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Time-evolving of very large-scale motions in a turbulent channel flow[1] JINYUL HWANG, JIN LEE, HYUNG JIN SUNG, KAIST, TAMER A. ZAKI, Johns Hopkins University — Direct numerical simulation (DNS) data of a turbulent channel flow at $Re_\tau = 930$ was scrutinized to investigate the formation of very large-scale motions (VLSMs) by merging of two large-scale motions (LSMs), aligned in the streamwise direction. We mainly focused on the supportive motions by the near-wall streaks during the merging of the outer LSMs. From visualization of the instantaneous flow fields, several low-speed streaks in the near-wall region were collected in the spanwise direction, when LSMs were concatenated in the outer region. The magnitude of the streamwise velocity fluctuations in the streaks was intensified during the spanwise merging of the near-wall streaks. Conditionally-averaged velocity fields around the merging of the outer LSMs showed that the intensified near-wall motions were induced by the outer LSMs and extended over the near-wall regions. The intense near-wall motions influence the formation of the outer low-speed regions as well as the reduction of the convection velocity of the downstream LSMs. The interaction between the near-wall and the outer motions is the essential origin of the different convection velocities of the upstream and downstream LSMs for the formation process of VLSMs by merging.

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