UK FAAM BAE-146 research flights during T-REX

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Introduction

• The Terrain Induced Rotor Experiment (T-REX)
special observing period took place during spring 2006.
• The UK FAAM BAE-146 research aircraft participated in T-REX for a 4 week period (13 March to 11 April 2006).
• The aircraft was based in Fresno, to the west of the Sierra Nevada and Owens Valley.
• A wide range of scientific flights were conducted. Amongst these were:
  – rotor/mountain-wave flights (IOPs 6, 8, 9, 10)
  – cold pool flights (EOPs 1 & 2)
  – dust and chemistry flights
• Preliminary results from such flights are presented here.

Mountain-wave measurements

• A large amplitude trapped lee wave was observed during IOP-6 on 25-26 March 2006.
• The wave event was accompanied by strong downslope winds and rotor motion within the Owens Valley.
• Measured vertical velocities exceeded 6 m s\textsuperscript{-1}
• The flow at 19 kft was turbulent above the Sierra Nevada range
• Comparison between northern and southern legs of the racetrack reveal significant north-south changes in the wave field

Chemical measurements

• Chemical measurements during IOP-6 show wavy signature which is approx. 90° out of phase with the vertical velocity.
• The O\textsubscript{3} and CO measurements are 180° out of phase, presumably due to vertical gradients of opposing sign.

Flight tracks

• Rotor IOP flights consisted of upwind profiles (nr. Fresno) and series of stacked “racetrack” legs between 19 kft and 28 kft ASL.
• Cold pool EOP flights consisted of upwind profiles, series of stacked straight and level legs up and down the Owens Valley between 6 and 22 kft ASL and profiles within the valley.
• Dropsondes were released within the valley during IOP and EOP flights.

Cold pool measurements

• Cold pool event occurred during 30 March, EOP-2.
• Strong inversion at 3.2 km observed in aircraft profiles within the Owens Valley.
• Flow beneath inversion is decoupled from that aloft.
• Increased turbulence across inversion layer.
• Inversion significantly weaker over Central Valley.

Instrumentation

The aircraft was equipped with:
• Turbulence probe, Rosemount temperature sensors, dropsonde system.
• Chemistry instrumentation (including O\textsubscript{3}, NO\textsubscript{x}, CO, sample bottles).
• ARIES (infrared interferometer), MARSS/DEIMOS (microwave radiometers).
• Cloud droplet and precipitation particle probes, INC (ice nucleus counter), CCN (cloud condensation nuclei).

Summary

• A range of scientific flights were conducted by the FAAM aircraft during T-REX.
• The measurements, in conjunction with other observations from the comprehensive T-REX dataset, will help shed new light on mountain-wave and rotor chemistry over complex terrain.
• The data are being used for high resolution model (Met Office Unified Model) development.