Tropospheric turbulence over the tropical open-ocean: Role of gravity waves

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A large set of soundings obtained in the Indian Ocean during 3 field campaigns is used to provide statistical characteristics of tropospheric turbulence and its link with gravity wave (GW) activity. The Thorpe method is used to diagnose turbulent regions of a few hundred meters depth. Above the mixed layer, turbulence frequency varies from ~10% in the lower troposphere up to ~30% around 12km heights. GW are captured by their signature in horizontal wind, normalized temperature and balloon vertical ascent rate. These parameters emphasize different parts of the wave spectrum from longer to shorter vertical wavelengths respectively. Composites are constructed in order to reveal the vertical structure of the waves and their link with turbulence. The relatively longer wavelength GW described by their signature in temperature (GWT) are more active in the lower troposphere where they are associated with clear variations in moisture. Turbulence is then associated with minimum static stability and vertical shear, stressing the importance of the former and the possibility of convective instability. Conversely, the short waves described by their signature in balloon ascent rate (GWw) are detected primarily in the upper troposphere and their turbulence is associated with a vertical shear maximum suggesting the importance of dynamic instability. Furthermore, GWw appear to be linked with local convection whereas GWT are more active in suppressed and dry phases in particular of the Madden-Julian Oscillation. These waves maybe associated with remote sources such as organized convection or local fronts such as those associated with dry air intrusions.

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