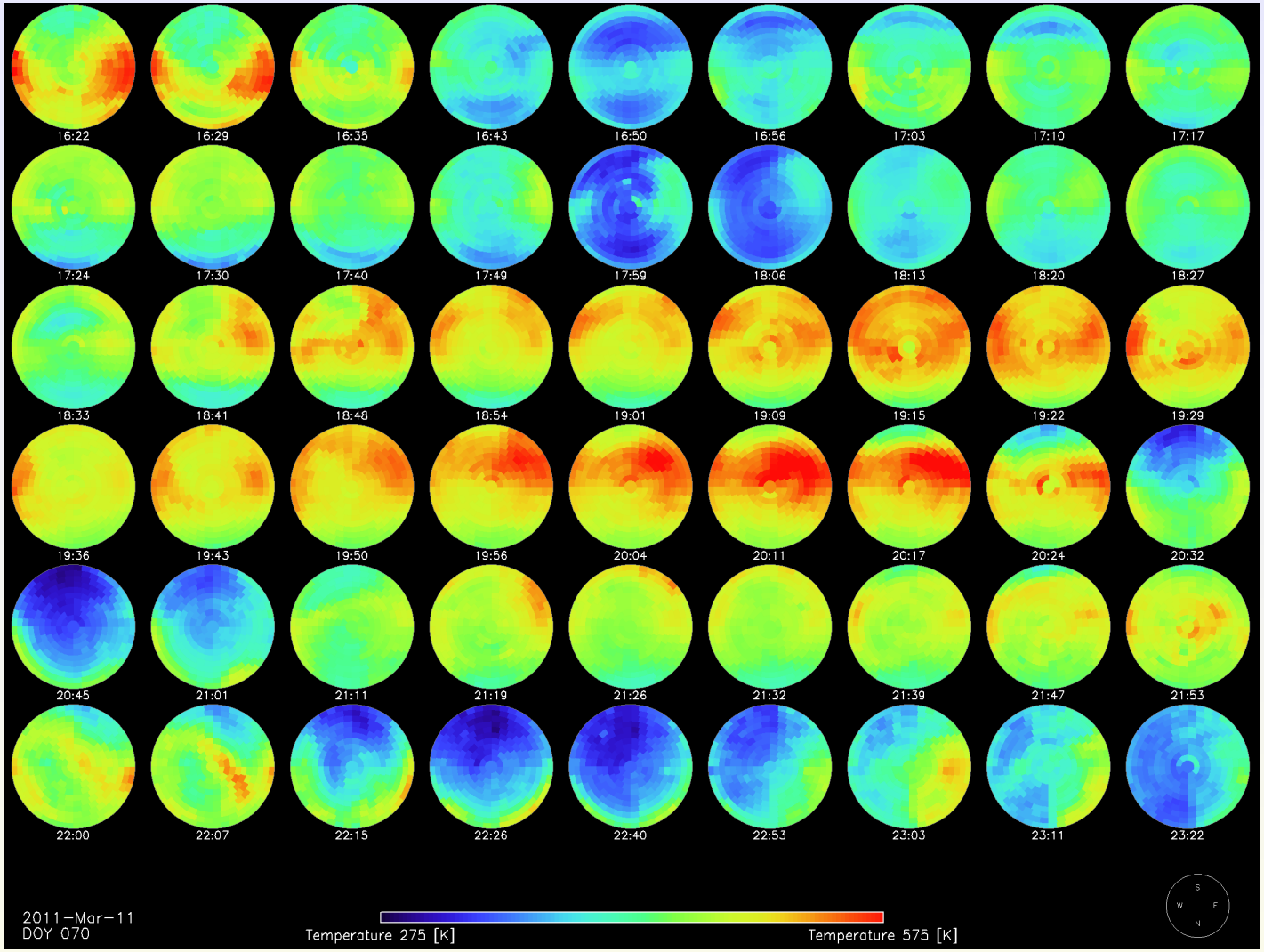
The altitude of aurorally excited 557.7 nm emission is a strong function of the characteristic energy of the auroral precipitation.

E-Region Wind Shear



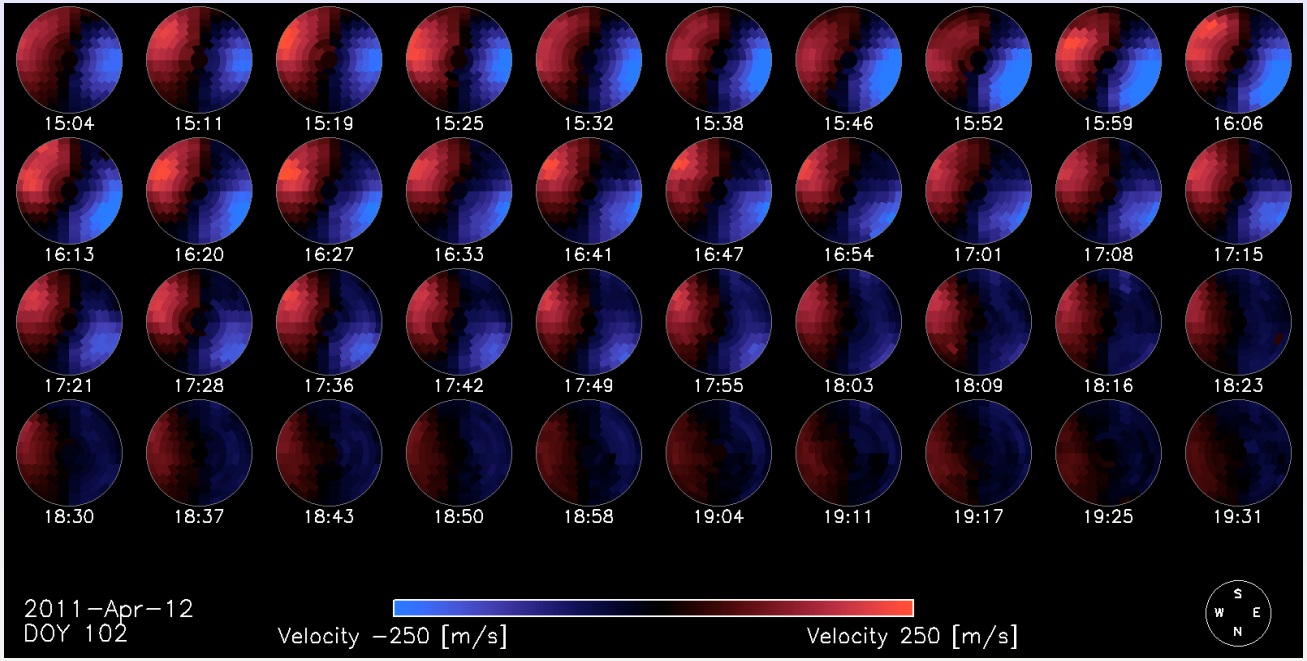
- Whereas F-region neutral winds are fairly constant with height, this is not true in the E-region. Strong vertical wind shear appears to be ubiquitous in the E-region.
- Thus if the 5577 nm emission height varies, *a Fabry-Perot would (incorrectly) interpret this as a change in the wind*.

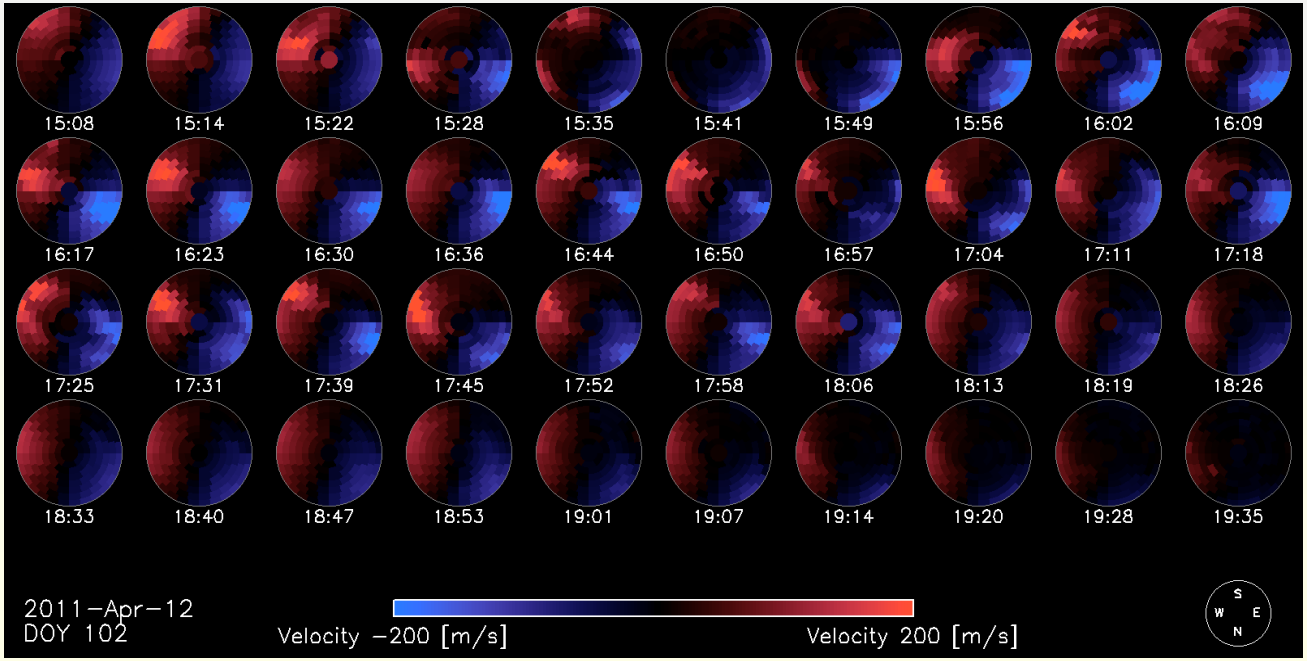
557.7 nm Temperature Variations



- 557.7 nm Doppler temperatures (and therefore emission heights) do change substantially – both spatially and temporally.
- When this occurs, there must be at least some artifacts introduced into the inferred wind fields.

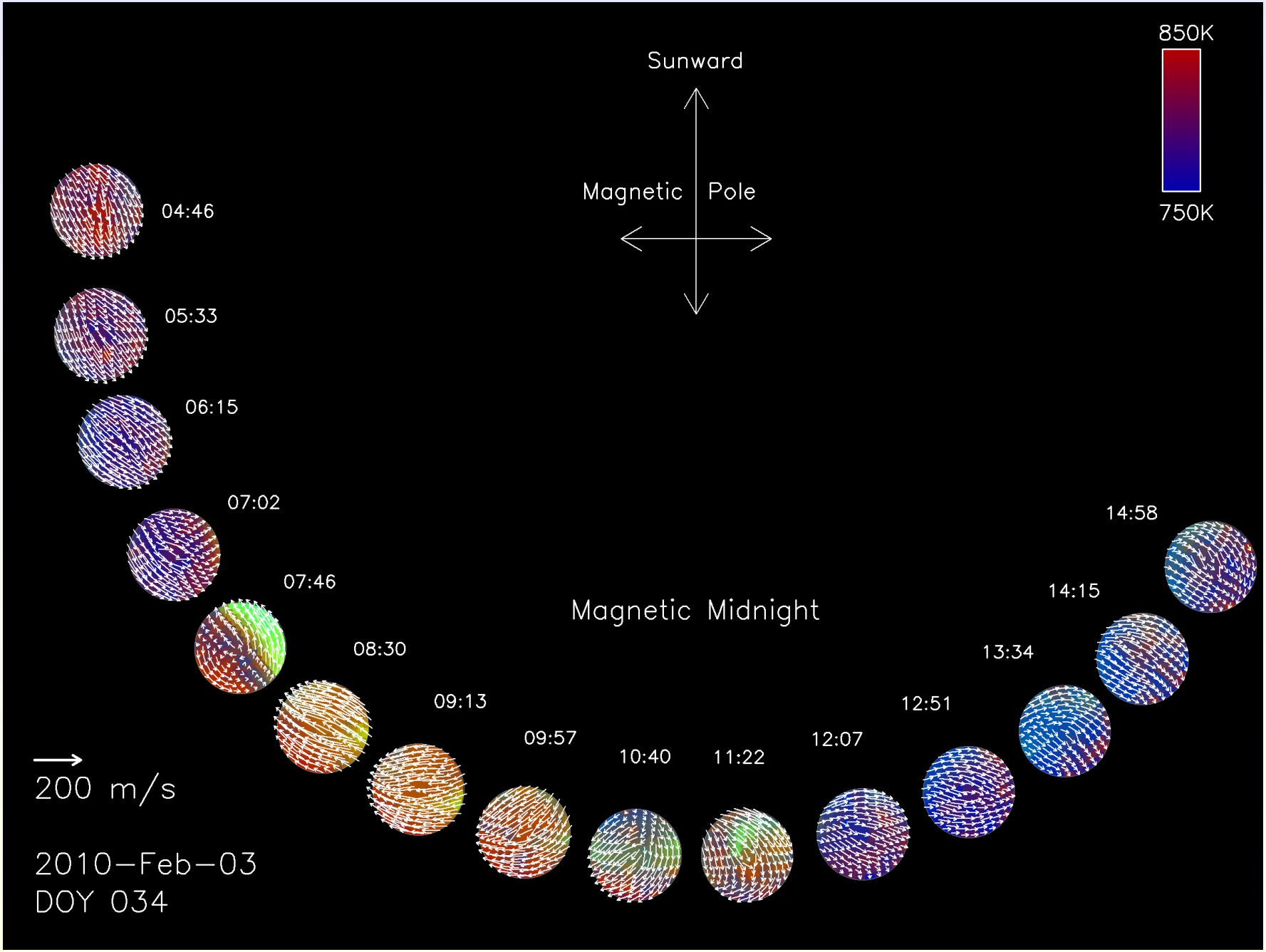
Observed 557.7 nm Distribution of Doppler Shifts



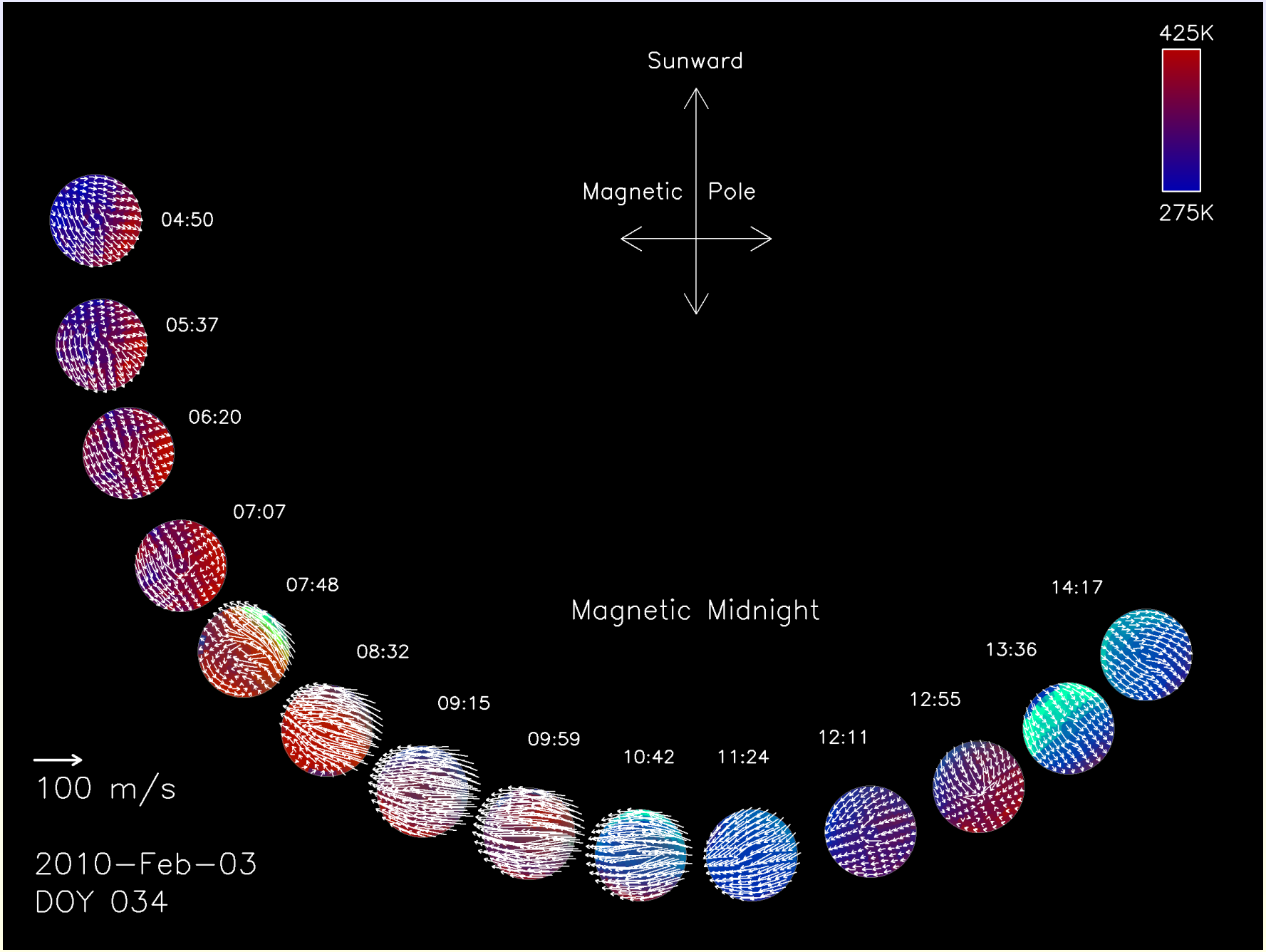


- The top panel shows 630.0 nm Doppler shifts across the sky.
- While not perfectly dipolar, the patterns are at least mostly smooth.
- The lower panel shows 557.7 nm Doppler shifts.
- Note the much noisier looking patterns.

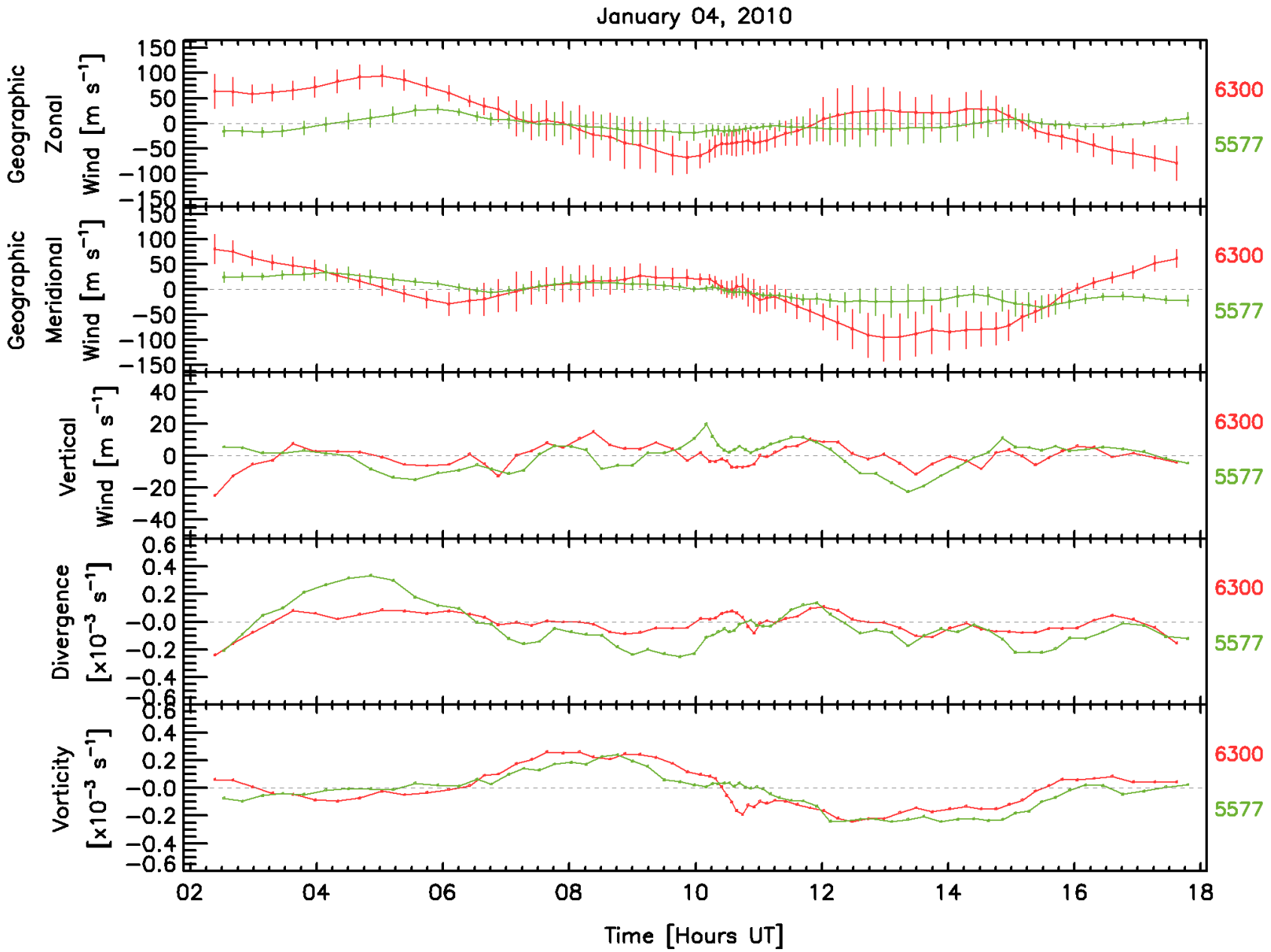
An Example of Winds Observed at 630 nm



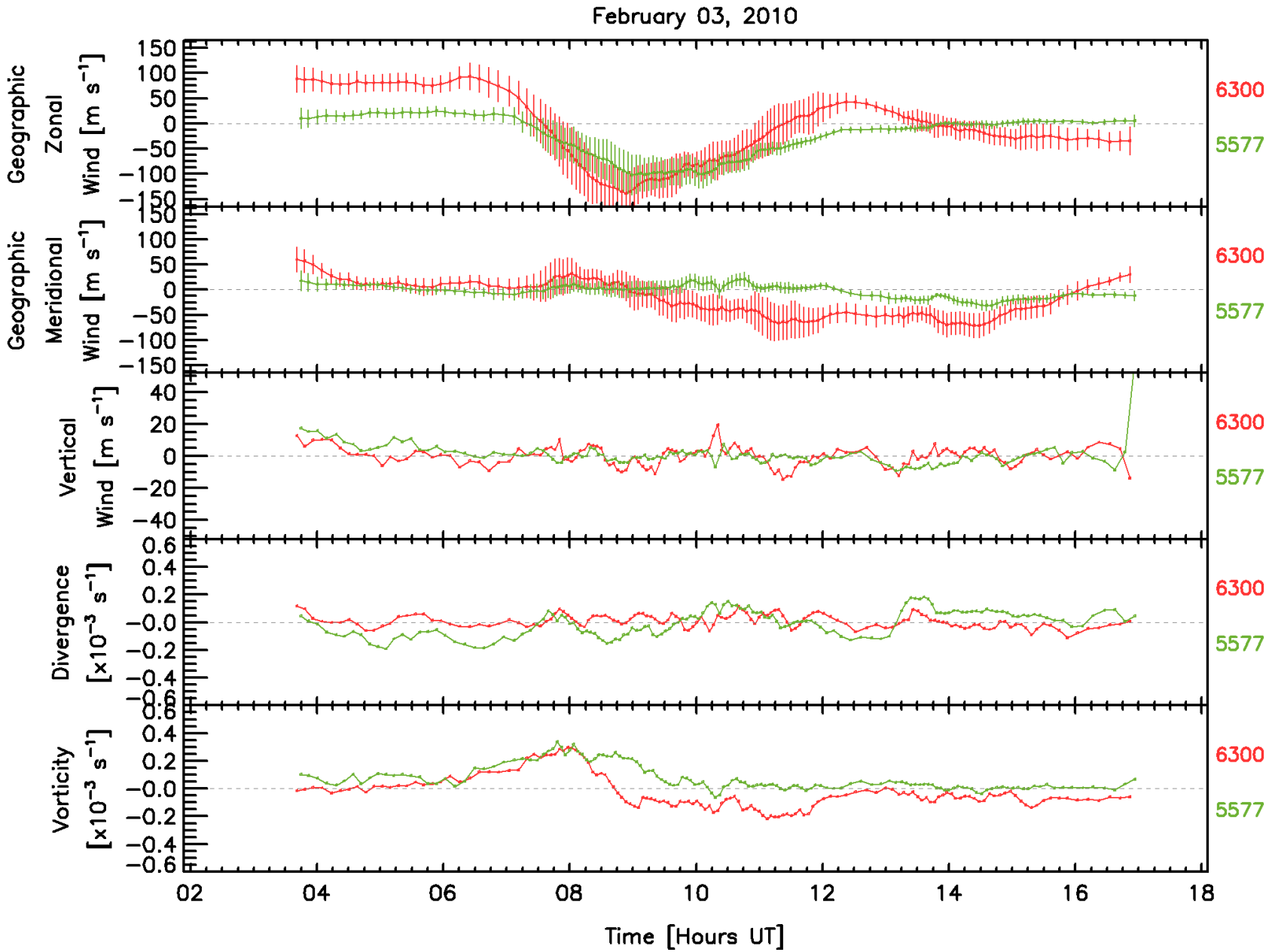
Comparison of Winds Observed at 558 nm



Red and Green Wind Comparison – Quiet Night



Red and Green Wind Comparison – More Active Night



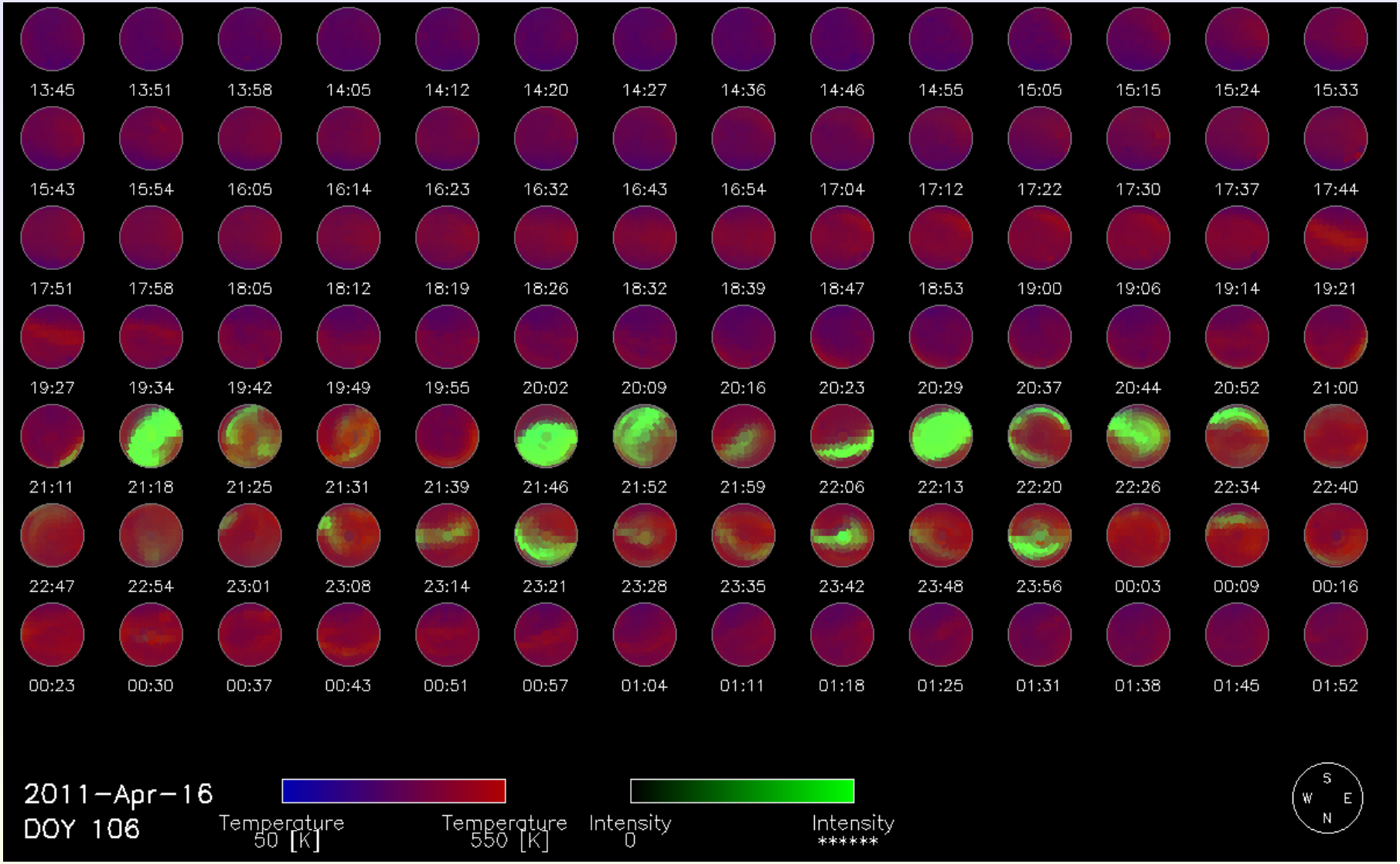
Time Evolution of the 557.7 nm Wind Field

- This shows the 557.7 nm winds measured on Feb 12, 2010.
- Green hues show auroral brightness.
- Blue through red hues show Doppler temperature.
- Colored streamers show transport trajectories.
- Note the wind responses on short time scales – are these actual wind responses, or just height changes?

557.7 nm Wind Field – Another Example

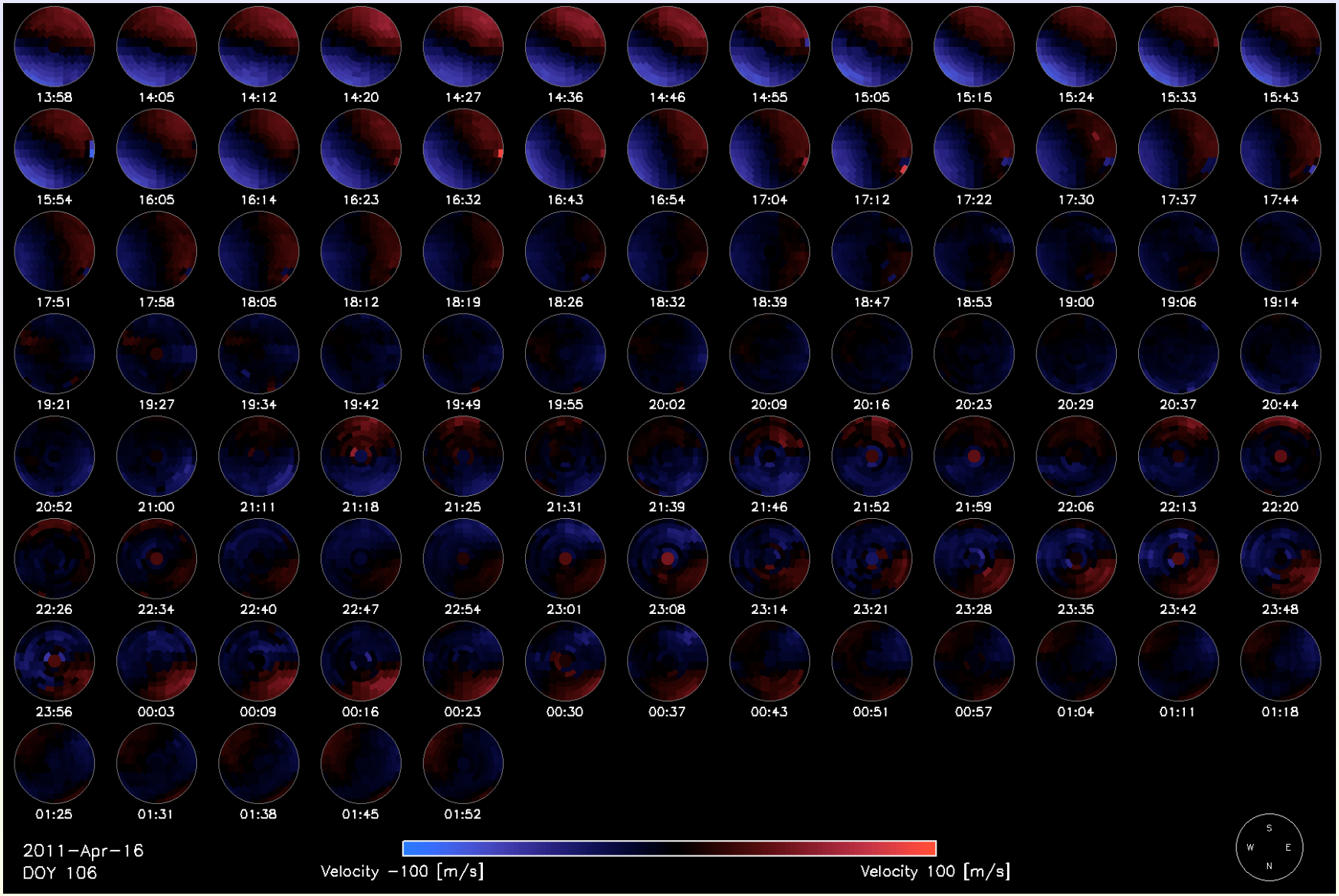
- This shows the 557.7 nm winds measured on Sep 24, 2010.
- Format is the same as the previous animation.
- Once again, there are significant responses on short time scales.

Temperature Brightness Maps from Mawson on April 16, 2011



These are the RGB maps from Mawson the night of April 16, 2011. Note the bright aurora and clear sky late in the night.

557.7 nm Wind Field – Puzzling "Noise"



Note the "noise" late in the night of April 16. This phenomenon is seen quite often, and *it is not due to cloud or poor signal!* – What's going on?

Conclusions

- The auroral $557.7\,\mathrm{nm}$ emission is very bright and is an excellent tool for mapping auroral characteristic energy.
- Winds determined from it are subject to artifacts due to altitude variations.
- These altitude variations have surprisingly little effect on the overall background wind estimates.
- They do introduce considerable uncertainty into interpretation of small-scale features.
- Nevertheless, it is quite likely that there is useful information to be learned by looking further into these small scale responses.