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Time-resolved evolution of the wall-bounded vorticity cascade[1]
ADRIÁN LOZANO-DURÁN, U. Politécnica Madrid, JAVIER JIMÉNEZ, UPM and CTR Stanford — We study the temporal evolution of vortex clusters in turbulent channels with $Re_\tau = 950$ and 1880, using DNS sequences with temporal separations among fields short enough for individual structures to be tracked. From the geometric intersection of structures in consecutive fields, we build temporal connection graphs of all the cluster interactions, and, from their properties, distinguish the "trunk" of each evolution from less important "branches." It is found that the lifetimes of the connected families of attached clusters are proportional to the cube roots of their maximum volumes, of the order of $Tu_\tau/h = 0.25$ for the largest ones, and that they move approximately with the overall advection velocity. Especial attention is paid to the origin of the attached structures, and to their relation with an inverse cascade. They tend to be born below $y^+ = 100$, and to grow upward, although a similar study of the Reynolds stresses suggests interactions in both directions. Merging of comparable clusters is common, but splitting tends to involve smaller fragments. The creation and evolution of new clusters during the bursting events of the logarithmic layer are also studied.

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