

The UK SOLAS observatory on Cape Verde

The UK SOLAS Steering Committee has allocated up to £750k for the development an atmospheric observatory on Cape Verde, to support UK SOLAS projects and the wider interests of the programme. UK SOLAS observatory development is being coordinated by DIAC (the NERC Distributed Institute for Atmospheric Chemistry), and will be implemented in partnership with Cape Verde National Institute of Meteorology and Geophysics (INMG), the Cape Verde National Institute of Fisheries and the Sea (INDP), and international SOLAS colleagues.

Why Cape Verde?

Initial considerations of suitable sites for observatory-based studies focused on the North and South Atlantic, on the basis that: i) these oceans were relatively accessible; ii) they were therefore where most UK SOLAS fieldwork is likely to occur; and iii) they were known to include locations subject to both 'background' marine air and continental transport, with strong seasonality and minimal local natural and anthropogenic sources. Sixteen Atlantic islands were investigated as possible sites, from Spitzbergen (79°N) to South Georgia (54°S). The main attributes of Cape Verde are described below.

Tropical North Atlantic

The Cape Verde Group is situated off the NW African Coast at between 15 and 17.5°N. Tropical ocean-atmosphere linkages are important to SOLAS science due to: large surface area; high photochemical activity (affecting production and loss of tropospheric ozone); high temperatures (affecting methane oxidation); and regional-scale features such as coastal upwellings, oligotrophic gyres, and dust transport from continental sources. Currently, the tropical Atlantic is not well represented in terms of number of monitoring sites, nor the quantity and quality of measurements made. Nevertheless, there is great interest by oceanographers and atmospheric scientists in field studies in the region, giving high 'added value' to long-term datasets.

Atmospheric and oceanographic conditions

Cape Verde receives air from both continental and marine sources. Seasonal variability dictates the degree of deposition from the NW African dust plume as well as the source region (marine vs continental) of air masses reaching Cape Verde.

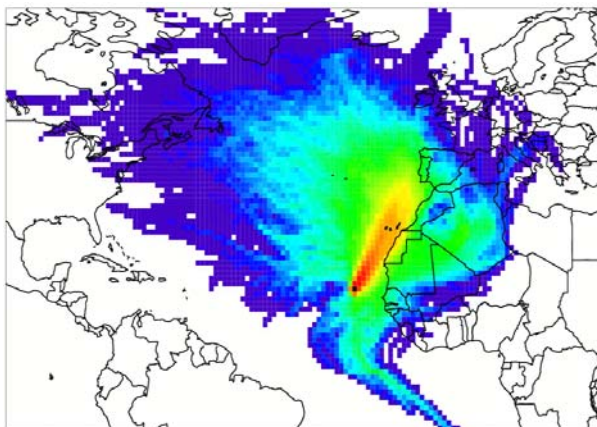


Figure 2. Air-mass back trajectory integration for 2000 using ECMWF model. Courtesy M. Evans, University of Leeds.



Figure 2 shows that much of the air reaching Cape Verde passes over the Mauritanian upwelling, off the coast of NW Africa. As a highly productive area, it is likely that the upwelling will be a substantial source of biogenic trace gases of great interest to SOLAS science. Away from the upwelling, year-round stratification tends to lead to continuous nutrient limitation and oligotrophy. Thus we might expect the impact of dust deposition in these areas to be substantial and clearly observable.

Much of the air leaving Cape Verde travels west to North America, passing over the atmospheric observatory on Barbados. Thus there is potential for Atlantic-wide connected flow studies between Bermuda and Cape Verde, and Cape Verde and Barbados. The Cape Verde region is also an important spawning ground for tropical cyclones (some of which develop into hurricanes).

Main measurements

Restrictions of budget and timescale have meant that UK SOLAS will focus on atmospheric measurements, as summarised in the Table below. Marine monitoring studies are expected to be supported by other funding mechanisms (eg via the EU, led by SOLAS partners in Germany), and in collaboration with US colleagues.

Measurement	Lowest likely Cape Verde concentration	Method or instrument
CO	40 ppb	Aerolaser 3001
Greenhouse gases	n/a	Flask sampling
O ₃ + NO _x	1 ppt (NO)	ANNOXA
Halocarbons	<0.02 ppt	Automated GCMS
NMHCs	2 ppt (propene)	Dual channel automated GC-FID
CH ₄	1 ppm	
OVOC's	50 ppt (formaldehyde)	
DMS	40 ppt	
BrO, IO	< 1 ppt	MAX-DOAS
Aerosol size distribution, chemical composition and physical characterisation	n/a	Various
Physical structure of atmosphere	n/a	Radiosonde (fortnightly)
Meteorological suite	n/a	

Other activities in the Cape Verde region

As indicated above, the Cape Verde region will be a focus for SOLAS science over the next five years. In addition:

- The *African Monsoon Multidisciplinary Analysis (AMMA)* is an international programme investigating the variability in the West African Monsoon, through atmospheric measurement, modelling and remote sensing. Whilst predominantly a land and terrestrial atmosphere based study, there are many common interests between AMMA and SOLAS. Links include the UK Meteorological Office *Dust And Biomass Experiment (DABEX)*, investigating the radiative effects and transport of dust- and biomass- derived aerosols over NW Africa and the surrounding ocean.
- The *Tropical Atlantic Climate Experiment (TACE)* plans to extend its *Pilot Research Moored Array in the Tropical Atlantic (PIRATA)* mooring array into the region around Cape Verde.

Additional scientific involvement – and/or financial support - is welcomed from any interested party, subject to approval by the Cape Verde authorities and SOLAS project partners.