# Characteristics of small and medium scale gravity wave propagations at the mesosphere and Lower Thermosphere regions over Brazilian equatorial region

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The present work reports long-term seasonal variability of the small and medium-scale gravity waves in the upper mesosphere and lower thermosphere over the Brazilian equatorial region. Optical and radio wave measurements were made at Sao Joao do Cariri ($7.40^0$S, $36.50^0$W) to investigate the seasonal behavior of the gravity wave characteristics in the mesosphere and lower thermosphere (MLT). High-resolution images of the mesospheric OHNIR emissions were obtained during 11 consecutive years. In average, 13 nights of observations were made every month from September 2000 to November 2010. In total 573 keograms were created and analyzed for medium-scale gravity waves while almost 5047 images were also analyzed using cross spectrum to find the parameters of small scale gravity waves. The anisotropy of the propagation direction of the medium scale gravity waves was preferentially northeast while the small-scale gravity waves were uniformly spread out in all directions. The critical layer theory for gravity wave filtering was applied to study the effects of middle atmospheric winds on the propagation of gravity waves. Consequently, medium scale gravity waves were found to be less susceptible to wind filtering effects. Especially, in summer and these waves could be capable of propagating into the lower thermosphere where they can seed Rayleigh-Taylor Instability (RTI) development. Some waves with phase speed greater than background wind speed managed to escape the critical layer. .