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Mean Dynamics of Channel Flow Transition JOE KLEWICKI, University of New Hampshire, JOHN ELSNAB, University of Utah, DAN MAYNES, Brigham Young University, TIM AMEEL, University of Utah — The redistribution of mean momentum and vorticity are explored for laminar-to-turbulent transition in fully developed channel flow. A central aim is to better understand how the mean dynamical mechanisms representative of the fully turbulent regime are first established. Specifically, the mean dynamics of channel flow transition evolve from a simple balance of two differential forces at every point to a balance involving three terms that forms into a complex four layer structure. Primary considerations stem from the emergence of the effects of turbulent inertia as reflected by the appearance of the Reynolds stress gradient in the mean dynamical equation. The experimental and DNS results presented support a scenario in which the initial instabilities lead to a Reynolds stress distribution that is generally localized in space, and that subsequently spreads both inward and outward from the peak value. A characteristic feature of this distribution is the juxtaposition of positive and negative Reynolds stress gradients – a dynamical feature that persists for all higher Reynolds numbers. Connections are drawn between the mechanisms initiated during transition and those responsible for mean profile behaviors at much high Reynolds numbers.

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