Dear Rodrigo,

thanks for your constructive comments.

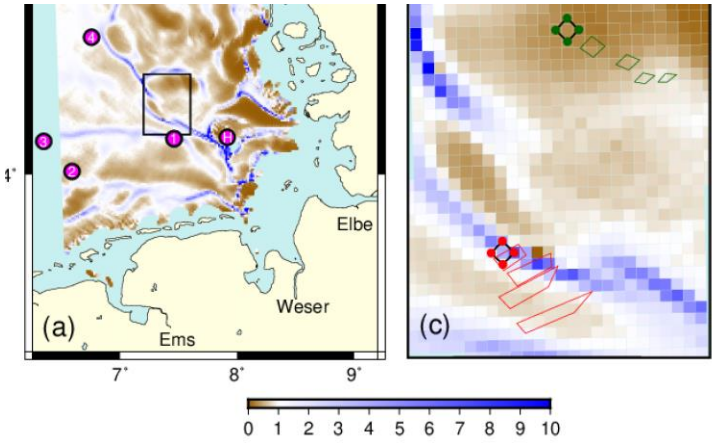
Using “attraction” instead of “convergence” actually seems to be a good option to avoid confusion.

The relationship between FTLE and FDLD turns out to be very stable, it occurrs for all examples. You are right, that must be stated more clearly.

And yes, the along-path divergences were calculated based on the same trajectories that were also used for LCS specification.

The revised manuscript will better address the relationship between confluence and convergence. Stretching plays an important role indeed, although its clear quantitative evaluation against convergence seems difficult. An evaluation could compare dilation and stretch, following the concept of Huntley et al. (2015). Nevertheless, the proper interpretation of such results based on the Jacobian’s singular values is not always simple.

The figure below shows Jacobian determinant values for the example of 26 March 2018 (Fig. 2a in the original manuscript). Values of the Jacobian were specified for a 100 h backward integration period. The right panel zooms in on the black frame in the left panel. For two example locations it illustrates the time evolution of the four surrounding trajectories needed to calculate the discretized Jacobian at the median point of their initial locations (red or green dots). Contours of the emerging deformed quadrangles are shown every 25 hours. In agreement with the value of the determinant, the area of the initial square increases in the one case (final value of the determinant is 3.7) and decreases in the other (final value: 0.31). Stretching, however, defined as the ratio of the larger and the smaller singular value is substantial in both cases (5.5 and 2.4, respectively). As this ratio can never be smaller than one, some stretching will always be analyzed.



Nevertheless, you are right that attraction in part originates from confluence. The fact that both confluence and convergence contribute to the FTLE field could be substantiated considering the correlation between either dilation or stretch rate and the FTLE. Here, both correlations were found to be comparable in size. An interesting aspect is, however, that while correlation between FTLE and dilation rate tends to

increase with longer integration time, correlations between FTLE and stretch rate seem to decrease. For the integration period of 250 hours, used in the paper, linear correlation of FTLE with dilation rate tends to be larger than correlation with stretch rate. This will be substantiated for examples already discussed.

To strictly exclude any potential problems with the limited vertical resolution of the archived hydrodynamic currents, I decided to skip all trajectories that encounter a water depth below 5 m (instead of 0 m at the coast line) at any time during their journey. As a result, the study now clearly focusses on open sea conditions.

Could the FDLD be a localized consequence of confluence? This might be the case, but an in depth analysis of this 3D effect would need going back to the original hydrodynamic model instead of using coarsened model output available from the BSH archive. It is also to be emphasized that bathymetric effects are important for the effects observed in the German Bight coastal area.

A general evaluation of how well FTLE and FDLD ridges do intersect in space and time seems difficult due to the weather dependent occurrence of very different situations (see the video in the supplement) with ridges being either smooth or sharp. Examples show, however, that correlation between FTLE and FDLD (or dilation rate) seem to increase for those examples with particularly sharp FTLE ridges.

Thanks again for your very helpful comments!

Best regards,
Ulrich