Four-year observation of upper atmospheric waves over Korean peninsula with an all-sky airglow camera

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We have carried out all-sky imaging of OH Meinel, O_2 atmospheric and OI 557.7 nm airglow layers in the period of July, 2001 through September 2005 at Mt. Bohyun, Korea (36.2˚N, 128.9˚ E, Alt =1124 m). We analyze images observed during total 153 clear moonless nights and find 97 events of band type waves. The band type waves were detected 28%, 16%, and 13% of total 645 moonless clear night hours with the OI, O_2, and OH filters, respectively. The band type waves were recognized at a level of 8% or more variation from background intensity when the cloud coverage was less than 30% of the overhead sky within 50˚ from the zenith. The characteristics of observed band type waves (wavelengths, periods, and shapes) are consistent with internal gravity waves, as other studies noted. It is interesting to note that the band type waves were detected more frequently with the airglow filter that samples the airglow layer at higher altitudes. Propagation of band type waves was predominantly westward during fall and winter, while only weak tendency in northeastward propagation seemed to exist during spring and summer. Mean wind fields in the intervening altitudes during fall and winter are eastward, supporting the idea that the eastward waves may have been filtered out and could not be seen at the mosopause altitudes. Source regions of the observed waves were sought by utilizing a ray tracing program with inputs of observed wave parameters and climatology wind fields. Less than one fifth the observed waves were traced back to tropospheric altitudes, while the rest of the waves seem to be generated from mesospheric altitudes. The ray tracing results are, however, uncertain due to lack of wind field information during the all-sky imaging observation.