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On a self-sustaining process at large scale in the turbulent channel flow YONGYUN HWANG, Laboratoire d'hydrodynamique, Ecole polytechnique, France, CARLO COSSU, Institut de Mecanique des Fluides de Toulouse (IMFT), France — The near-wall region of wall-bounded turbulent flows has been understood as the place where an independent self-sustaining cycle exists, and the associated coherent motions in this region have been rigorously described with traveling waves and/or unstable periodic orbits in the phase space. On the other hand, in the outer region, turbulent motions have often been thought to be produced from the active near-wall cycles via so called the 'bottom-up' process. However, recent investigations revealed that outer layer motions can experience significant non-normal amplifications. These findings suggest that self-sustaining processes could also exist at large scale. In this study, we consider a fully-developed turbulent channel at $Re_\tau \approx 550$. We show that large-scale and very-large-scale motions in the outer region can sustain even when smaller-scale structures in the near-wall and the logarithmic regions are artificially quenched. The self-sustaining process is active only at the lengths scales larger than $L_x \times L_z \approx 3h \times 1.5h$, in good accordance with the most energetic length scales observed in the outer region.

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