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Nonlinear Processes in Geophysics
Discussions
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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

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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 narrowband spectra, but also large peak wavenumber k0»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 k0 allows neglecting P+. Thus, the peakons found by Fedele and Dutykh (JFM, 2012) are asymptotically correct for asymptotically large peak wavenumber k0Âz ÌĞ1,

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Discussion paper

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 super harmonic instability. Thus, the compact Zakharov equation, with our 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 steep- nesses/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

CRAWFORD, D. R., LAKE, B. M., SAFFMAN, P. G. & YUEN, H. C. 1981 Stability of weakly nonlinear deep-water waves in two and three dimensions. J. Fluid Mech. 105, 177–191.

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