Graphical Turbulence Guidance

Part I - Mission Connection

Product Description

The enhanced (2006) version of the Graphical Turbulence Guidance (GTG) retains the information from the original GTG, fielded in 2003. The enhanced GTG extends the vertical domain of the GTG from 20-45 thousand feet to 10-45 thousand feet (above mean sea level). A composite containing the maximum vertical value of the 26 levels is also produced. The GTG is a suite of automatically-generated turbulence products that gives the location and intensity of clear-air turbulence over the 48 conterminous United States and adjacent coast waters. GTG was developed by the NCAR Turbulence Product Development Team, sponsored by the Federal Aviation Administration's Aviation Weather Research Program, and implemented by the National Weather Service Aviation Weather Center as a supplement to turbulence AIRMETs and SIGMETs.

Purpose

The GTG was developed to meet an outstanding need for improved turbulence forecasts. It was designed to produce high resolution turbulence analyses and forecasts in space and time. The GRIB format allows users to examine a vertical profile at each grid point between 10 and 45 thousand feet or visualize the turbulence at one or more constant pressure levels. The horizontal grid points are 20 km apart.

Schedule

The enhanced GTG output contains:

1. an analysis (0-hour), and 1, 2, and 3-hour forecasts every hour for each vertical level between 10 and 45 thousand feet

2. a 6, 9, and 12-hour forecast every three hours for each vertical level between 10 and 45 thousand feet

3. a composite containing the maximum vertical value for each grid point for all 26 levels for each analysis and forecast

Audience

The GTG has been approved for limited operational use by the Aviation Weather Steering Group composed of members from the Federal Aviation Administration and the National Weather Service. The GTG has been authorized for use by operational meteorologists and trained dispatchers and is not as a substitute for the turbulence information contained in AIRMETs and SIGMETs.

Web Interface

The GTG output can be visualized at the following URLs. These sites allow users to see turbulence output at intervals of 3 thousand feet between 12 and 42 thousand feet, as well at the composite (maximum) value of all 26 levels.

The experimental version of the enhanced GTG product is available at http://weather.aero/turbulence.

The operational version will be available at http://adds.aviationweather.gov/turbulence after January 8, 2007.

Feedback Method

The National Weather Service is always seeking to improve product quality by continuously soliciting user feedback. Comments regarding the GTG may be sent though the "Feedback" link located in lower portion of the left-hand column of the operational GTG webpage at http://adds.aviationweather.gov/turbulence.

You may also send comments to:

National Weather Service
Attn: Clinton Wallace, Aviation Support Branch Chief
Aviation Weather Center
Phone: (816) 584-7248
Email: Clinton.Wallace@noaa.gov

Part II - Technical Description

The GTG turbulence analyses and forecasts have been extended down to 10 thousand feet above mean sea level (FL100) from 20 thousand feet (FL200). This means that turbulence predictions are now available at both upper levels (≥FL200) and mid-levels (FL100-FL200). Within the GTG algorithm, the mid-level and upper-level forecasts are computed separately and merged at the FL200 boundary. In order to smooth discontinuities that may occur at the FL200 boundary, a mean filter is applied to vertical columns of data between the FL190 and the FL210 data. New turbulence diagnostics have also been added to the original GTG as a result of continued turbulence diagnostic research.

The GTG now uses a combination of 10 turbulence diagnostics for both the upper and mid-levels. The suite of diagnostics chosen depends on the overall performance of each diagnostic as well as the efforts to ensure that each diagnostic is correlated with a unique set of atmospheric processes that may be contributing to turbulence, i.e., the diagnostics are uncorrelated with one another.

The method for combining a given set of turbulence diagnostics to derive the turbulence forecasts has remained unchanged from that used in the original GTG. A dynamic weighting

strategy is used to compute the individual diagnostics in the analysis (0-hr forecast) and at all forecast times (1, 2, 3, 6, 9 and12-hour). At the analysis time selected turbulence diagnostics are compared to available pilot reports (PIREPs), scored and ranked in descending order of performance.

During the weighting and merging process, both PIREPs and *in situ* eddy dissipation rate (edr) data from commercial aircraft are used to evaluate the performance of the individual diagnostics. *In situ* edr measurements have been recorded and downlinked on United Airlines (UAL) 737-200s and 757-300s for several years, but it is only recently that the quality control (QC) processes have been implemented sufficiently to allow use of this data within the GTG. The benefits of using the *in situ* edr measurements in GTG are obvious: (1) they are more precise in position, time, and intensity, and (2) there are many more reports than PIREPs (about 1000/hour during regular flight times). In principle there is no altitude restriction within GTG for the use of *in situ* edr data. However, the *in situ* edr QC process seems to be reliable only during aircraft cruise conditions; during climbs and descents there still seems to be spurious data. Therefore, at this time the *in situ* edr data is only used within GTG at upper levels (>FL200).