POSIDON Science Flight Report

2016-10-14 RF02

Takeoff: 0030 UT October 14 (10:30 Oct 14 Guam local)
Landing: 0545 UT October 14 (16:45 local), duration: 5.3 hours
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Pilots: Tom Ryan, Don Darrow

Summary:

This flight contributed to a number of POSIDON objectives, including survey of SO2 and O3 in the UTLS, sampling clouds and gases in air masses downstream of deep convection with different ages, sampling TTL cirrus.

Flight Description:

The objectives of the flight were 1) explore SO2 and O3 distributions in the UTLS, 2) to compare aircraft measurements of SO2 with GMAO model in air downstream of increased volcanic activity (Bagana) in Papua New Guinea, and 3) to measure cirrus clouds and gases downstream of convective systems at various ages and in TTL in general. The flight plan called for a 946-nm flight path due east with profiles through the TTL between 43 and 55 kft, with an MMS maneuver at the east end of the path and a zoom climb to maximum altitude at the end of the return leg prior to descent into Guam.

The GMAO forecasted high SO2 region (the east half of the flight path) was highly affected by convection. Cirrus clouds were observed from 43 kft all the way to the tropopause (51 – 53 kft). At times the cirrus were so thick that the NOAA total water signal was saturated. SO2 in these convection-inferenced and cloudy air masses was below the instrument detection limit (Figure 1). Possible explanations include i) the GMAO model forecast was not accurate, ii) the SO2 was scrubbed by ice particles and therefore invisible to the SO2 instrument, which is only sensitive to the gas-phase SO2, and iii) part of the ice water entered the SO2 instrument and affected the instrument background.

O3 mixing ratio between 12 and 15 km on the outbound leg were extremely low, averaging approximately 5 ppb (Figure 2). Low O3 values (< 30 ppb) were measured up to just below the CPT on the east half of the flight path (meaning also in cirrus clouds), indicating that these air parcels were heavily influenced by deep convection (Figures 2 and 3).

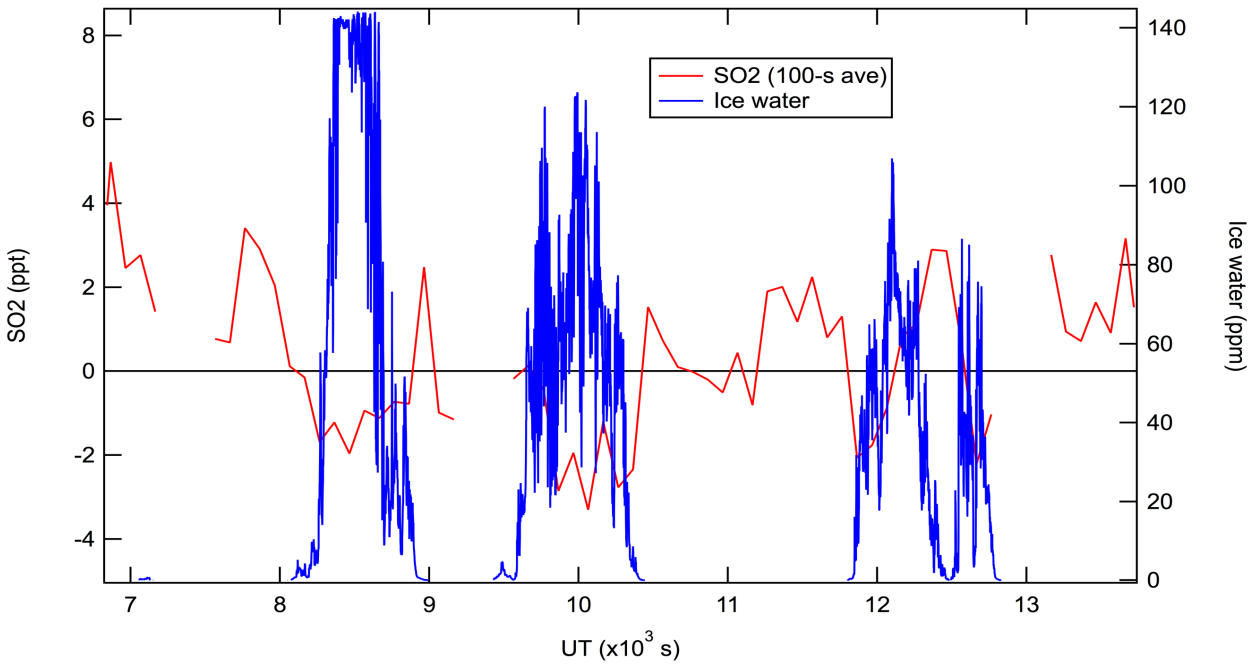

Figure 1. Time series of SO2 and ice water during the 14 Oct 2016 flight. The SO2 and ice water signals appear to be mutually exclusive.

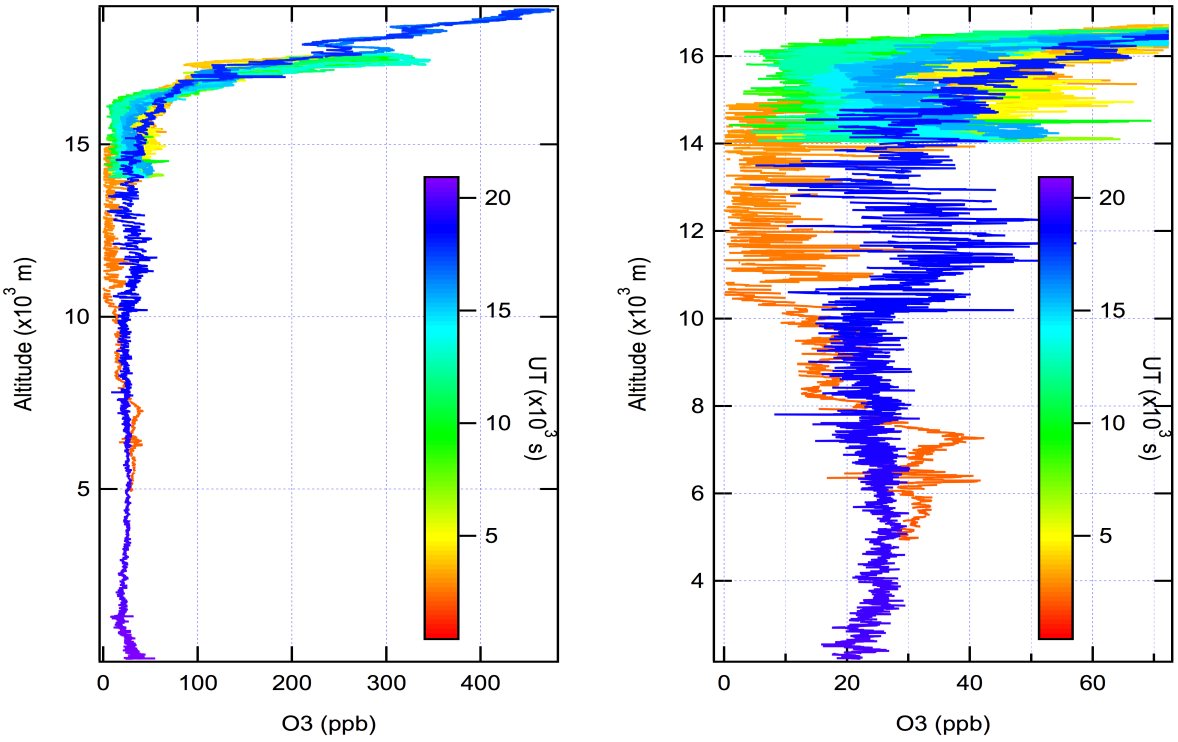

Figure 2. O3 profiles.

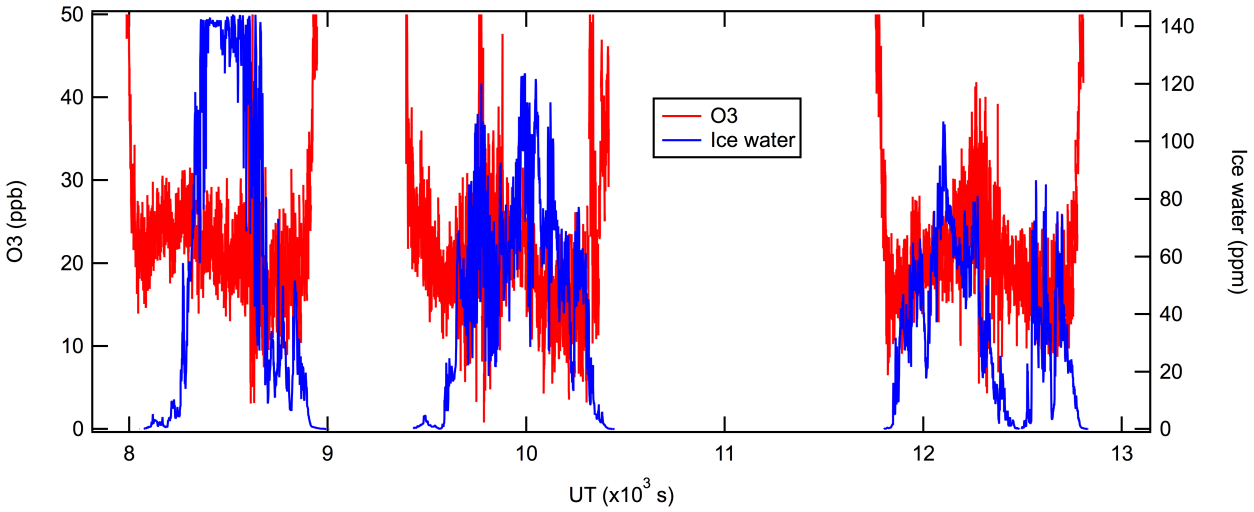

Figure 3. Time series of O3 and ice water.