Review of: Full scale spectra of 15-year time series of near-surface horizontal wind speed on the north slope of Mount Everest, by Han et al.

Title: The station is in a valley that significantly affects the winds, rather than on the north slope of Mount Everest" as seen from Figure 1. Perhaps 'in a valley on the north SIDE of Mt Everest."

General Comments

While some interesting results are suggested in places, this paper contains some significant errors and internal contradictions, discussed in more detail below.

(1) Figures 6 and 7 show vastly different sonic-anemometer-based spectra; and extension of sonic data to frequencies much larger than it was designed for.
(2) The authors use a relationship (equation (1)) that absurdly assumes a universal spectrum for high and low frequencies, and then uses it to provide the dashed slope lines in Fig. 7).
(3) After explaining the more energetic high-frequency spectrum in winter in terms of larger wind speed, the authors produce a graph (Fig. 8) that shows the highest turbulence energy at the lowest wind speeds.

Also, while the role of Everest seems to be focused on, the real physics has to do with the terrain surrounding the site. This could be addressed by either expanding the area in Fig. 1 so that the fetch from all directions is better represented, or better yet, by adding a figure that focuses on the terrain in all directions nearer the site. Some discussion already appears; it would be enriched by such a figure.

Furthermore, processing of sonic-anemometer data can be quite involved. There is nothing about correction for orientation, etc. that usually is addressed in a paper dealing with sonic data. Such care could improve the slope at higher frequencies except of course for the aliasing at the highest frequencies. I am unsure about whether sonic data have been used at the lowest frequencies.

Thus, this paper needs a major rework, and probably redoing some data processing and analysis, before it can be considered for publication.

Specific Comments

Abstract:
Again, north SIDE of Mt. Everest (L 19). "slope" implies that the station is not in a valley.

L78. This is incorrect. Sampling rolls in the cross-roll direction leads to one wavelength but the gap between synoptic-scale energy and roll-scale energy will still exist. (though it is unlikely that an aircraft sampling rolls would have a track long enough to sample synoptic variability).

Furthermore, if the boundary layer eddies are being sampled from a tower, the rolls will show up with a period of the order of a half-hour or more, with large eddies with a period of the order of five minutes (at the strong wind speeds associated with rolls). So there will be a gap between the signal representing the large eddies and the signal representing the rolls, and a gap between the signal of the rolls and synoptic variation.

Also, if the winds are weak, large eddies could have long period as well – even of the order of a half hour, assuming the large eddies aren't evolving. I.e., things get complicated. But there could still be a gap between the large eddy signal and the synoptic signal.

L85-87. This sentence provides no information – how could two sites show "universal characteristics consistent with findings in the literature." Please correct or delete.

L94. Re Li et al. (2021). Horizontal wind component spectra? Wind speed spectra? The results could be different for spectra of wind speed and spectra for one of the wind components.

L100. GATE needs to be spelled out. It is the Global Atmospheric Research Programme (GARP) Atlantic Tropical Experiment.

L105. Delete starting with "therefore".

L112-L115. Discussion of local circulations. This discussion is not clear, but it is important since it appears to apply to where the measurements are taken. Why is it so different from idealized mountain-valley circulations? I have a hunch that it has to do with the side of Mt. Everest the valley is on. This should be discussed in terms of which slopes are illuminated by sunlight, and which slopes are not. I.e., the surroundings in all directions should be considered.

This discussion could be greatly improved through use of a second map showing the local terrain surrounding the site. That is, it shouldn't cover as large an area as Fig. 1.

L119. Regarding the next sentence about being "debated" – perhaps it is more precise to say that the origins of circulations in the Himalaya are still the subject of active research.

L123. Since the station is in a valley, which profoundly affects the winds, one should be more precise, e.g.., what is being documented is 'the winds in a valley on the north side of Mt. Everest, 30 km to the north of the peak.' Further, this provides insight into the local circulation there. ('on the north slope of Everest' implies being ON the slope, which would imply a different circulation than one in a valley on the north side.). Which is also affected by other nearby terrain.

L137. Interaction between the atmosphere, terrain, and surface cover?

L138. Suggest, "The QOMS station is situated at the bottom of the Rongbuk Valley at an elevation of 4276 m above sea level, approximately 30 km north of the summit of Mt. Everest (Figure 1). At the station, the Rongbuk Valley runs in a NNE-SSW direction (approximately 10° to 190°), with a width of about 1.5 kilometers.

(NOTE: 10 to 190 degrees is closer to north-south than to NNE-SSW, but the map suggests something closer to NNE-SSW, which would be more like 22.5 degrees to 202.5 degrees). PLEASE CHECK.

L145. Wind direction and speed?

L151. Should read 'wind speed and direction' (velocity is a vector). Though, didn't you simply analyze wind speed? You need to be specific about this. People either analyze wind components

(u,v,w), horizontal wind components (u,v) or wind speed; and the results obtained for wind speed vs u and v are different. Okay, it's included in the next paragraph.

Table 1. 'Total' should be 'Total Days'

Section 2.3 okay, although it is important to document how the sonic-anemometer data were processed (corrections for orientation, etc.) and then analyzed.

Figure 2. I would have expected the winds going downslope from Everest would provide the dominant direction, which would be from the SSW. But I am not sure what the terrain looks like to the north of the site. So – when you write 'northeasterly to northerly' do you mean 'toward the northeast to north'? (This is one of the frustrating ambiguities of the English language!).

I just looked up "wind rose" on the Internet, which indicates that wind roses indicate the direction *from* which the wind is blowing, so I am guessing I should interpret the wind is mostly being from the NNE. If so, I would recommend more explicitly writing "north to northeast winds" or even more specifically, "winds from the north to northeast."

Assuming that the dominant wind directions are from the north to northeast, it appears that nearby terrain or terrain to the north has a strong influence as well.

The following sentences, which refer to north winds, suggest that most the winds are from the north-northeast, but I think it would be better to avoid use of 'easterly', etc.

On a related matter, since you are presenting a complete wind rose, it would be useful to have a topographic map with the station at the center. Could be a simplified version. (see other comments about this)

L213-L215. Suggest, for more precision and less ambiguity.

In general, prevailing winds are along the valley, with directions from the SSE to SW in the spring, autumn and winter; and from the NNE in summer; with higher speeds from the southern directions.

L218-220. This sentence makes no sense. Why would downward transport of zonal wind (from the west) increase the winds from the south? Please check and correct.

L220-221. For clarification, suggest (If this is correct)

The strong SSW to SW winds in Fig. 3 are driven by .. (rest of sentence okay)

L245. Insert 'for the days"

L250 The existence of aliasing at the highest frequencies should be announced immediately, in Section 2.3, BEFORE the first figure showing spectra.

I.e., Lines 278-280 be deleted, replaced with a statement in Section 2.3 that the increase in spectral energy at the highest frequency is due to aliasing, which results from sampling a signal at too low a rate. This applies to all the spectra shown. It has nothing to do with white noise.

L258. “costal” should be ‘coastal’.

L260. How about simply contrasting “over land” vs “over the ocean.” And, it would be more precise to say the average diurnal peak is smaller over the ocean, rather than ‘missing.’ You could check whether the Uemaya paper shows a weak diurnal cycle, so that could be cited. A diurnal peak over land is common knowledge, so no citation would be necessary,

Regarding the 12-h peak in a mountain area, it would be useful to cite the presence of thermally-driven upslope and downslope winds, citing the book by Whiteman. (I think ‘upslope and downslope’ winds is sufficiently broad to include upvalley and downvalley winds as well). You could use the adjective “common” or “frequently seen” to indicate that they would not always be observed, since well-defined thermally-driven circulations are most probable in fair-weather, weak-synoptic wind, situations.

L264. Since the Kang and Wan papers DOES observe a weak 12-hr peak at the Boulder Atmospheric Observatory, contradicting rather than supporting your statement. I would omit citation of this study here. Also, the measurements are not in a mountain area, but near a mountain area.

L269-271. There is missing information here. You cannot explain a 12-hour cycle showing up that well with one maximum and one minimum in wind speed in 12 hours.

L294. Horizontal wind speed?

Comparing Figs 6 and 7 – In Fig. 6, the frequency-weighted sonic spectral energy for horizontal wind is three orders of magnitude lower than that found from the measurements from the tower at 10 m. Yet in Fig. 7, you the sonic energy of the same order of magnitude as that found at the tower at the low-frequency end!

Similarly, the slope of the sonic-derived spectral energy is positive in Fig. 6 over several decades where it is negative in Fig. 7.

Something is wrong here! Data processing? Even believing sonic data at such low frequencies?

L303-4. Figures 3 and 4 show wind SPEED not the west-to-east wind component, so this statement needs correcting (or the figure needs correcting). Also, you should make sure the cited papers in line 229-230 are for the corresponding measurement.

L310. The mesoscale motions being related to the complex terrain (e.g., mountain-valley flows) and deep convection?

L313. But the basic physics of the Kolmogorov frequency range assumes the smaller eddies simply get their energy from the larger eddies. In this frequency range, the motions are driven by buoyancy associated with nonuniform heating (for complex-terrain flows) and release of latent heat (deep convection). So, it’s coincidence. The curious thing is the lack of a -2/3 slope at the higher frequencies, where it’s expected (even though there is some energy introduced at higher frequencies).

L323. Simply because eddies pass by the sensor faster?

L331-332. I question whether the spectra are reliable at these frequencies, due to a combination of aliasing and a significant departure from the expected -2/3 slope.

L335 – L339. The existence of a spectral gap is not necessarily a matter of debate; rather the existence of such a gap varies with the situation (and sometimes the method of sampling).

Figure 7. Lots of problems here! (1) Why is the low-frequency sonic-derived spectral energy three orders of magnitude here higher than in Fig. 6? (2) Moreover, even the slope of the spectral energy as a function of frequency is of opposite sign between 10^{-3} and 10^{-1} Hzm=. (3). Eq (1) is arbitrary and contributes nothing, so fitting the low frequencies to match the data has no meaning. (4) Thus, you need only one thick line, to indicate slope – the solid blue line. The red line isn't needed, unless you want to state that the low frequencies don't look like 2-D turbulence. ((1) and (2) noted earlier)

L349. The spectral gap DID vanish.

L350, surpasses that of summer, as noted earlier. Can remove the text after "summer" as this was already discussed in detail.

(I am ignoring discussion of the dubious eq (1))

L376-L380, figure 8. Something is very weird about this plot. It suggests that turbulence intensity is higher with weaker wind, quite the opposite of what was discussed earlier. I suggest that this section either be corrected or deleted altogether.

L405-406. For the 12-h spectral peak, should check nighttime winds, too, as noted before.

414. There is no spectral gap in summer.