Notes on averaging chipod profiles and comparison to Chameleon data for EQ08 and EQ14

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Contents

1 Overview

Comparing average profiles of χpod estimates (assuming $\gamma = 0.2$) to Chameleon data for the EQ08 and EQ14 experiments. Individual χpod estimates tend to be biased low, but if we average many profiles together do the average profiles agree?

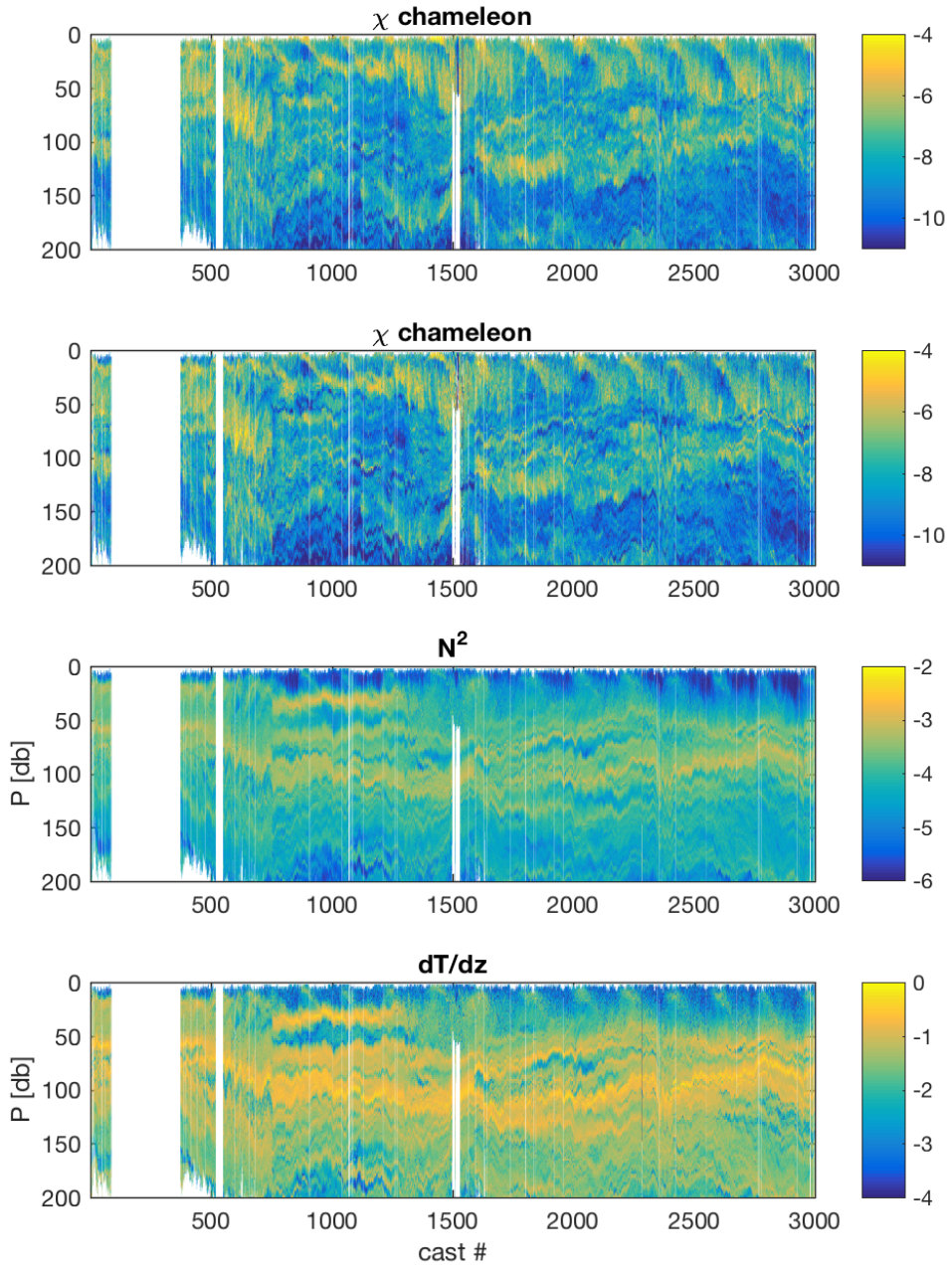

Figure 1: Comparison of χ from chameleon method and chi-pod method, for EQ14 chameleon profiles. Each profile was averaged in 2m bins. Values of below chameleon noise floor (-8.5) have been naned out.

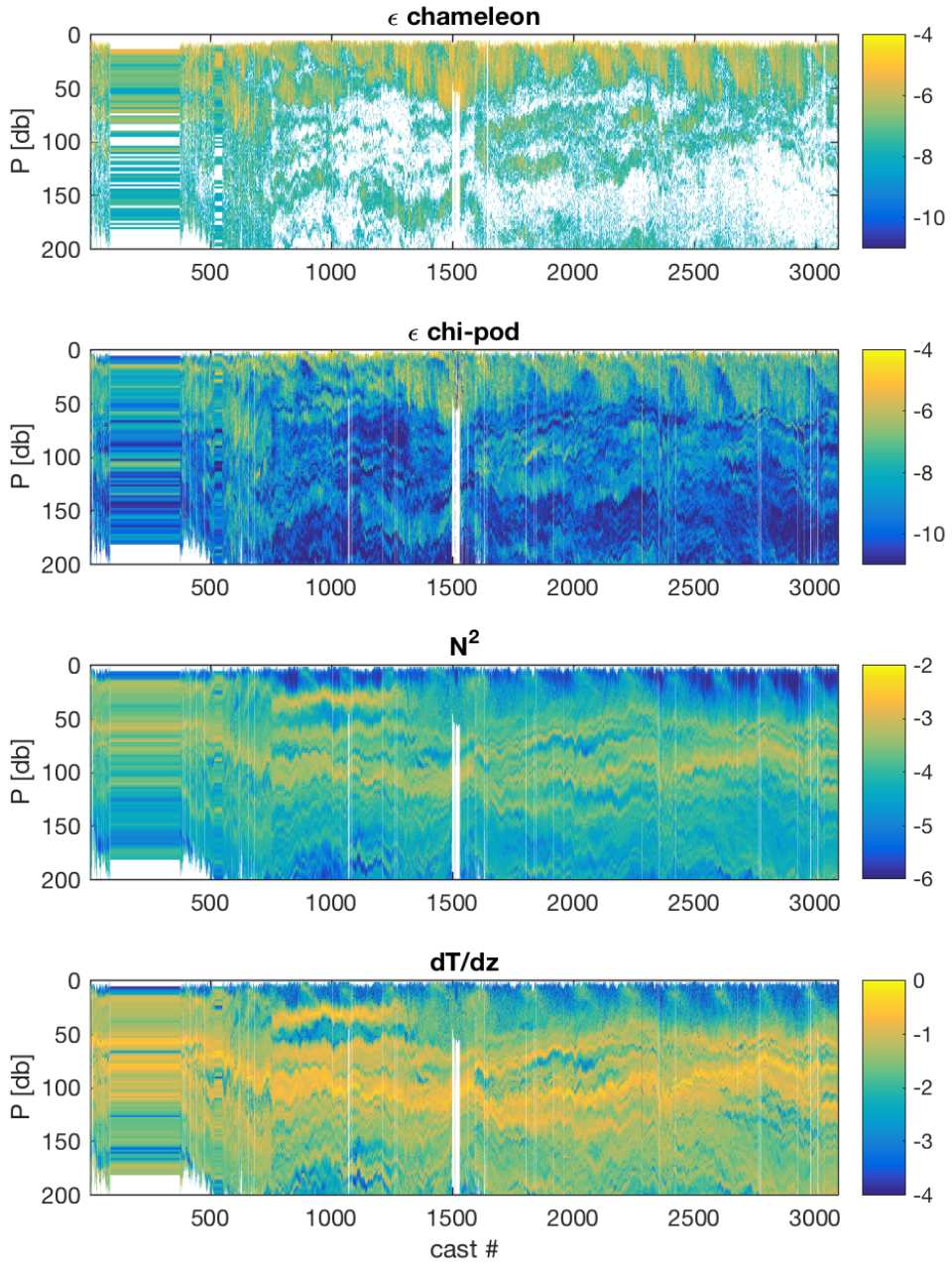

Figure 2: Comparison of ϵ from chameleon method and chi-pod method, for EQ14 chameleon profiles.

2 Comparing individual estimates of ϵ

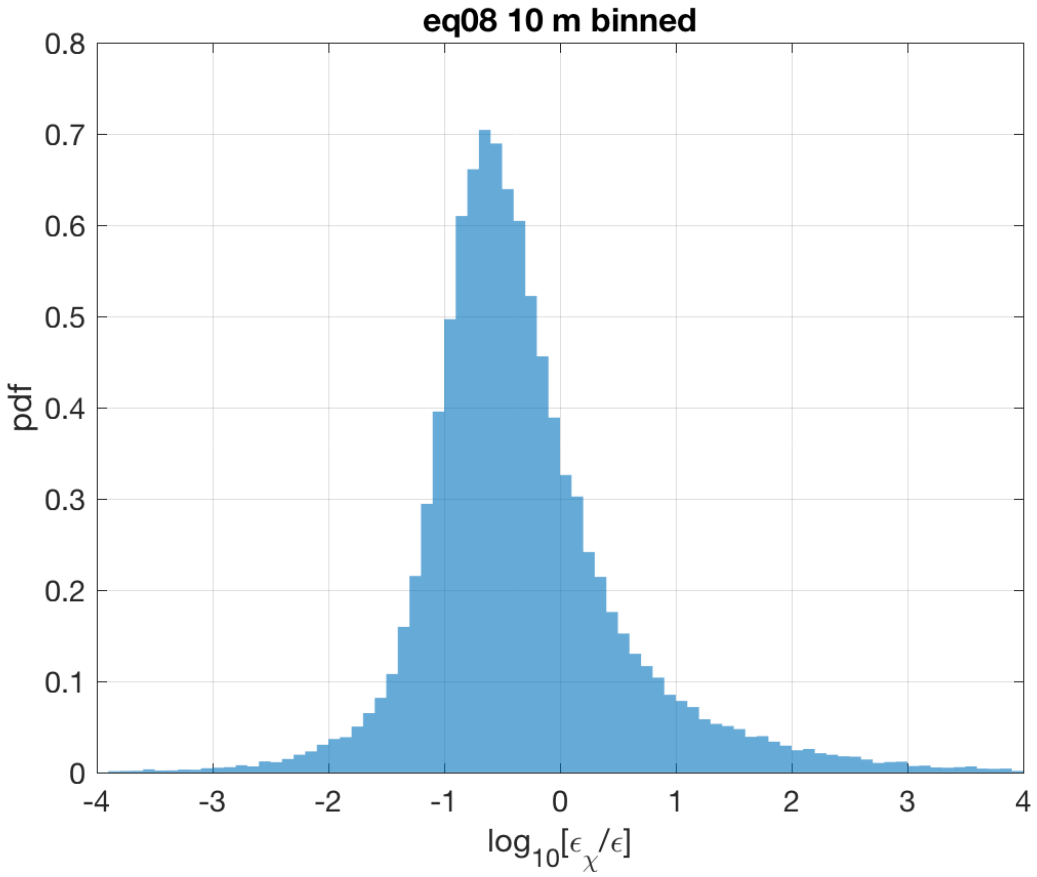

Figure 3: EQ08: Histogram of the ratio of ϵ estimates from χpod method to the chameleon values, for χpod method applied to 1m binned profiles. Estimates for each profile were averaged in 10m depth bins.

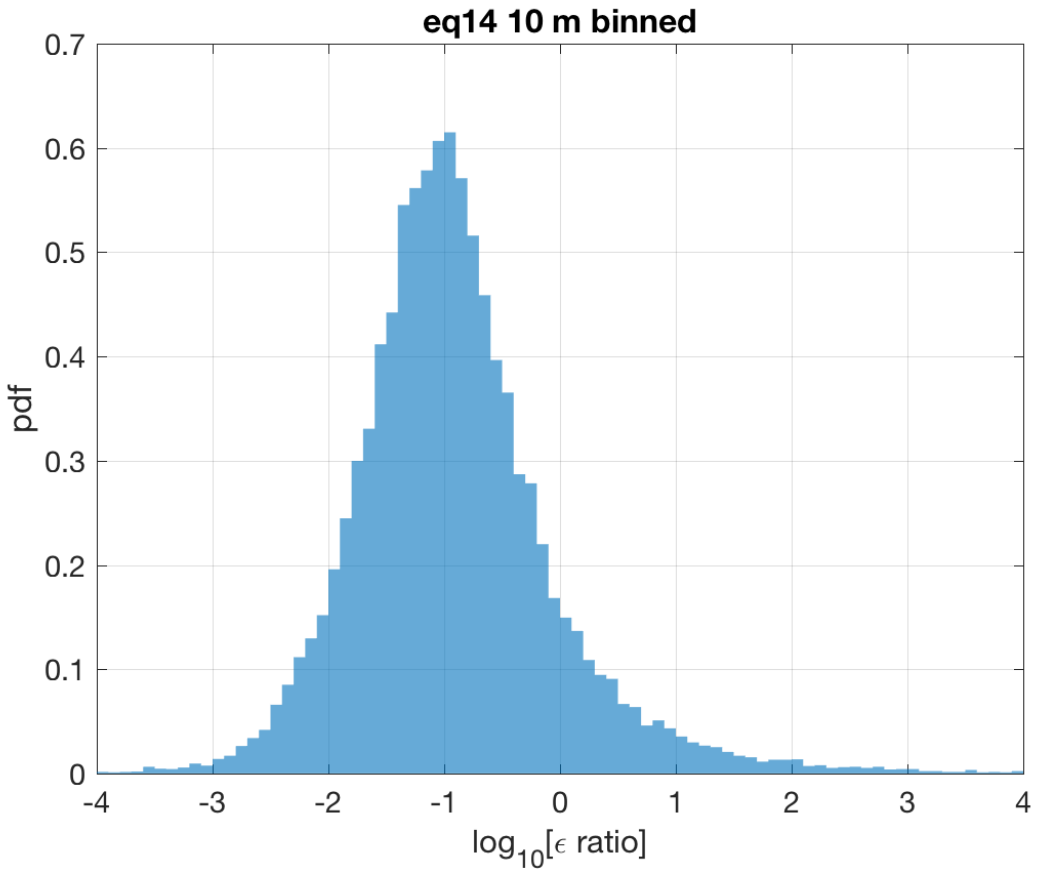

Figure 4: EQ14: Histogram of the ratio of ϵ estimates from χpod method to the chameleon values, for χpod method applied to 1m binned profiles, and applied to just patches. Estimates for each profile were averaged in 10m depth bins.

3 Comparing time-averaged profiles of ϵ

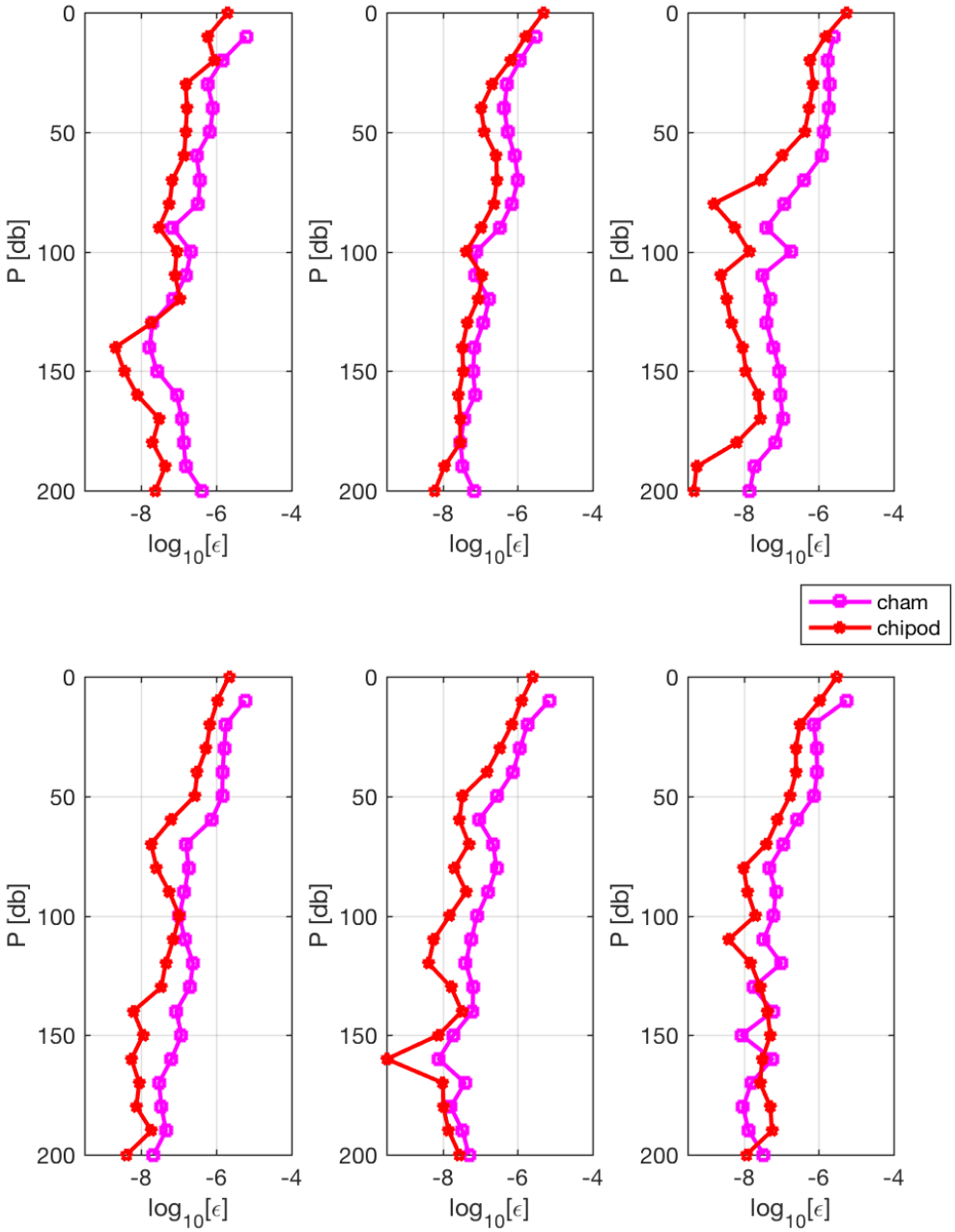

Figure 5: EQ14 : Profiles of ϵ, averaged over 500-cast chunks. Different lines are 1m binned Chameleon ('cham'), χpod method applied over 1m bins ('bin'), and χpod method appplied to patches ('patch'). *Note χpod estimates where $log_{10}\epsilon > -4$ are discarded. Title of each panel gives profile range used, as well as the number of good profiles actually in that range.

4 γ computed from averaged quantities

If we compute gamma from time-averaged N^2, T_z, χ, ϵ do we get $\gamma = 0.2$? Estimates from the averaged data are larger (Figures 6,7) but still slightly less than 0.2 .

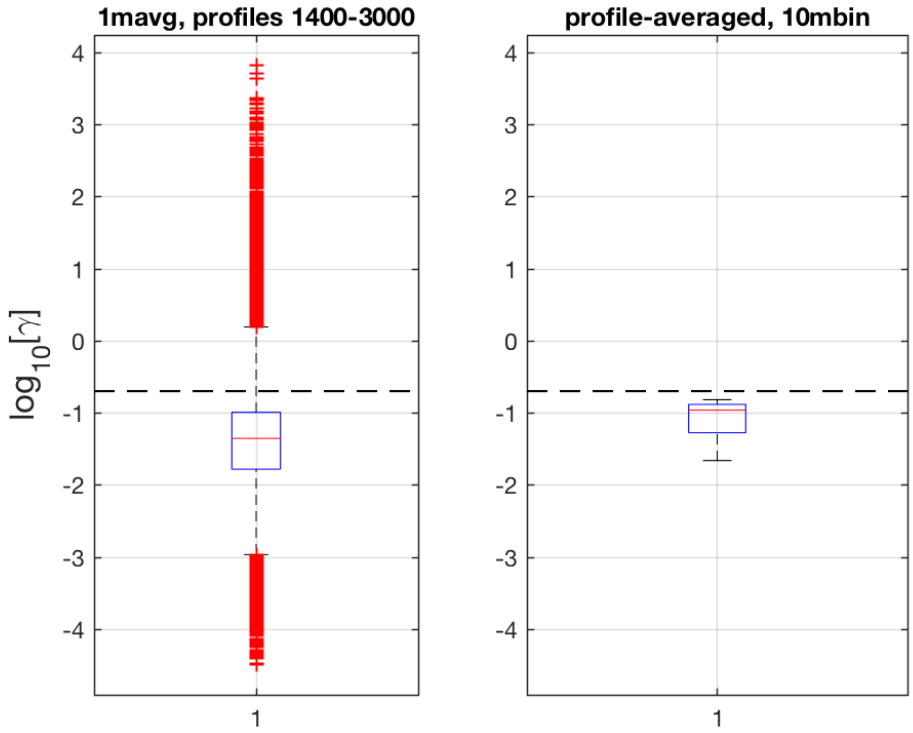

Figure 6: Boxplots of $log_{10}[\gamma]$ for a set of profiles from EQ14. Left is for all 1m avg data. Right is for data from all profiles averaged in 10m bins. Horizontal dashed line indicates $\gamma = 0.2$.

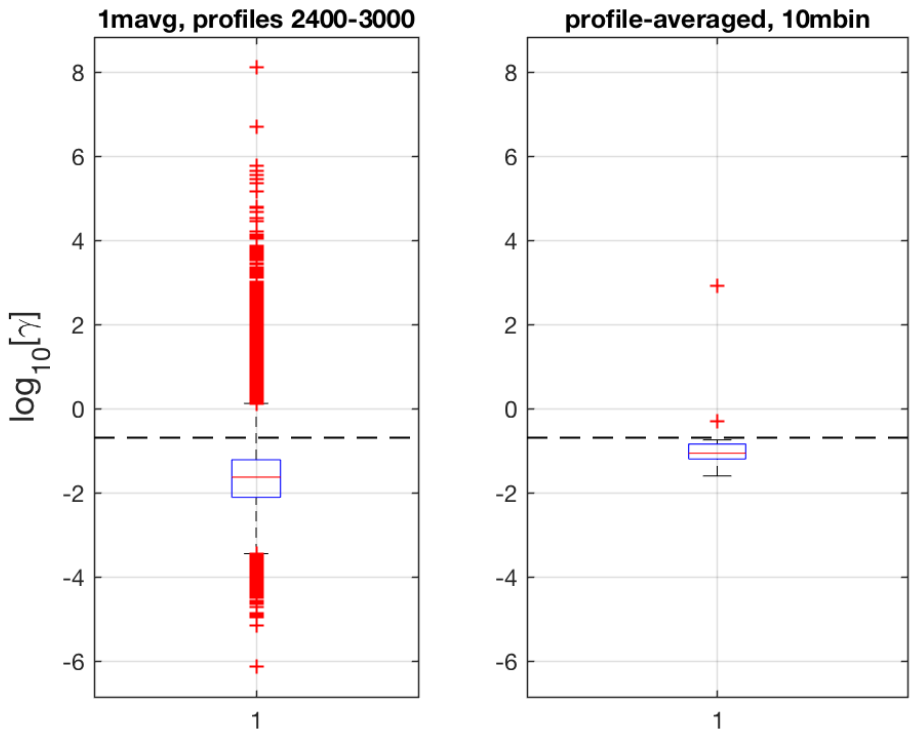

Figure 7: Boxplots of $log_{10}[\gamma]$ for a set of profiles from EQ14. Left is for all 1m avg data. Right is for data from all profiles averaged in 10m bins. Horizontal dashed line indicates $\gamma = 0.2$.

5 How many profiles need to be averaged to converge?

Next I wanted to see how many profiles we need to average for the χpod profile to converge to the chameleon profile. Obviously this will depend on the specific profiles used and the characteristics of the turbulence, but here they seem to converge after about 100-150 profiles.

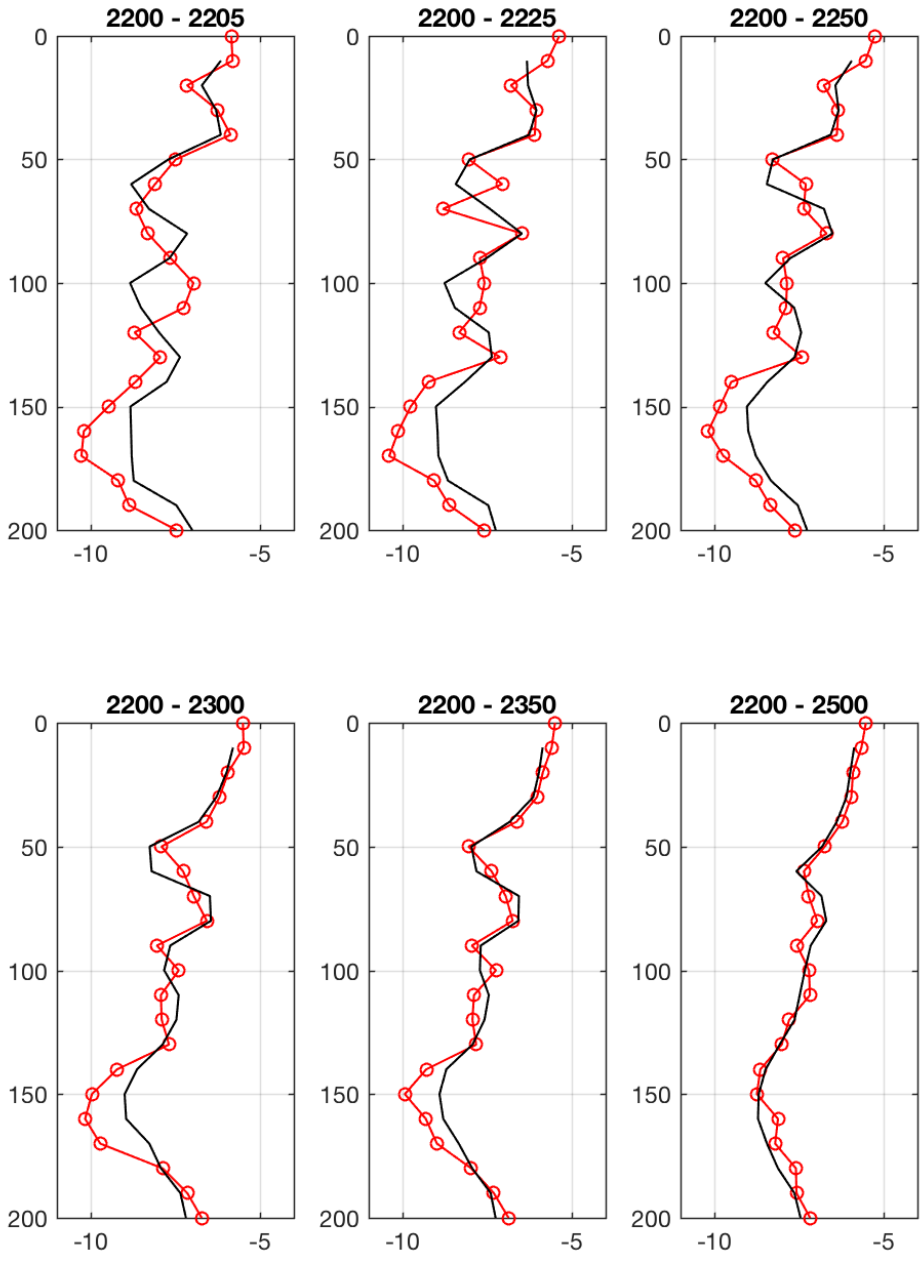

Figure 8: EQ14: Average profiles of ϵ from binned χpod method and chameleon, for different number of profiles (given by title).

6 Normalized eps vs chi plots

Assuming that

$$\gamma = \frac{N^2 \chi}{2\epsilon < T_z >^2} \tag{1}$$

, plotting $[\epsilon/N\hat{2}]$ vs $[\chi/t_z^2]$ should follow a straight line with slope equal to $1/2\gamma$.

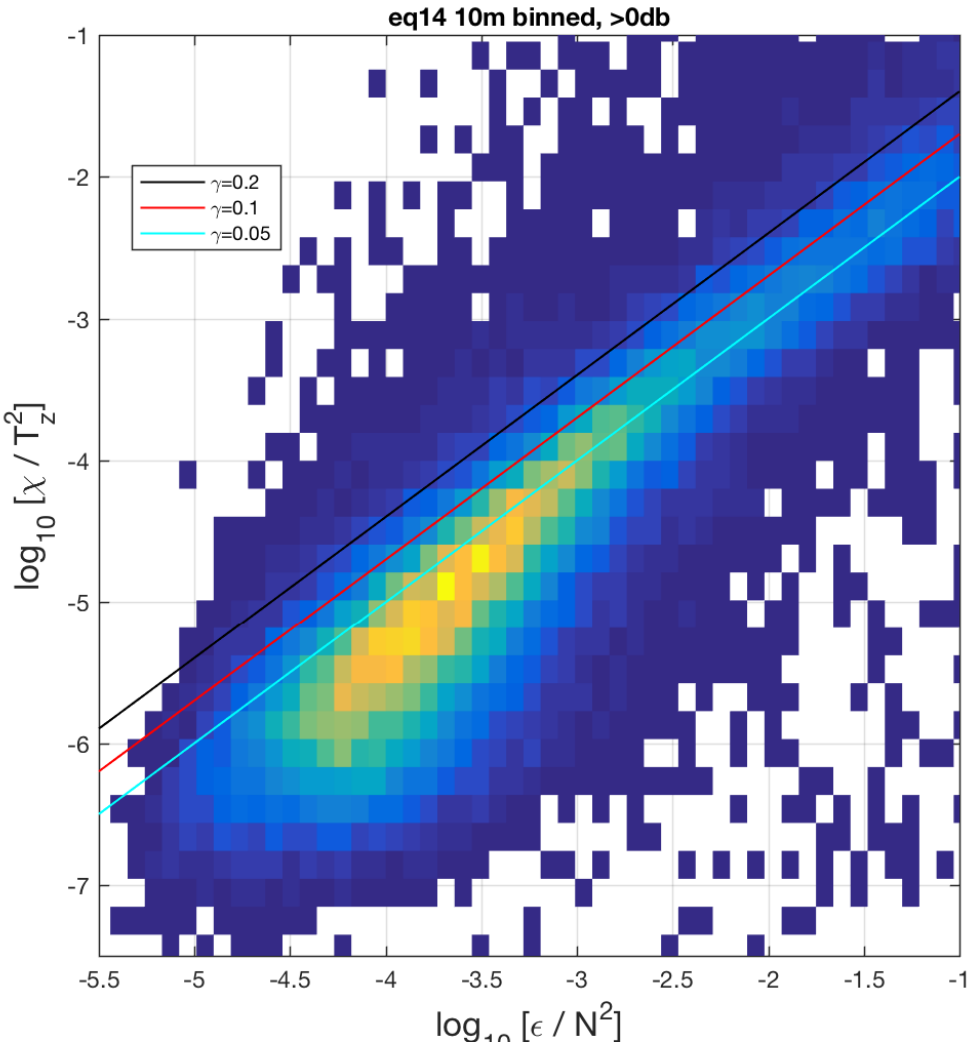

Figure 9: EQ14: 10m binned chameleon $\epsilon/N\hat{2}$ vs χ/t_z^2 for *ALL depths*. Lines show different values of γ. Values of ϵ below noise floor ($log_{10}\epsilon < -8.5$) are discarded also.

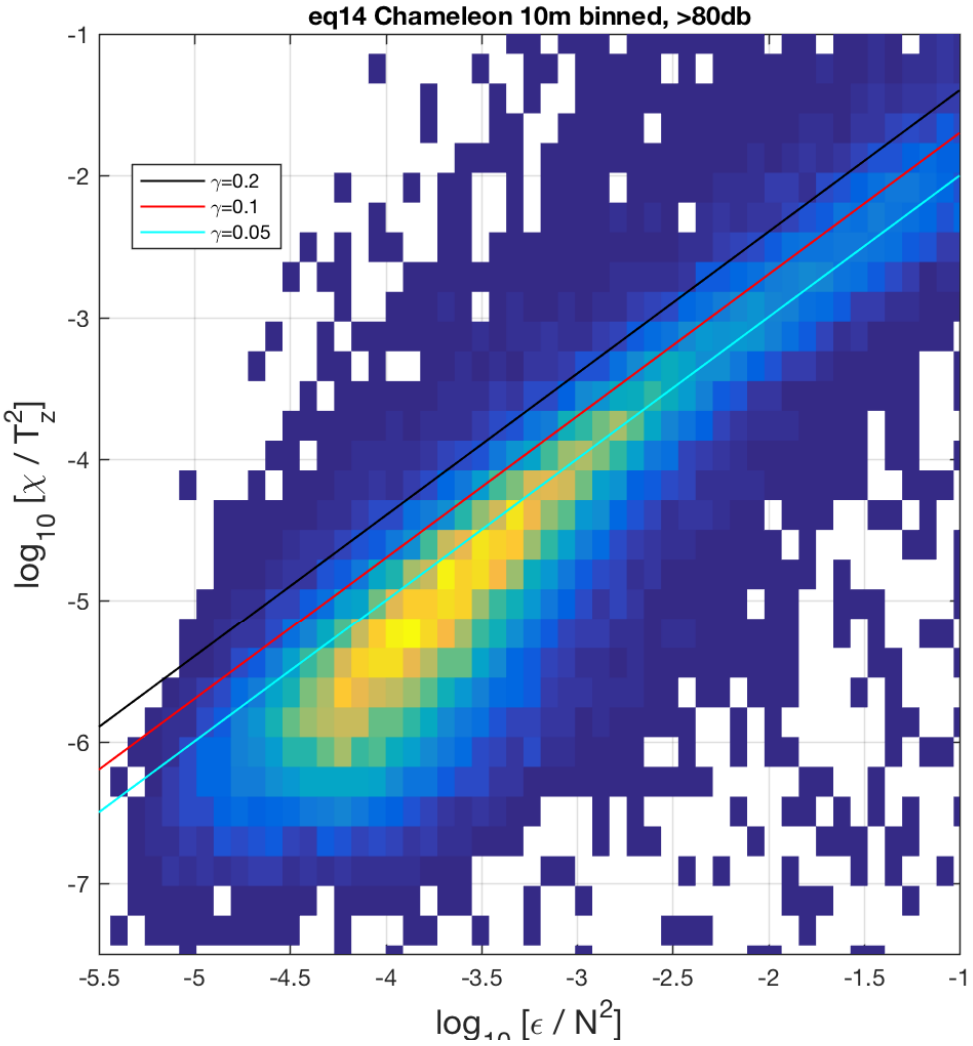

Figure 10: EQ14: 10m binned chameleon $\epsilon/N\hat{2}$ vs χ/t_z^2 for *below 80db*. Lines show different values of γ. Values of ϵ below noise floor ($log_{10}\epsilon < -8.5$) are discarded also.

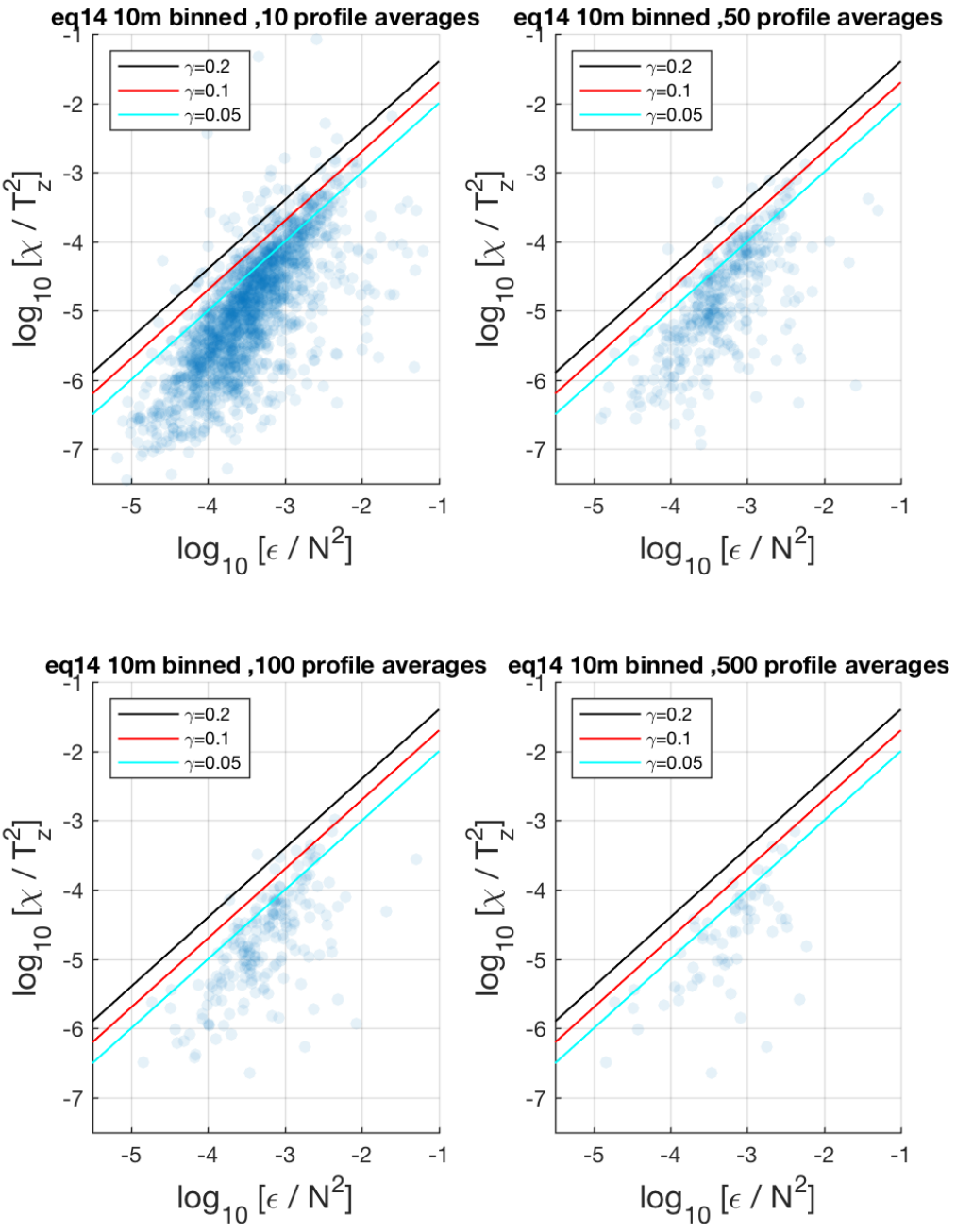

Figure 11: EQ14: 10m binned chameleon $\epsilon/N\hat{2}$ vs χ/t_z^2, averaged over varying number of profiles. Lines show different values of γ. Data shallower than 80db have been discarded to avoid mixed layer where night-time convection occurs.

7 Summary

- Inidivudal (and 10m binned) χpod estimates of ϵ are biased low compared to Chameleon values.
- When many profiles are averaged in 10m bins, the average profiles of ϵ agree better.
- γ computed from averaged (across profiles) N^2, T_z, χ, and ϵ is larger, but not quite 0.2 (mean is around 0.1?)
- Average profiles seem to converge after about 100 profiles?