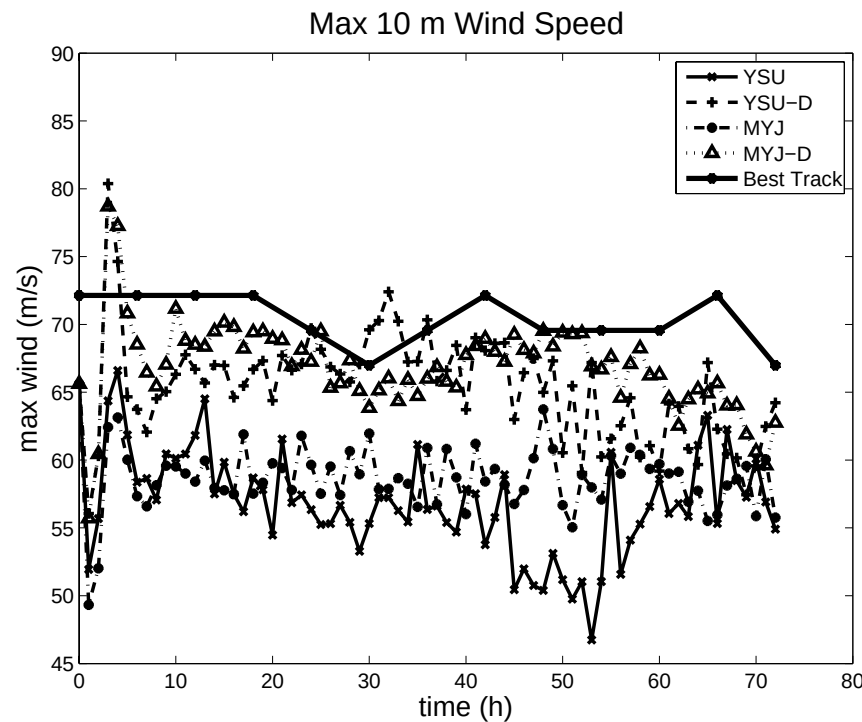


The Relationship Between High-Resolution Model Output and “1 Minute Sustained” Wind Speed

- When evaluating and comparing model output to observations, it is common practice to simply use the instantaneous maximum diagnosed 10 meter wind speed from the model.



This is an example from our recently submitted papers on Hurricane Isabel. The points show hourly maximum 10 m wind speeds from the 1.33 km grid.

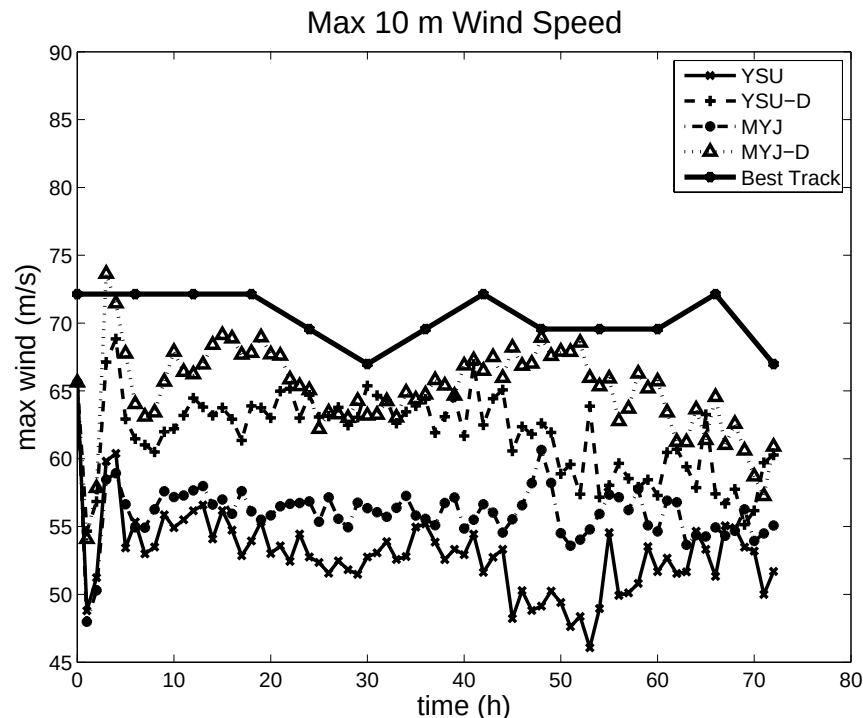
- But how well does that correspond to a one minute sustained wind (in the model)?
Consider this back of the envelope estimate:

If the maximum wind is an average over one grid cell, then what is the time for which we can expect that wind to be sustained?

$$1.33\text{km}/70\text{ms}^{-1} = 19\text{s}$$

This suggests the 1.33 km data is more “noisy” than 1-minute winds.
So what if we use the data on the next largest grid?

$$4.0\text{km}/60\text{ms}^{-1} = 67\text{s}$$



However...

Major comments

Note that P=page, L=line, negative line numbers are counted from the page bottom.

Part I

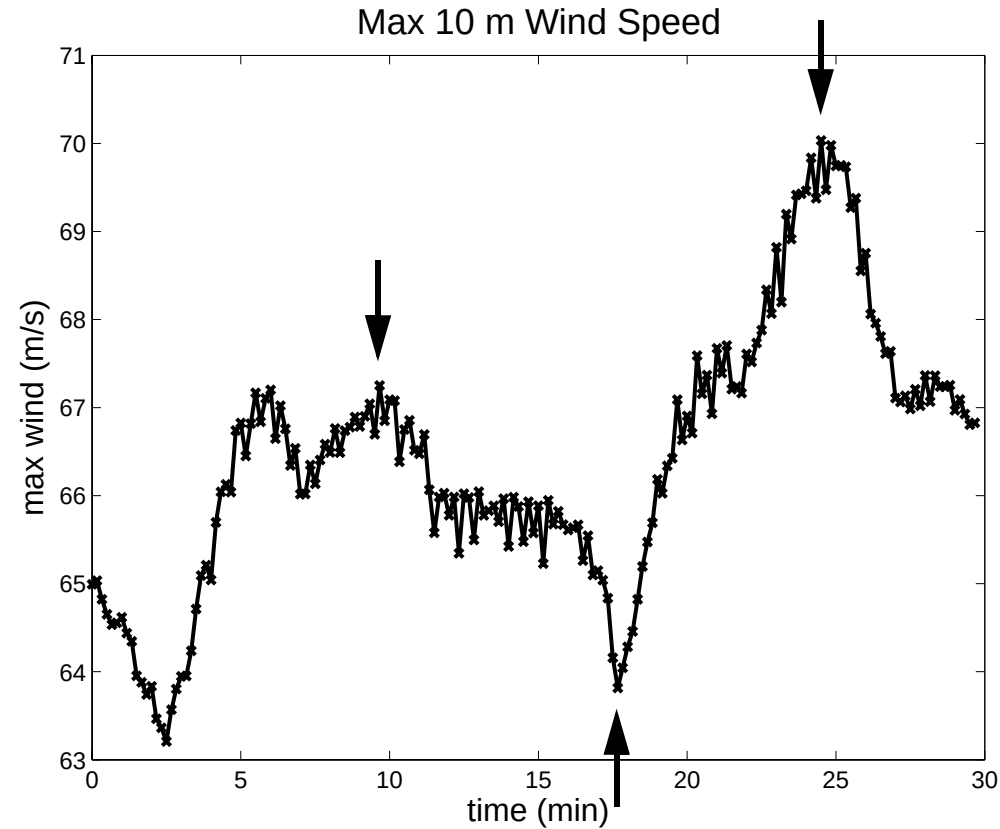
1. Section 5c. The argument as to what averaging period a model grid cell corresponds to is incorrect. Firstly, the cell is a 3-dimensional average, while a time average is 1-dimensional. The appropriate measure is the number of turbulence integral scales over which the averaging is done (e.g. Lumley and Panofsky 1964); since the cross-stream integral scale is several times less than the long-stream, the time-equivalent averaging of a grid cell is much greater than the analysis here suggests. Secondly, the model resolution is not the same thing as the grid spacing, but depends also on any implicit or explicit horizontal diffusion, etc. Skamarock (2004), for example, have argued that the effective horizontal resolution of their particular configuration of WRF is 7 times the grid spacing.

•So now what?

Well, the time step on the inner nest is 10 sec.

To see what is happening on sub-minute time scales, let's just save the data every time step and find out!

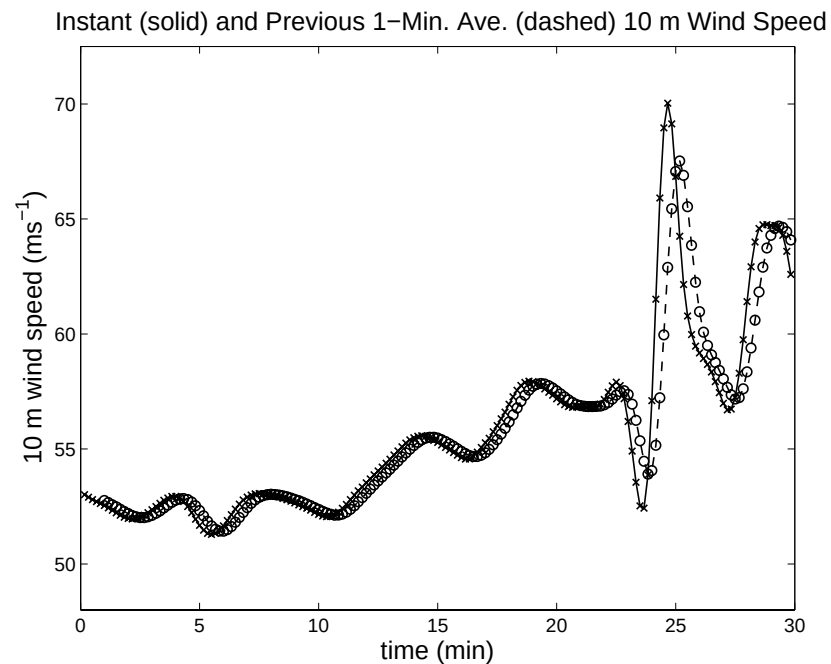
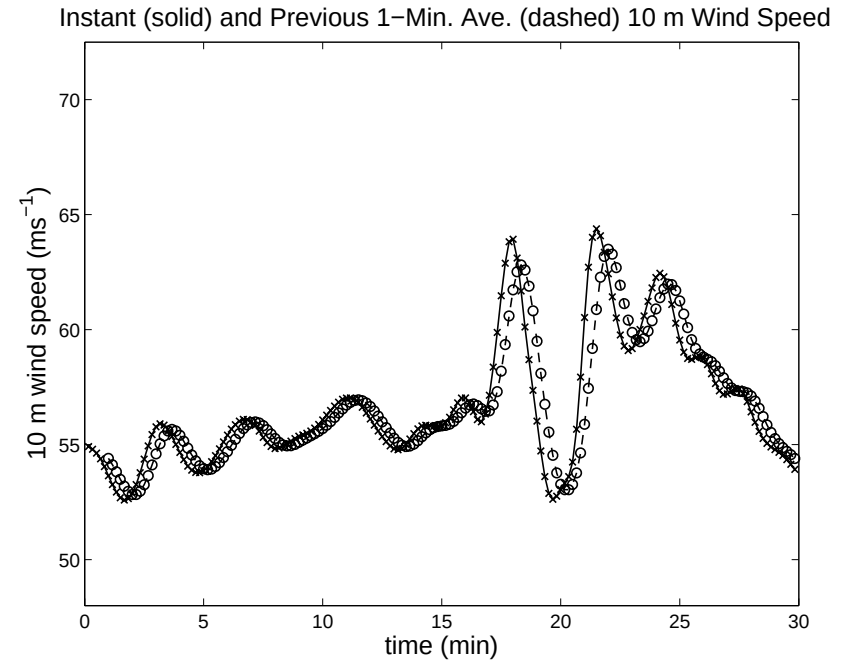
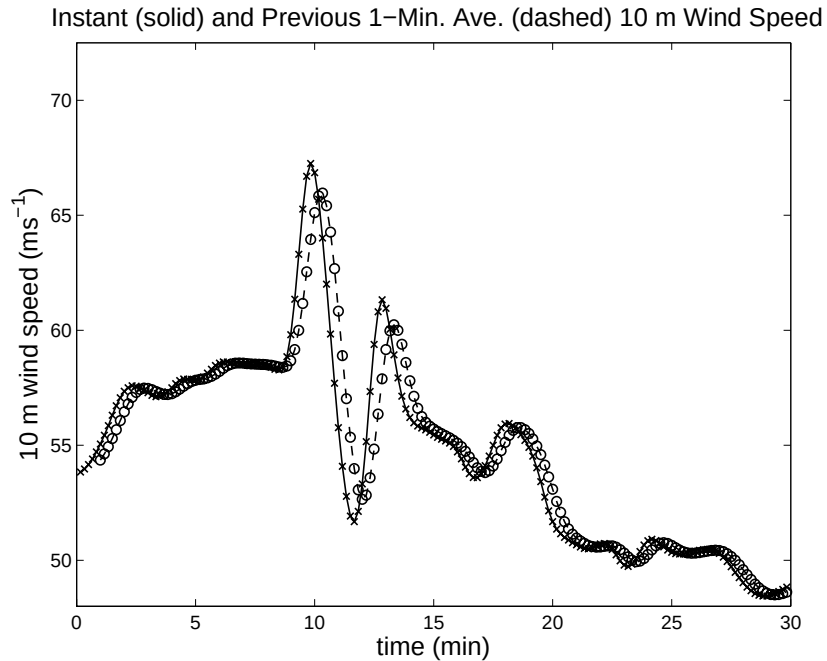
- We restarted the simulations at 00Z Sep. 14th and saved data every 10 seconds:



We selected three wind maxima to examine, and saved the lat/lon locations.

Had to write Matlab code to find the grid point with the same lat/lon at each time.
(This is tricky because the grids are moving and the lat/lon lines are curved.)

Results



Instantaneous wind maxima are just 1-2 m/s more than 1-min averages

Wind maxima are associated with passing meso/misovortices with a length scale of 10-15 km

These results are for the YSU PBL scheme with improved C_d formula

Results for MYJ PBL scheme with improved C_d formula

