Assessing the Link Between Aerosol Mixing State, Structure and Composition and their Optical Properties: Ascension Island as a Testbed for the South-East Atlantic Aerosol
Proposal Goals and investigational approach:

- Explore how differences in bulk aerosol optical properties measured by in-situ instruments are linked with aerosol single particle properties and how LASIC, CLARIFY and ORACLES are linked and representative of the SEA domain.

- Assess trends in BB single particle characteristics and optical properties during the burning season.

- Investigate whether we can perform closure of BB optical properties and trends between our single particle and process understanding and the in-situ optical bulk measurements.
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ORACLES, CLARIFY and LASIC MAC trends:

August (ORACLES 2017)

September (ORACLES 2016)

October (ORACLES 2018)
ORACLES, CLARIFY and LASIC MAC trends:

➢ ORACLES and CLARIFY show MAC decreasing with BB season with relatively similar magnitudes; CLARIFY shows higher MAC values with no obvious trend/slight increase?

Zuidema et al., GRL, 2018
Spatial location and land-type sources of Filter samples:
Selecting linked cases:

Only CLARIFY had matched cases for filter times

- 6 samples link LASIC observation by its forward trajectory, 2 samples are connected with backward trajectory.
- Time of airmass reaching LASIC region (the circle in the plot, centered at ASI, with 0.5° radius) is ranging from 42.7 to 0.7 hours.
- Most of the linked forward trajectories are inside MBL (brown color). The backward trajectories of those samples show they are originated from marine source.
- Backward trajectory linked samples are in free-troposphere.
Effect of cloud processing in MBL samples:

<table>
<thead>
<tr>
<th>LASIC</th>
<th>MAC(405nm)=21.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLARIFY</td>
<td>MAC(405nm)=20.7</td>
</tr>
<tr>
<td>Gold2</td>
<td>MAC(405nm)=20.7</td>
</tr>
<tr>
<td>Gold15</td>
<td>MAC(405nm)=22.0</td>
</tr>
<tr>
<td>Gold18</td>
<td>MAC(405nm)=21.0</td>
</tr>
</tbody>
</table>
MAC and composition for MBL sample from land:

**CLARIFY**

MAC (405nm) = 25.5

**LASIC**

MAC (405nm) = 25.7

Category 2: (Gold 11)

**CLARIFY**

After 1.7-hour

**LASIC**

DOE-ASR Meeting, June 24, 2020
Free Troposphere and Ground sample comparison:

**LASIC 300m**

7 days backtrajectory on 2017082411

MAC(405nm) = 25.3

**CLARIFY 2900 m**

7 days backtrajectory of sample Gold 10

MAC(405nm) = 20.1

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**Gold 10**

LASIE AMS

Total: 0.21 µg m⁻³

**Ground**

2.6-hour

**2900 m**

Gold 10 AMS

Total: 5.94 µg m⁻³

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DOE-ASR Meeting, June 24, 2020
### MAC, filter composition and sources:

<table>
<thead>
<tr>
<th>Filter name</th>
<th>Source-Traj CLARIFY</th>
<th>Source-Traj LASIC</th>
<th>MAC CLARIFY</th>
<th>MAC LASIC</th>
<th>Particle types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold2</td>
<td>marine</td>
<td>marine</td>
<td>20.7</td>
<td>21.2</td>
<td>chloride</td>
</tr>
<tr>
<td>Gold15</td>
<td>marine</td>
<td>marine</td>
<td>22</td>
<td>20.7</td>
<td>calcium chloride</td>
</tr>
<tr>
<td>Gold18</td>
<td>marine</td>
<td>marine</td>
<td>21</td>
<td>22.9</td>
<td>calcium chloride</td>
</tr>
<tr>
<td>Gold11</td>
<td>Shrub</td>
<td>Shrub</td>
<td>25.5</td>
<td>25.7</td>
<td>calcium+Na+NaCl</td>
</tr>
<tr>
<td>Gold12</td>
<td>Shrub/grasses</td>
<td>Shrub/grasses</td>
<td>22.6</td>
<td>-</td>
<td>BC+Na+K salts</td>
</tr>
<tr>
<td>Gold24</td>
<td>Savannah</td>
<td>marine</td>
<td>20.1</td>
<td>-</td>
<td>BC+Na+K salts</td>
</tr>
<tr>
<td>Gold10</td>
<td>Savannah</td>
<td>Shrub</td>
<td>20.1</td>
<td>25.3</td>
<td>BC+Na salts</td>
</tr>
<tr>
<td>Gold19</td>
<td>Savannah</td>
<td>marine</td>
<td>18.8</td>
<td>21.7</td>
<td>Minerals+Si(dust)</td>
</tr>
</tbody>
</table>
Preliminary results summary

➢ When comparing cases, we need to take into account not just trajectory source but also the time spent in the MBL and cloud processing along the trajectory and just before sampling.

➢ From the few matching cases we found in the MBL, LASIC MAC will increase compared to CLARIFY if no cloud processing occurred just before sampling and will decrease if cloud processing occurred.

➢ AMS ground composition for LASIC is much lower in total mass for all compared samples with CLARIFY (whether in MBL or FT), with higher percentage of BC and lower percentage of Organic material when compared with CLARIFY AMS.

➢ Calcium and Na salts seem to be related to higher MAC (with Shrubs sources); Marine sources have the second highest MAC in the investigated group and mineral type has the lowest.