COMPARISON OF GRAVITY WAVE SIGNATURES IN THE E-REGION WIND INTERFEROMETER (ERWIN) AND PEARL ALL SKY IMAGER (PASI)

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Introduction
- Gravity waves are thought to be responsible for the large scale circulation pole to pole circulation in the mesosphere.
- Gravity waves are generated in the lower atmosphere, propagate upward increase in amplitude and perturb the airglow chemistry causing variations in irradiance.
- Airglow intensity variations caused by the passage of these waves are an important means to identify the character of these waves.

Motivation
- The earth’s mesosphere and lower thermosphere (MLT) is the least explored region of the earth’s atmosphere.
- The MLT is influenced by varying and large amplitude upward propagating waves and tides from the lower atmosphere.
- By examining these perturbations in irradiance and wind (using the PEARL All Sky imager and ERWIN observations) the character of the gravity waves can be determined.
- This poster describes the initial steps in accomplishing this comparison (i.e. ensuring that the time scales of the instruments involved are the same).
- Correlations between the irradiance and wind signatures for specific time periods when gravity waves are present will be explored to identify their characteristics.

Instruments
Schematics of All Sky Imager (ASI) optical train. Courtesy of KEO Scientific ltd

The PEARL All Sky Imager provides information on airglow and auroral emissions over the full sky above Eureka. The airglow emissions viewed include the oxygen, green and red lines, hydroxyl in the near-Infrared, the sodium doublet and the Nitrogen first negative group(0,1) band. These emissions are centered around average heights of 87, 90, and 96 respectively. The filter wheel has 8 positions, five of which are filled with narrowband (2nm) filters, one for each emission. OH filter has a 720-910nm band pass with a notch at 8654nm. Smaller scale periodic spatial temporal variations in the observed radiances are interpreted as signatures of buoyancy or gravity waves which occur naturally in the atmosphere. The imager also provides contextual information for other airglow instruments.

ERWIN is a wide angle Michelson interferometer designed to use airglow to determine winds and irradiance in the mesopause region (90). Winds are determined by spectrally isolating single emission lines and measuring their Doppler shifts along the line-of-sight. The light is gathered at these heights in the four cardinal directions from a 20km radius region at an elevation angle of 38 degrees.

Specific Airglow Emissions
- Green line ([GL]557.7 nm): $O(^1S \rightarrow ^1D)$
- Hydroxyl ([OH] vibrational transitions): $H + O_3 \rightarrow OH^* + O_2$
- $O + O + M \rightarrow O_2^* + M$
- $O + O_2^* \rightarrow O(^1S) + O_2$

Methods
- Time Series of Air Glow Intensity Emission for All Sky and ERWIN. Corresponding to the same region of viewing at the same time period has been analyzed.

Time Shift Adjusted for OH Airglow emission intensity plots

Time Shift Adjusted for GL Airglow emission intensity plots

Results
A time shift of 0.14Hrs (8.4mins) between the ERWIN and ASI has been identified.

Summary
Diagnosing this time shift between the ASI and ERWIN instruments is essential for the analysis of gravity wave features since errors in the relative timing of events will result in incorrect gravity wave features. Both instruments are versatile tools for detecting gravity wave signatures in the mesosphere. Further analysis will be undertaken to diagnose specific events in which gravity waves have been identified. The ASI will provide a view of the spatial context of these waves and the wind and irradiance information at several heights will allow the characteristics of these waves to be determined.

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