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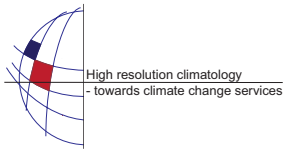

Automated turbulence forecasts for aviation hazards

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An operational turbulence forecast system for commercial and aviation use is described that is based on an ensemble of turbulence diagnostics derived from standard NWP model outputs. In the U. S. this forecast product is named GTG (Graphical Turbulence Guidance) and has been described in detail in Sharman et al., WAF 2006. Since turbulence has many sources in the atmosphere, the ensemble approach of combining diagnostics has been shown to provide greater statistical accuracy than the use of a single diagnostic, or of a subgrid tke parameterization. GTG is sponsored by the FAA, and has undergone rigorous accuracy, safety, and usability evaluations. The GTG product is now hosted on NOAA's Aviation Data Service (ADDS), web site (http://aviationweather.gov/), for access by pilots, air traffic controllers, and dispatchers.

During this talk the various turbulence diagnostics, their statistical properties, and their relative performance (based on comparisons to observations) will be presented. Importantly, the model output is $\varepsilon 1/3$ (where ε is the eddy dissipation rate), so is aircraft independent. The diagnostics are individually and collectively calibrated so that their PDFs satisfy the expected log normal distribution of $\hat{\varepsilon} 1/3$. Some of the diagnostics try to take into account the role of gravity waves and inertia-gravity waves in the turbulence generation process.

Although the current GTG product is based on the RUC forecast model running over the CONUS, it is transitioning to a WRF based product, and in fact WRF-based versions are currently running operationally over Taiwan and has also been implemented for use by the French Navy in climatological studies. Yet another version has been developed which uses GFS model output to provide global turbulence forecasts. Thus the forecast product is available as a postprocessing program for WRF or other model output and provides 3D maps of turbulence likelihood of any region where NWP model data is available. Although the current GTG has been used mainly for large commercial aircraft, since the output is aircraft independent it could readily be scaled to smaller aircraft such as UAVs. Further, the ensemble technique allows the diagnostics to be used to form probabilistic forecasts, in a manner similar to ensemble NWP forecasts.