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Investigation of large fluctuations of scalar dissipation related to coherent vortices and flow topology BERTRAND ROLLIN, YVES DUBIEF, The University of Vermont — For Schmidt numbers greater than one, turbulent mixing of passive scalars produces large fluctuations of scalar dissipation contained in thin and elongated volumes. Recent research has shown that those sheet-like structures form in biaxial extensional flows. The first objective of this study is to relate this particular topology of turbulent flows to coherent vortices. Next, the dynamics of the regions of strong scalar dissipation is investigated as a function of the surrounding vortices and biaxial extensional flows. The study is based on direct numerical simulation of a turbulent Kolmogorov flow at low Reynolds number, with the adequate resolution for Schmidt number larger than unity. The local topology of the flow is characterized by the invariants and eigenvalues of the velocity gradient tensors. We use algorithms of vortex skeleton identification to examine the spatio-temporal correlation between the topology of the regions of strong scalar gradients and the neighboring vortices.

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