NORTHWEST AIRLINES FLIGHT EXPERIMENTS

Arlin J. Krueger
NASA/Goddard Space Flight Center

The first ozone maps from TOMS data showed spatial structures which closely resembled patterns in upper air charts. This suggested that the high resolution ozone data might serve as a proxy for these charts. However, lacking detailed, coincident temperature and wind data the association could not be demonstrated.

In March, April, and May 1981 an experiment was conducted in which realtime TOMS data was provided to the meteorological operations office of Northwest Airlines for direct comparison with their upper air charts. It was demonstrated that the regions of steep gradient in total ozone corresponded with fronts in the upper troposphere, specifically breaks in the tropopause associated with jet streams. Other small scale structure in the ozone could be related to minor trough and ridge lines. This suggested that the relation between total ozone and tropopause height might apply even on relatively small scales, and an analysis produced high correlation coefficients provided that the air mass origin was considered.

A second objective was to test the use of total ozone data for location of high cabin ozone risk areas. This was based on the hypothesis that an aircraft flying at a constant pressure level can pass from low, tropospheric ozone concentrations in a ridge (low total ozone) to high, stratospheric ozone concentrations in a trough (high total ozone). The FAA provided an instrument to monitor cabin ozone during several routine flights. The cabin ozone mixing ratio at 37,000 ft altitude was found to vary from less than 100 ppb in a ridge (300 DU total ozone) to greater than 300 ppb in a trough (400 DU total ozone).

A third analysis showed that clear air turbulence was located where upper air fronts were in rapid motion as suggested by comparison of the 1200 UT synoptic charts and the ozone map taken about 6 hours later.