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Interactive comment on "Scale-dependent analysis of in situ observations in the mesoscale to submesoscale range around New Caledonia" *by* Guillaume Sérazin et al.

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Thanks for your review and the two additional papers on the structure functions you suggested. The two study you mentioned mainly use drifter data as in Balwada et al. (2016), and are therefore able to estimate third order structure functions. We found that we were lacking a sufficient number of observations from ADCPs to estimate higher order statistics.

Here is a response to your question: "Submesoscale flows exist because they are not overrun by mesoscale flows, which are far stronger. So, how come the authors emphasize weak submesoscale motions in a region presumably dominated by mesoscale and

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other very strong flows (IGWs andwakes)? Or submesoscale band is simply a generic name for many other phenomena that map into that range somehow?"

The definition of submesoscale flows in terms of fluid dynamics is: flows with a Rossby number Ro close to the Froude number Fr (i.e. a burger number Bu close to 1). In other words, both stratification and rotation are important in the dynamics of submesoscale motions. In the ocean those conditions are generally met for horizontal spatial scales of 100 m to 10 km, and vertical scales of 10 m to 10 km. Yet, this depends on the regions because the Coriolis force is latitudinally dependent and the stratification is regionally dependent, but the scientific community usually refer to scales smaller than 10 km as being in the subsmesoscale band. Because of the flow is turbulent, there is a continuum between mesoscale and submesoscale motions and energy is transferred between scales in a continuous manner. The result is a continuous spectrum with energy dropping as scales get smaller. Thus, I will not say that submesoscale are overrun by mesoscale flows because they are a continuation of mesoscale eddies and the energy pathway to smaller scales.

Mesoscale eddies are a potential source of submesoscale structures as they are associated with strong density fronts storing available potential energy, from which instabilities (mixed layer instability, frontogenesis and turbulent thermal wind) feed submesoscale motions. When mesoscale eddies are weak, it is still possible to have submesoscale vortices generated by sharp but well elongated density fronts through the same types of instabilities as shown in D'Asaro et al., 2018. In this case, it is easy to isolate submesoscale structures as they are not dependent of transient features like mesoscale eddies.

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