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Superclusters from velocity divergence fields

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Galaxy superclusters are starting to be routinely detected in observational data of the large scale structure of the Universe.
Diverse definitions and algorithms have been presented in the literature with the expectation to build a compelling framework to study superclusters.
In this work we present the strengths of defining superclusters as watershed basins in the divergence velocity field.
We apply this definition on diverse datasets generated from linear theory and N-body simulations, with different grid sizes, smoothing scales and types of tracers.
From this framework emerges a linear scaling relation between the average supercluster size and the autocorrelation length in the divergence field, a result that holds for one order of magnitude from 10 Mpc h^{-1} up to 100 Mpc h^{-1}.
Our results suggest that the divergence-based definition provides a robust context to quantitatively compare results across different observational or computational frameworks.
It can also facilitate the exploration of how supercluster properties depend on cosmological parameters to quantify the possibility of using superclusters as cosmological probes.

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