Preparation of Image Data from All Sky Camera for the Study of Gravity Waves in the Upper Atmosphere

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Abstract

The tip of the Antarctic Peninsula, where King Sejong Station (KSS) is located, is known for extremely strong gravity wave activity. Since 2008, Korea Polar Research Institute has been operating All Sky Camera at KSS to investigate the gravity wave activity in the mesosphere and thermosphere regions. ASC system with three different filters can capture the 2-D structures of gravity wave in the upper atmosphere. However, the data analysis requires pre-processing of the image data from the ASC system. In this study, we present the processes of data preparation of the image data for obtaining physical parameters of the gravity wave in the upper atmosphere.

Raw image data

ASC system of Korea Polar Research Institute uses three different filters (OH, OI-5577, and OI-6300) to capture the 2-D structures of the gravity waves in different altitudes.

Determination of the transformation matrix

To derive the horizontal parameters of the gravity waves appeared in raw images, it is essential to conduct coordinate transformations. To perform the transformations, we use a standard coordinate which is introduced at Garcia et al., 1997. The goal of the coordinate transformations is to achieve the distance coordinates from pixel coordinates in the raw images. The procedure of the coordinate transformations is like below.

1. Select stars and obtain their information
2. Check the lens function
3. Find transformation matrix
4. Draw a line parallel to propagating direction
5. Take intensity profiles from consecutive images on the same line
6. Calculate wave parameters
7. Present the processes of data preparation of ASC images for the study of gravity waves in MLT region.

Summary

- We presented the processes of data preparation of ASC images for the study of gravity waves in MLT region.
- Assuming that there’s linear relation between the elevation angle and the pixel distance from the zenith is a easy way and its error is small or negligible in middle and high elevation region, but it may lead to non-negligible error in low elevation region depending on the format of the lenses.
- Determination of the transformation matrix needs to be done only once. But whenever there are physical changes or adjustments in all sky camera system, it has to be done again.
- In determination of wave parameters, FFT or Lomb-Scargle Periodogram analysis can be used as well.

Reference