EGU22-770
https://doi.org/10.5194/egusphere-egu22-770
EGU General Assembly 2022

Diagnosing the thickness-weighted averaged eddy-mean flow interaction from an eddying North Atlantic ensemble

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The analysis of eddy-mean flow interaction provides key insights into the structures and dynamics of inhomogeneous and anisotropic flows such as atmospheric and oceanic jets. As the divergence of Eliassen-Palm (E-P) flux formally encapsulates the interaction, the community has had a long-standing interest in accurately diagnosing this term. Here, we revisit the E-P flux divergence with an emphasis on the Gulf Stream, using a 48-member, eddy-rich (1/12°) ensemble of the North Atlantic ocean partially coupled to identical atmospheric states amongst all members via an atmospheric boundary layer model. This dataset allows for an unique decomposition where we define the mean flow as the ensemble mean, and interpret it as the oceanic response to the atmospheric state. The eddies are subsequently defined as fluctuations about the ensemble mean. Our results highlight two points: i) the implementation of the Thickness-Weighted Averaged (TWA) framework for a realistic ocean simulation in diagnosing the E-P flux divergence, and ii) validity of the ergodic assumption where one treats the temporal mean equivalent to the ensemble mean, which is questionable for a temporally varying system such as the ocean and climate.