Geophysical Research Abstracts,
Vol. 11, EGU2009-6693, 2009
EGU General Assembly 2009

Evaluation of Clear-Air Turbulence Diagnostics: GTG in Korea

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Turbulence forecasting algorithm, the Graphical Turbulence Guidance (GTG) system developed at NCAR (Sharman et al., 2006), is evaluated with available turbulence observations (e.g. pilot reports; PIREPs) reported in South Korea during the recent 4 years (2003–2007). Clear-air turbulence (CAT) is extracted from PIREPs by using cloud-to-ground lightning flash data from Korean Meteorological Administration (KMA). The GTG system includes several steps. First, 45 turbulence indices are calculated in the East Asian region near Korean peninsula using the Regional Data Assimilation and Prediction System (RDAPS) analysis data with 30 km horizontal grid spacing provided by KMA. Second, 10 CAT indices that performed ten best forecasting score are selected. The scoring method is based on the probability of detection, which is calculated using PIREPs exclusively of moderate-or-greater intensity.

Various statistical examinations and sensitivity tests of the GTG system are performed by yearly and seasonally classified PIREPs in South Korea. Performance of GTG is more consistent and stable than that of any individual diagnostic in each year and season. In addition, current-year forecasting based on yearly PIREPs is better than adjacent-year forecasting and year-after-year forecasting. Seasonal forecasting is generally better than yearly forecasting, because selected CAT indices in each season represent meteorological condition much more properly than applying the selected CAT indices to all seasons. Wintertime forecasting is the best among the four seasonal forecastings. This is likely due to that the GTG system consists of many CAT indices related to jet stream, and turbulence associated with the jet can be most activated in wintertime under strong jet magnitude. On the other hand, summertime forecasting skill is much less than in wintertime. To acquire better performance for summertime forecasting, it is likely to develop more turbulence indices related to, for example, convections. By sensitivity test to the number of combined indices, it is found that yearly and seasonal GTG is the best when about 7 CAT indices are combined.