

Cloud top height of and aerosol layers above the stratocumulus deck over the South-East Pacific

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ABSTRACT

The VOCALS-REX (VAMOS [Variability of the American MONsoon Systems] Ocean-Cloud-Atmosphere-Land Study Regional EXperiment) field campaign was carried out in October and November 2008 off the coast of northern Chile to measure properties of the atmosphere above, within and below the stratocumulus deck over the southern Pacific Ocean. As part of this study several aircraft were flown to measure and intercompare cloud and aerosol properties. One of them was the Dornier 228 operated by the Natural Environment Research Councils (NERC) Airborne Research and Survey Facility (ARSF). As well as collecting in-situ aerosol and meteorological data, the aircraft played an important role in collecting remote sensing data. Remote sensing instruments on board included the AISA Eagle & Hawk hyperspectral instruments, a polarimeter and an aerosol lidar, which were all used together to discover cloud properties. The aerosol lidar is an ALS300 instrument supplied by Leosphere. The raw data output has a time resolution of 1 second and range resolution of 1.5 metres. A flight speed of approximately 100 metres per second translates to a horizontal resolution of 100 metres. Data were collected for most of the 15 science flights carried out over the South-East Pacific. Measurements of cloud top height and aerosol backscatter are presented for these flights and initial conclusions show that the cloud deck height is around 1 kilometre and increases further out to sea.

1. INTRODUCTION

This slightly extended abstract presents some sample lidar data from the VOCALS-REX (VAMOS [Variability of the American MONsoon Systems] Ocean-Cloud-Atmosphere-Land Study Regional EXperiment) field campaign carried out in October and November 2008 off the coast of northern Chile.

2. LIDAR SYSTEM

The Leosphere lidar presented here is an ALS300 polarisation lidar used for measuring profiles of aerosol backscatter coefficient as well as polarisation of the backscattered beam. The units is operated by the Facility for Ground based Atmospheric Measurements (FGAM) in the United Kingdom (UK). Its range is 200

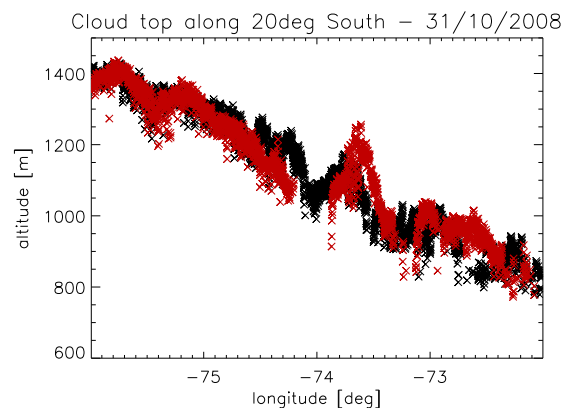


Figure 1. Cloud top height from the Leosphere lidar along 20 South on 31/10/2008. Black crosses are on the outbound leg and red crosses are from the return leg.

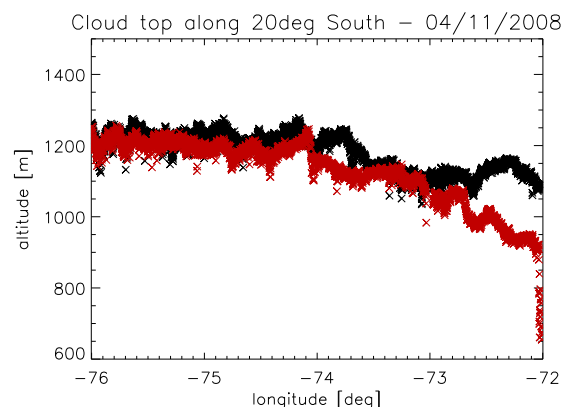


Figure 2. Cloud top height from the Leosphere lidar along 20 South on 04/11/2008. Black crosses are on the outbound leg and red crosses are from the return leg.

metres to a minimum of about 10 kilometres with a time resolution of 1 second and range resolution of 1.5 metres.

3. VOCALS-REX

During VOCALS-REX the lidar was installed on the Dornier 228 operated by the Natural Environment Research Councils (NERC) Airborne Research and Survey Facility (ARSF). The configuration of the lidar was pointing directly down out of the aircraft. It was operated during most of the 15 flights during the campaign and was used to measure the cloud top height of the stratocumulus deck as well as aerosol plumes being emitted from the Andes and coastal towns.

4. CLOUD TOP HEIGHT

From the data collected during the flights, cloud top height was determined by looking for the strongest backscatter. This was made easier as the cloud observed is stratocumulus cloud which had a high reflectivity. With the plane travelling at 100m.s^{-1} the horizontal resolution of cloud top height is 100 metres and the vertical resolution is 1.5 metres as stated above.

5. 20 SOUTH FLIGHTS

One of the types of flights flown during the campaign were flights between 76°W and 72°W along 20°S . Three of the aircraft (including the Dornier) involved in the campaign flew 20 South flights. The purpose of these flights were to create a statistical dataset over the same space.

The Dornier flew 20 South missions on 31/10/2008, 04/11/2008, 09/11/2008 and 13/11/2008 and the results are shown in Figures 1 to 4. These plots show how the cloud field varied during the campaign and also how the slope is not constant.

6. FUTURE WORK

Further work is being carried out to retrieve aerosol backscatter coefficient from these and other flights. This data will show the extent of aerosol plumes that have been emitted from the Andes which are mainly created by copper smelters. Other detectable plumes should be ones emitted from coastal towns. This data should also give a good measure of where aerosol is being entrained into the stratocumulus deck.

ACKNOWLEDGMENTS

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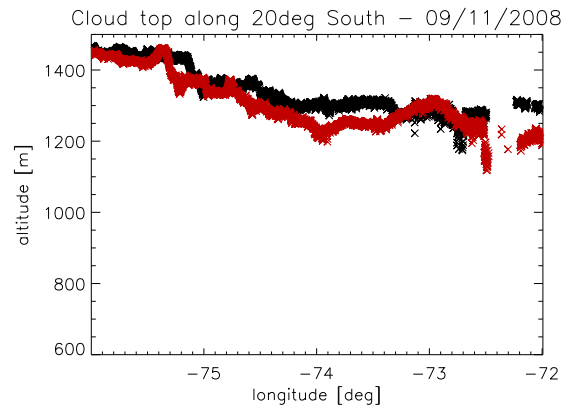


Figure 3. Cloud top height from the Leosphere lidar along 20 South on 09/11/2008. Black crosses are on the outbound leg and red crosses are from the return leg.

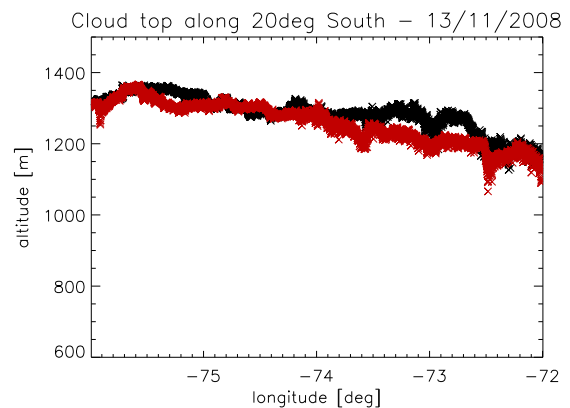


Figure 4. Cloud top height from the Leosphere lidar along 20 South on 13/11/2008. Black crosses are on the outbound leg and red crosses are from the return leg.