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Spatial characterization of vortical structures and internal waves in stratified turbulent wake using POD P. DIAMESSIS, Cornell U., R. GURKA, Ben Gurion U., A. LIBERZON, Tel Aviv U. — Proper orthogonal decomposition (POD) is applied to 2-D slices of vorticity and horizontal divergence obtained from the 3-D DNS of the stratified turbulent wake of a towed sphere at Re=5x10^3 and Fr=4. Slices are sampled along the stream-depth (Oxz) and stream-span planes (Oxy) at 231 times during the interval $Nt \in [12, 35]$. POD was chosen amongst the available statistical tools due to its advantage in characterization of simulated and experimentally measured velocity gradient fields, as previously demonstrated for turbulent boundary layers. In the Oxz planes, at the wake centerline, the higher most energetic modes reveal a structure similar of the structure of late-time stratified wakes. Off-set from centerline, the signature of internal waves in the form of forward-inclined coherent beams extending into the ambient becomes evident. The angle of inclination becomes progressively vertical with increasing POD mode. Lower POD modes on the Oyz planes show a layered structure in the wake core with coherent beams radiating out into the ambient over a broad range of angles. Further insight is provided through the relative energy spectra distribution of the vorticity eigenmodes. POD analysis has provided a statistical description of the geometrical features previously observed in instantaneous flow fields of stratified turbulent wakes.

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