E117-006 **Room: 201B** **Time: May 18 15:00-15:15**

Concentric gravity waves and instabilities in the mesosphere lower thermosphere with all-sky imagers over US and Japan

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Kyoto University (KU) all-sky imager at OH Meinel NIR bands has been deployed at Yucca Ridge Field Station (YRFS), Fort Collins (41N, 105W), Colorado, US since 2003. The collaborations between institutes in Colorado (CSU, CoRA and NCAR) and RISH, KU on the study of the imager data has resulted in fruitful achievements.

Concentric gravity waves are generated when convectively updraft overshoots the tropopause. However, expanding concentric rings of gravity waves in the mesopause region have been rarely observed in the airglow imagers. Strong wind in the middle atmosphere can filter out some of the gravity waves, removing portions of the excited concentric rings. Because this type of gravity waves is generated by the deep convections in the troposphere, it has fundamental impact on the dynamic coupling between lower and upper atmosphere and on the general circulations. To our knowledge, the number of the reported concentric gravity waves so far is single digit. However, from 2003 to 2008, the KU OH imager at YRFS observed 10 nights of concentric gravity waves with various shapes and scales. This greatly expanded the data base for the concentric gravity waves, enabling the first ever statistical study. Since all 9 out of 10 events of concentric patterns among ~760 nights of image were observed in May or late August/early September when the mean wind is changing directions, we hypothesize that the weak mean wind near equinoxes is a necessary condition for gravity waves excited from convective overshoots near the tropopause to be observed as concentric rings in the OH layer at 87 km. 7 of 10 nights has radiosonde measurements from the ground up to z=30-35 km. This data showed that the wind speeds from the tropopause to ~30-35 km were smaller than ~20-30 m/s. The typical phase velocity of the waves is greater than 50 m/s. Therefore, gravity waves were not blocked by the winds at those nights and we could observe them using the imager. Also because the deep convections are unavailable in the winter in the Midwestern US, no concentric gravity waves are generated in winter.

The event on 11 May 2004 was selected for the case study because the ring pattern was observed for about 1.5 hours, with the rings encompassing nearly 360º for the first 30 minutes. The centers of the rings were observed at the two convective plumes. We measure the horizontal wavelengths and periods of these gravity waves as functions of both radius and observation time. The observations compare favorably with predictions using the internal gravity wave dispersion relation with assumed zero wind. The results of the ray trace model and a convective plume model by S. Vadas with the climatology wind and temperature fields in May agreed well with the observations.

Ripples with horizontal wavelengths less than 10-15 km in the airglow imager, are thought to be signatures of the local convective or dynamic instabilities. The instabilities in the mesopause region (80-100 km) are closely correlated to the vertical propagation of tidal waves and planetary waves. The ongoing project is to compare the climatology of the ripples observed at Colorado, US (41N, 105W) by the KU YRFS OH imager to the ripples observed at Misato observatory, Wakayama, Japan (34.1N, 135.4E) by the KU ASI multi-color imager as well as Optical Mesosphere Thermosphere Imagers (OMTI) by Nagoya University located at Shigaraki MU observatory (34.9N, 136.1E). These sites in the US and Japan are at the similar latitude but ~240 degree apart in longitude. The tides and planetary waves can possibly modulate the local stability longitudinally. As a result, it may make the Brunt-Vaisala frequency squared, N2, negative or Richardson number less than 0.25. This global coverage of convective stability measurement can be achieved by TIMED/SABER satellite temperature measurement. In the presentation, we will show some initial results of the local time variation of ripples and stabilities.