

REVIEWER 01

This paper describes four bore-like wave events observed in the mesosphere with an all-sky imager over South-East Brazil. A complete description of the atmospheric background conditions was also provided by coincident Na lidar and radar measurements. Bore-like events are trapped waves which are able to propagate over large distances. Their presence gives important information about the structure of the upper atmosphere. The manuscript is clear and well-written. Although it provides some interesting results, these are not new. They just corroborate previous studies. The paper gives a good overview of ducted waves science and a fairly complete description of the four investigated cases. However, the authors should answer the following comments/questions:

1. A map illustrating the measurements would be useful, with the field of view of the imager and the locations of the Na lidar beams where they intersect the OH layer.

Response:

Thanks very for the suggestion. The map showing the field of view of the imager and the positions of the instruments are provided below. The description of the symbols used are all explained in the caption of the figure.

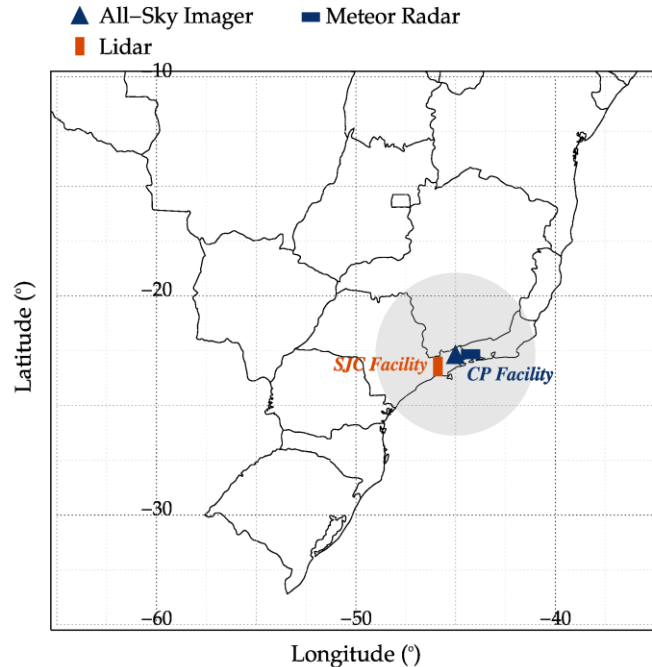


Figure 1: Geographical map indicating the location of the all-sky imager (dark blue triangle) and the meteor radar (blue horizontally-oriented rectangle) at Cachoeira Paulista (CP facility) and the Lidar (orange vertically-oriented rectangle) at São José dos Campos facility. The grey circular shaded region indicates the field of view of the all-sky image.

2. How was λ_H measured because the events all appeared as a single front?

Response:

Even though the events do appear as single front, the λ_H was estimated considering the position of the crest and trough. Despite the troughs not being so evident visually, by making a cut perpendicular to the phase propagation, short oscillations (trails) are evident. The temporal change in the peak crest and succeeding oscillations are used as reference to determine wave parameters as describe as follows.

To compute the GW horizontal parameters (i.e., wavelength(λ_H), observed period(τ_H), phase speed(c_H), and direction of propagation(ϕ_H)), a two-dimensional (2D) fast Fourier transform based cross-correlation spectrum (Garcia et al., 1997) was used to estimate parameters of small-scale gravity waves (Nyassor et al., 2021; Nyassor et al., 2022a; Nyassor, et al., 2022b). The detailed step-by-step description of the cross-correlation spectral analysis (Wrasse et al., 2007), used to estimate the horizontal parameters of the observed bores can be found in Wrasse et al., 2024.

3. In equation (1), only some of the parts are used in this study, why is that? What about $1/4H^2$ and u' ?

Response:

The parts used are the components that have significant contributions to the estimation of m^2 . This was informed based on the scale analysis performed, where the other parameters such as $1/4H^2$ and u' are negligible in comparison to the other parameters, hence their omission in Equation 1.

4. Uncertainties are plotted on the figures, can you also provide the error calculations?

Response:

The errors of the calculations are based on the error propagation techniques of Bevington and Robinson (2003). Here, the error is estimated in the wind measurements at each altitude and subsequently, in the estimation of the total m^2 and the m^2 considering only the buoyancy term and shear term.

5. Evidence for inversion layers is not always obvious, especially for events 2 and 4. It would be interesting to expand the background plots to the whole nights. Something similar to Figure 7 in Bossert et al., 2014 (<https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2014JD021460>). It would also help providing an explanation for the origin of the ducting regions (large scale wave, tide?), and interpret the data, not just present it.

Response:

We appreciate the suggestion on the provision of more details on the plots to provide the temporal evolution of the inversion layer and their extent. In the Figure below, an hour resolutions contour plots are presented for the 4 bore events.

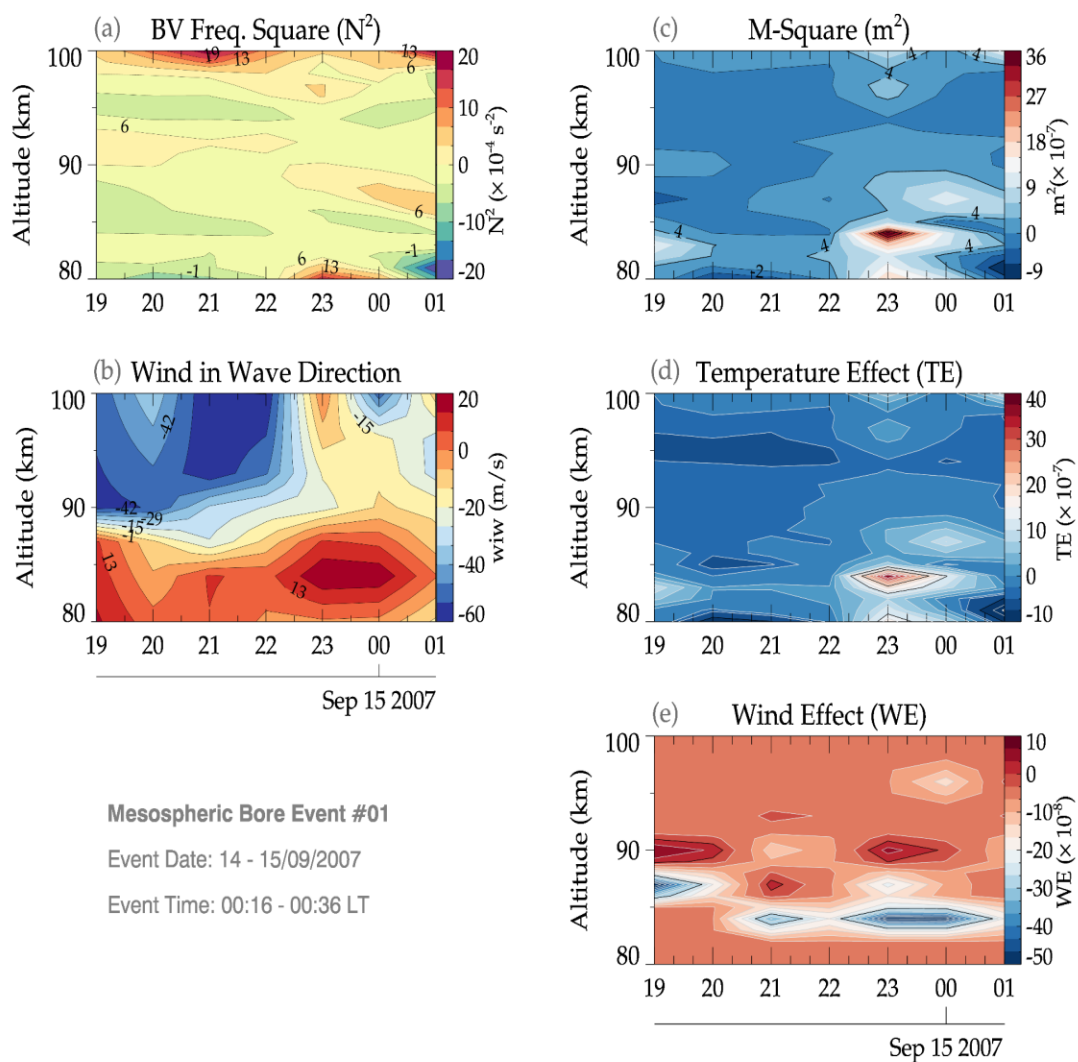


Figure 2: Vertical profiles for Event 1 on 14–15 September 2007: (a) buoyancy frequency (N^2), (b) w_{iw} and (c) m^2 . The estimated m^2 considering only the buoyancy and shear term, respectively are presented in panels (d) and (e).

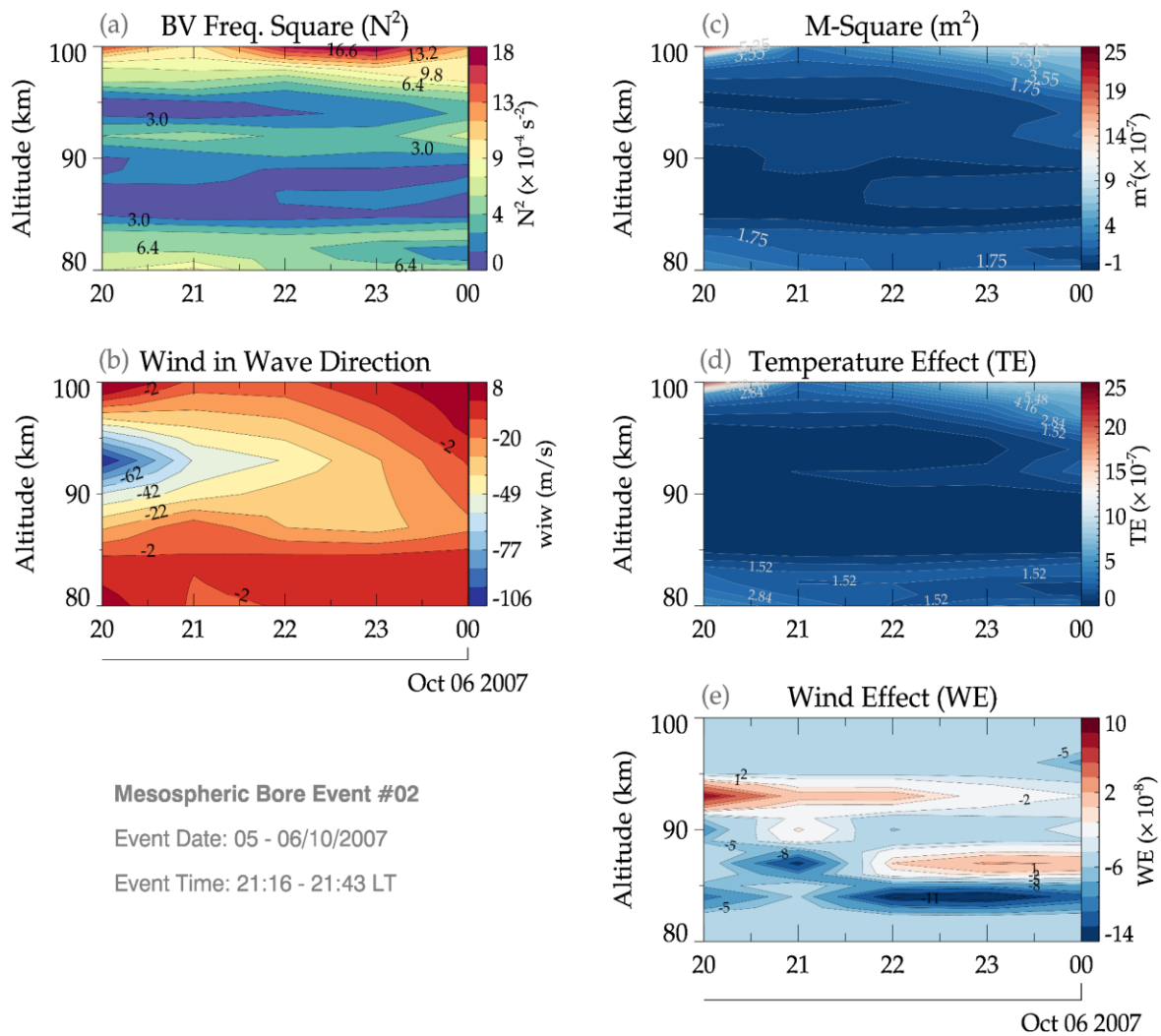


Figure 3: Similar to Figure 2 but for Event 2 on 05 - 06 October 2007.

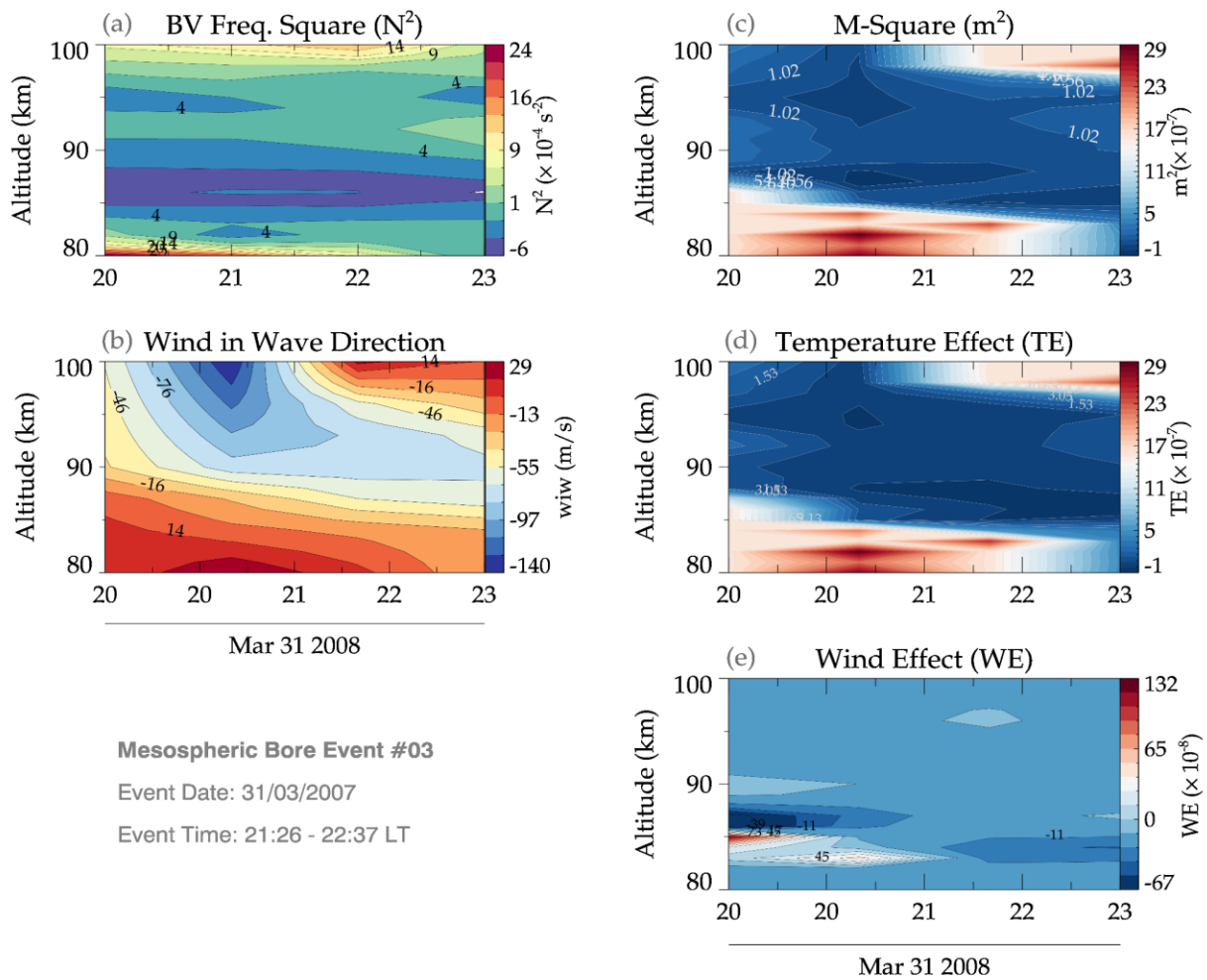


Figure 4: Similar to Figures 3 but for Event 3 on 31 March 2008.

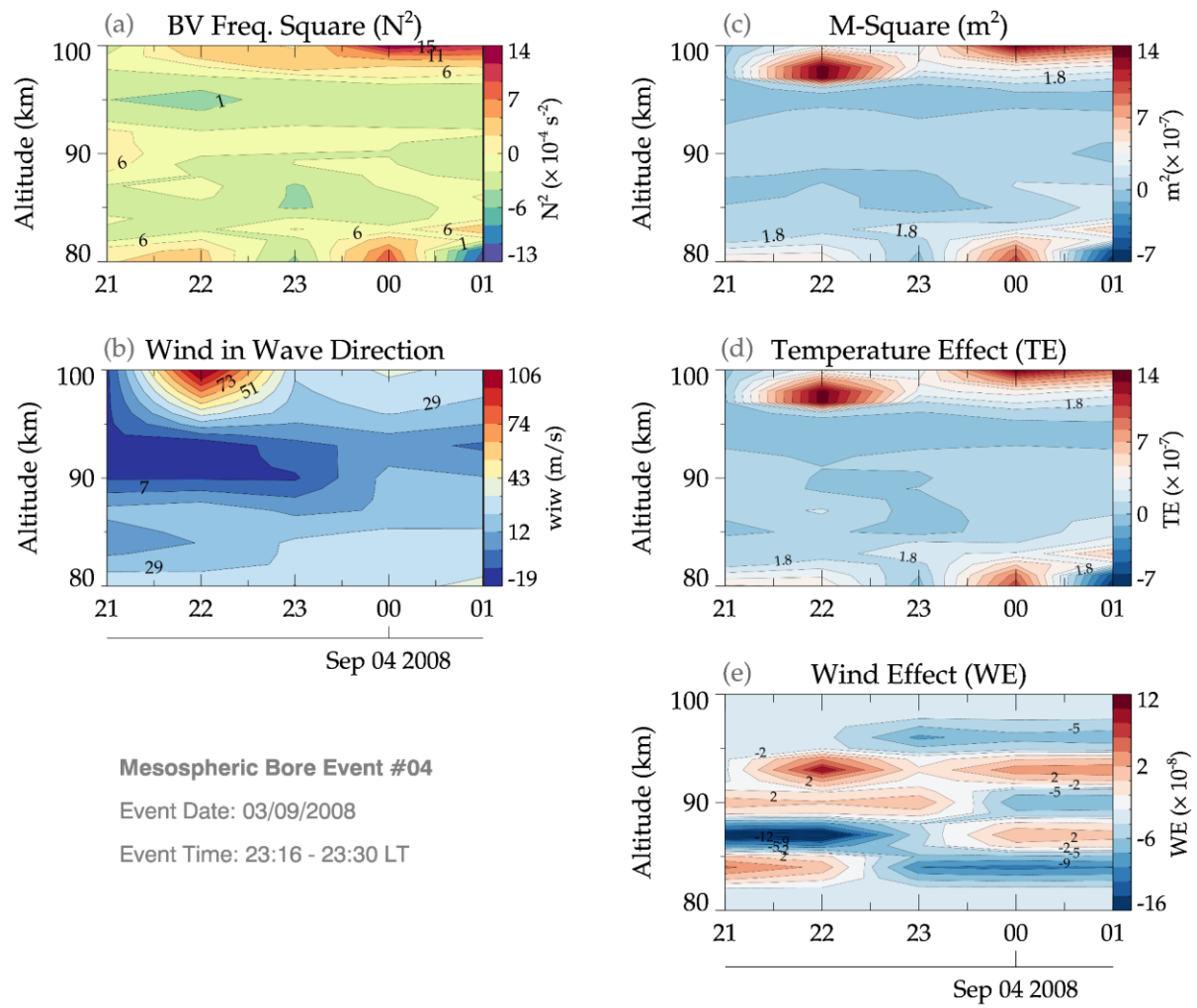


Figure 5: Similar to Figures 4 but for Event 4 on 03 - 04 September 2007.

6. Some figures could be nicer, especially 2, 5, 7, and 9, which look low quality.

Response:

The quality of Figures 2, 5, 7 and 9 have been enhanced and are presented below as follows.

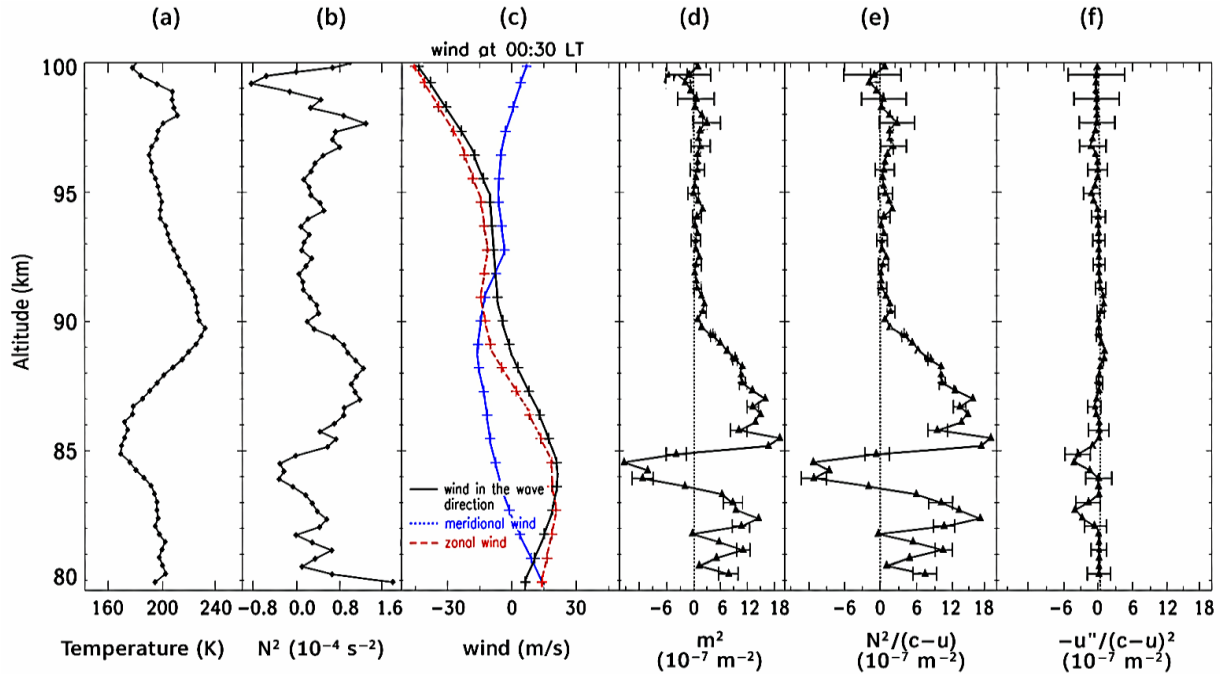


Figure 6: Vertical profiles for Event 1 on 14–15 September 2007: (a) temperature, (b) buoyancy frequency (N^2), (c) zonal, meridional, and wiw (with error bars), (d) total m^2 , (e) m^2 from temperature, and (f) m^2 from wind.

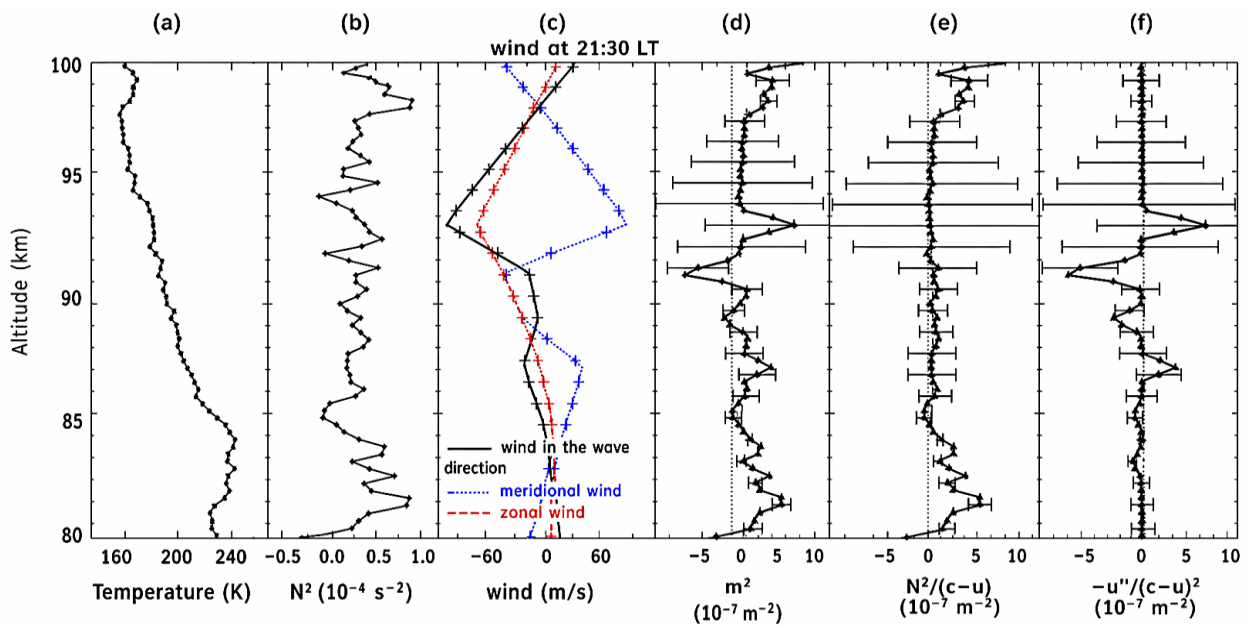


Figure 7: Vertical profiles for Event 2 (5 October 2007): (a) temperature, (b) buoyancy frequency (N^2), (c) zonal, meridional, and wiw (with error bars), (d) total m^2 , (e) m^2 from temperature, and (f) m^2 from wind.

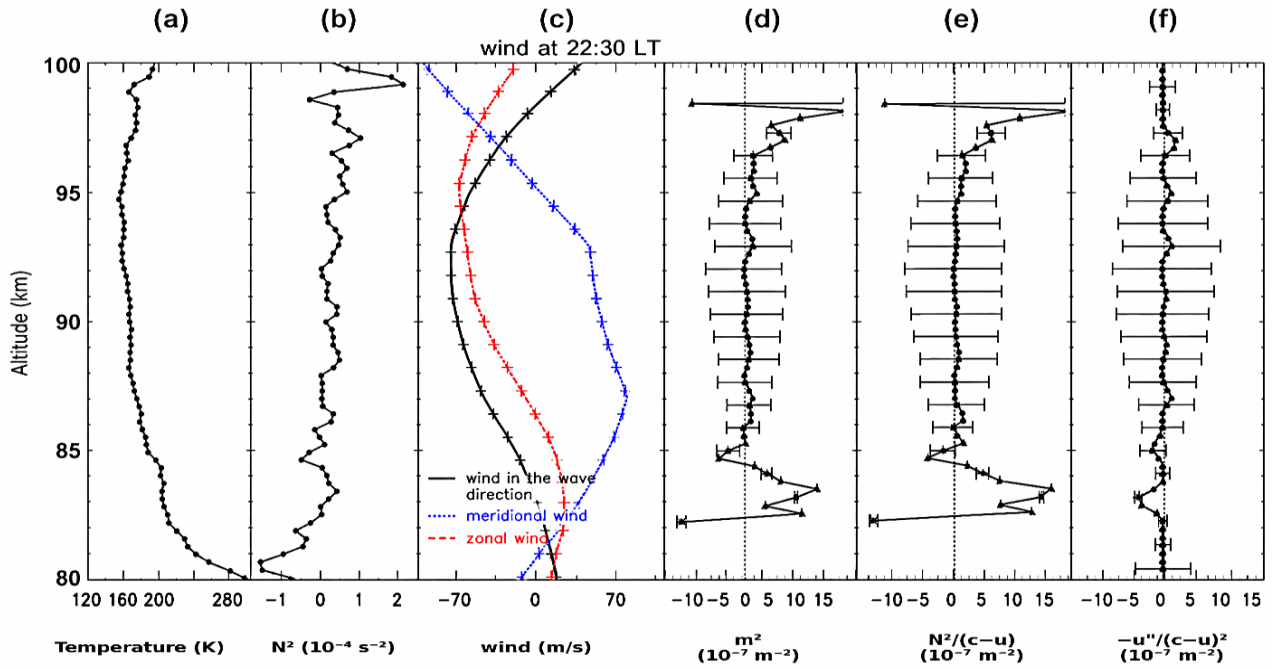


Figure 8: Vertical profiles for Event 4 on 31 March 2008: (a) temperature, (b) buoyancy frequency (N^2), (c) zonal, meridional, and wiw (with error bars), (d) total m^2 , (e) m^2 from temperature, and (f) m^2 from wind.

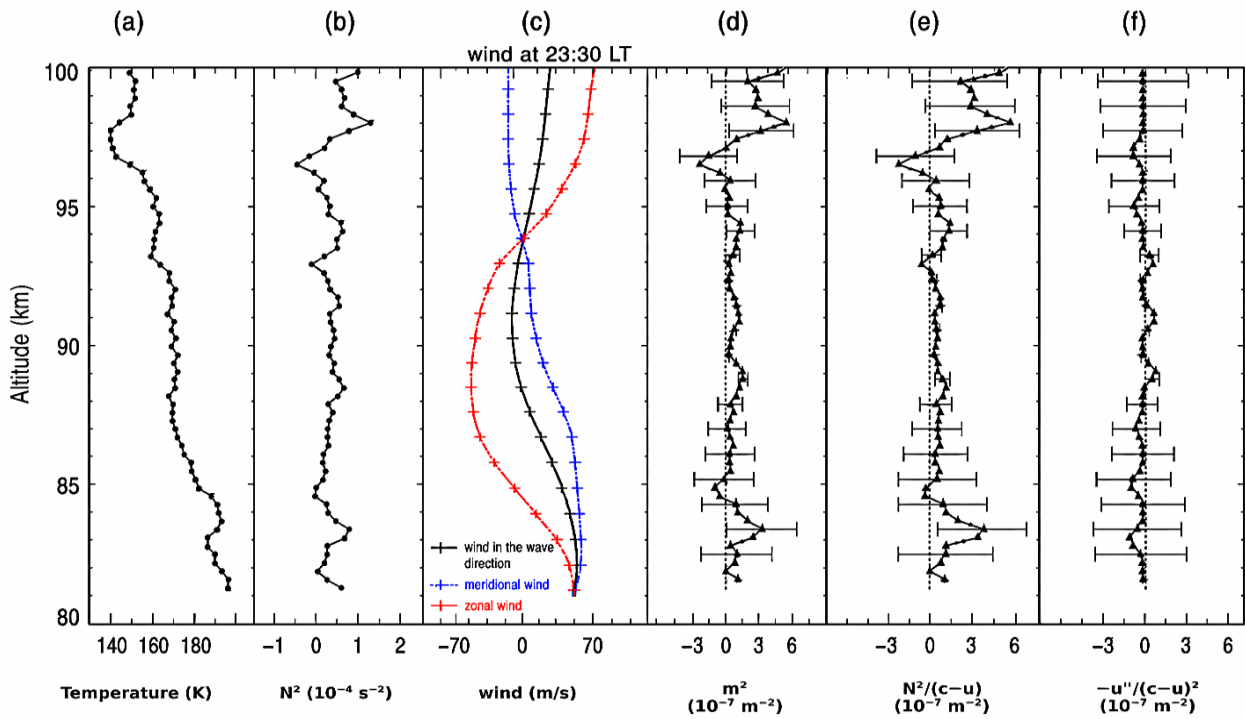


Figure 9: Vertical profiles for Event 5 on 3 September 2008: (a) temperature, (b) buoyancy frequency (N^2), (c) zonal, meridional, and wiw (with error bars), (d) total m^2 , (e) m^2 from temperature, and (f) m^2 from wind.

Minor Comments

1. Line 83: I think SJC is west of Cachoeira Paulista!

Response: Well noted. Correction has been made.

2. SABER is mentioned in the data availability section but it's not clear when/how it was used in the study.

Response: Well noted. Correction has been made. It was used for the newly included SABER plots.

