Planning Layered Atlantic Smoke Interactions with Clouds' (LASIC) AMF1 Deployment

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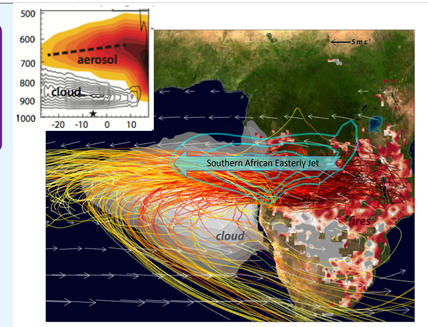


Motivation

Southern Africa is the world's largest emitter of biomass burning aerosols, seasonally transported westward over the least examined of the planetary subtropical stratocumulus decks. Model representations must consider not only the direct aerosol radiative effect, but also the cloud adjustments. Low cloud mixing with overlying air is also implicated in IPCC model climate sensitivity. LASIC aerosol and cloud measurements on Ascension Island spanning June 1, 2016-October 31, 2017, provide a first-ever characterization of the full annual cycle, spanning two biomass-burning aerosol seasons, with which to articulate effects and processes.

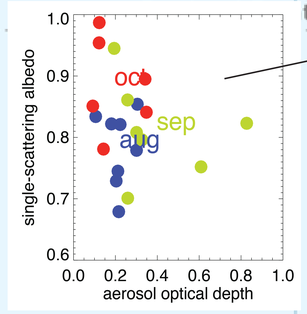
Implementation

* AMF1/MAOS on remote windward SE site far from airfield
* consistent SEerly winds allow detailed radar scanning along mean wind direction during all months
* radiosondes launched at airfield sample full boundary layer, complemented by MWR and ceilometer
* first ever documentation of diurnal cycle; Sept-Oct 2016 IOP
* complementary deployment to St. Helena in fall 2017
* first report on installation Thursday 10:45-12:45 Potomac rm in biomass-burning aerosol breakout

A focus on near-field micropulse lidar data

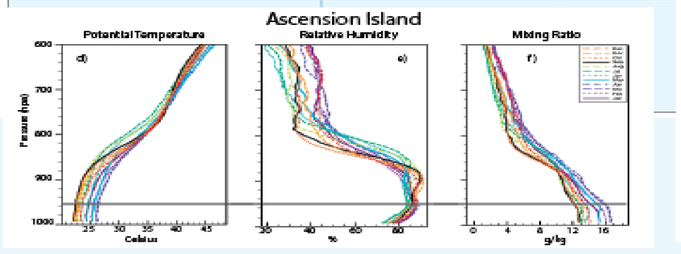
* amount of mixing betwen free-tropospheric smoke and underlying clouds unknown
*micropulse lidar critical for assessing relative locations of aerosol and cloud
* emphasis on lidar data quality includes assessment by both vendor and MPLNET
* current work at Miami developing familiarity. Example below of low cloud/aerosol characte-zation using MPL and a zenith radiometer confirms quantitative near-field use of MPL

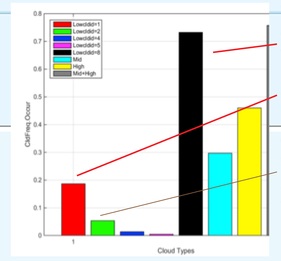
Example of thin low cloud & aerosol optical depth retrieval using Miami MPL



Hypotheses

* smoke is present July-October with Sept max, and increasing single-scattering albedo
* smoke loading at Ascension closely tied to strength of zonal free-tropospheric winds emanating off of Africa (see top right)
* low clouds distributed over two levels, with the cloud at inversion most responsive to overlying thermodynamic changes (consistent with surface observations but unproven)

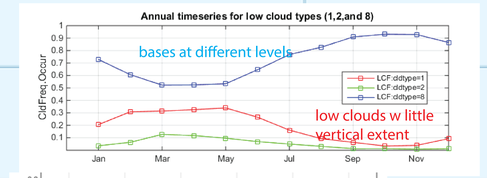




surface observers most frequently observe:
8=cumulus and stratocumulus with bases at different levels, particularly July-Dec
then
1=clouds with little vertical extent
then
2=cumulus with moderate vertical extent

more mid- and hi- cloud also present Aug-Dec

daily data since 1984



prevailing wind

Complementary Deployments

These characterize aerosol and boundary layer up/down wind of Ascension based in Namibia: *NASA EVS-2 ORACLES 2016, 2017 P-3 & ER-2 aircraft PI J. Redemann, Deputy PI R. Wood * UK CLARIFY 2016 FAAM BAe-146 aircraft. PI J. Haywood * French AEROCLO 2016 F-20 plane. PI P. Formenti based in St-Helena: surface-based instrumentation fall 2017, UK-Miami-DOE

Acknowledgements and References: Support for the planning of the LASIC campaign has been provided by DOE ASR grant DE-SC0013720. The LASIC Science Plan is available at https://www.arm.gov/publications/programdocs/doe-sc-arm-14-037.pdf
Complementary campaigns discussed in Zuidema, P., J. Redemann, J. Haywood, R. Wood, S. Piketh, M. Hipondoka, and P. Formenti, 2016:Smoke and clouds above the southeast Atlantic: Upcoming field campaigns probe absorbing aerosol's impact on climate. Bull. Am. Meteor. Soc., 97, doi:10.1175/bams-d-15-00082.1 For further background see Adebiyi A. and P. Zuidema, 2016: The role of the southern African easterly jet in modifying the southeast Atlantic aerosol and cloud environments. Q. J. R. Meteorol. Soc., DOI: 10.1002/qj.2765 and referenes therein.