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Large-scale motions in a plane wall jet EBENEZER GNANAMANICKAM, LATIM JONATHAN, BHATT SHIBANI, Embry-Riddle Aeronautical University — The dynamic significance of large-scale motions in turbulent boundary layers have been the focus of several recent studies, primarily focussing on canonical flows - zero pressure gradient boundary layers, flows within pipes and channels. This work presents an investigation into the large-scale motions in a boundary layer that is used as the prototypical flow field for flows with large-scale mixing and reactions, the plane wall jet. An experimental investigation is carried out in a plane wall jet facility designed to operate at friction Reynolds numbers $Re_\tau > 1000$, which allows for the development of a significant logarithmic region. The streamwise turbulent intensity across the boundary layer is decomposed into small-scale (less than one integral length-scale δ) and large-scale components. The small-scale energy has a peak in the near-wall region associated with the near-wall turbulent cycle as in canonical boundary layers. However, eddies of large-scales are the dominating eddies having significantly higher energy, than the small-scales across almost the entire boundary layer even at the low to moderate Reynolds numbers under consideration. The large-scales also appear to amplitude and frequency modulate the smaller scales across the entire boundary layer.

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