Interactive comment on “Phase-dependent dynamics of breather collisions in the compact Zakharov equation for envelope” by Dmitry Kachulin and Andrey Gelash

Anonymous Referee #1

Received and published: 30 March 2018

Dear authors

I would like to see a discussion in your introduction about the compact Zakharov equation, with and without the P+ operator along the lines of my previous reply to you. I think it is important as it clarify the range of applicability of the two equations, with or without the P+ operator. Not only narrow-band spectra, but also large peak wavenumber $k_0 \gg 1$. Note that in Fedele (JFM, 2014) the projection operator P+ is discussed after Eq. 2.5 of that paper. The assumption of narrow-band envelope and/or large peak wavenumber $k_0$ allows neglecting $P+$. Thus, the peakons found by Fedele and Dutykh (JFM, 2012) are asymptotically correct for asymptotically large peak wavenumber $k_0 \gg 1$. 
suggest-ing a local structure (at small scales) of a breaking wave of the compact Zakharov equation. Furthermore, irrespective of the P+ operator, the compact Zakharov equation manifests superharmonic instability above the critical steepness $\mu_c=0.577$ (also proven for the full Zakharov equation with no restrictions on wavenumbers, see paper by Crawford et al. 1981). Thus, such instability is unaffected by P+ and it indicates a trend to breaking at high wavenumbers. Note that both NLS and Dysthe do not manifest superharmonic instability. Thus, the compact Zakharov equation, with or without the P+ operator (Fedele & Dutykh 2012), goes beyond the NLS and Dysthe models as it has a built-in breaking-type mechanism at high wavenumbers. It may well be that the presence of the P+ operator may delay breaking to larger steepnesses (?!??). Clearly, the P+ operator acts as a dissipation mechanism at low wavenumbers, and that's why peakons are not observed or one has to go to larger steepnesses/wavenumbers to see them. The two versions of the compact Zakharov equation, with or without the P+ operator, are both important for understanding wave breaking and the local structure of a breaker at high wavenumbers.

Said that, the revised manuscript is acceptable for publication.

References
