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Interactive comment

Interactive comment on "From standard wind measurements to spectral characterization: turbulence length scale and distribution" *by* Mark Kelly

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Author's reply to comment (SC1) by A. Peña

> "Thanks for a very interesting paper. It is indeed extremely convenient to have a parametrization for the Mann length scale that is based on commonly measured parameters. Here three short comments on your manuscript:"

Thanks; I'm hoping to provide something which is theoretically and empirically sound, and convenient to use in wind applications.

"1. My previous work both in the citations and in the references should be Peña, A and not Peña Diaz, A. I think you have two references (and the corresponding citations) with that issue."

Ok, I'll update my BibTeX entries that include your name.

"2. In Peña *et al*. (2010) we did not explicitly suggest a parametrization for the Mann length scale but we relate it to the length scale of the wind profile as you point out. Your work suggests $L_{\mathrm{MM}} \approx \sigma_u/(dU/dz)$ which roughly means that $L_{\mathrm{MM}} \approx z$ in the surface layer (if the approximation $\sigma_u \approx u_*/\kappa$ is used), whereas our relation $L_{\mathrm{MM}} \approx 1.7\ell$ roughly means $L_{\mathrm{MM}} \approx 0.68z$. The latter is also in accordance with the work of Chougule *et al*. (2014) from measurements at Høvsøre and at Ryningsnäs."

First, this is only approached in the *neutral* surface layer (ASL).
Secondly, for $\sigma_u/u_* \approx 2.3$ (as shown in sections 2–3, and also found for the data sets in the neutral ASL), then $L_{MM}|_{\mathrm{nASL}} \approx 2.3z/\kappa \simeq 0.92z$ as given at the beginning of section 2.3.

Chougule *et al.* (2014, e.g. Fig. 5) actually shows agreement with $L_{MM} \sim z$ in the ASL ($z = 20$m) at Høvsøre (though their analysis is only for U between 7–8 m/s). At Ryningsnäs, when accounting for the displacement height ($d \simeq 13$m) then their results are again consistent with the above, with $L_{MM} \approx z-d$ or actually slightly larger (though affected by roughness-sublayer effects above the forest there).

"3. So what is the reason for the differences between Peña *et al*. (2010)/Chougule *et al*. (2014) and your results? Could it be the way the velocity spectra was analyzed (you seem to extract the Mann parameters from each individual 10-min record whereas Peña *et al*. (2010)/Chougule *et al*. (2014) ensemble average spectra for different turbulence conditions)? What is the uncertainty of the fit when performed on each 10-min case?"

As noted in my response to point 2 above, in the *neutral surface layer* there are not significant differences.

Overall, the increase of L_{MM} in unstable conditions is significantly larger than the decrease in stable conditions, as also implied e.g. in Sathe *et al.* (2012). The vertical range and extent to which $\langle L_{MM}\rangle \sim z$ in all conditions depends on the (relative) widths of the stable- and unstable sides of the stability distribution $P(1/L)$ as well as the distribution of ASL depth.
As for the uncertainty on spectrally-fit L_{MM}, this is beyond the scope of the current article—though I do note that the fit was improved markedly by rejecting $\Gamma > 4.95$ (which corresponds to the fit using the highest Γ of the lookup-table of Mann-model outputs), and such rejection roughly appeared to eliminate potential bias in L_{MM}; the latter is included as a footnote in section 3.2. Continuing work includes checking such fitting uncertainty/variability, as well as analysis per wind speed bin.

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