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Measurements of humidity, turbulence and ice crystals in cirrus clouds

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Results are presented from the EMERALD airborne cirrus measurement campaign. This was conducted above South Australia in September 2001 and involved two aircraft with laser remote sensing and in situ measurements. The Egrett aircraft carried instruments for measurements of humidity, ice crystals, turbulence/waves, radiation, and ozone. The King Air aircraft carried a lidar that was used to map the structure of the clouds and to guide the flight path of the Egrett. Results are presented showing the interaction of humidity, ice crystals, and dynamics within the cirrus clouds. It was found that intense turbulence was associated with latent heating/cooling where the crystals were forming at cloud top and where the crystals were sublimating at cloud base. In the crystal formation region the greatest crystal concentrations were associated with the most intense turbulence and the most confined distribution of relative humidity.