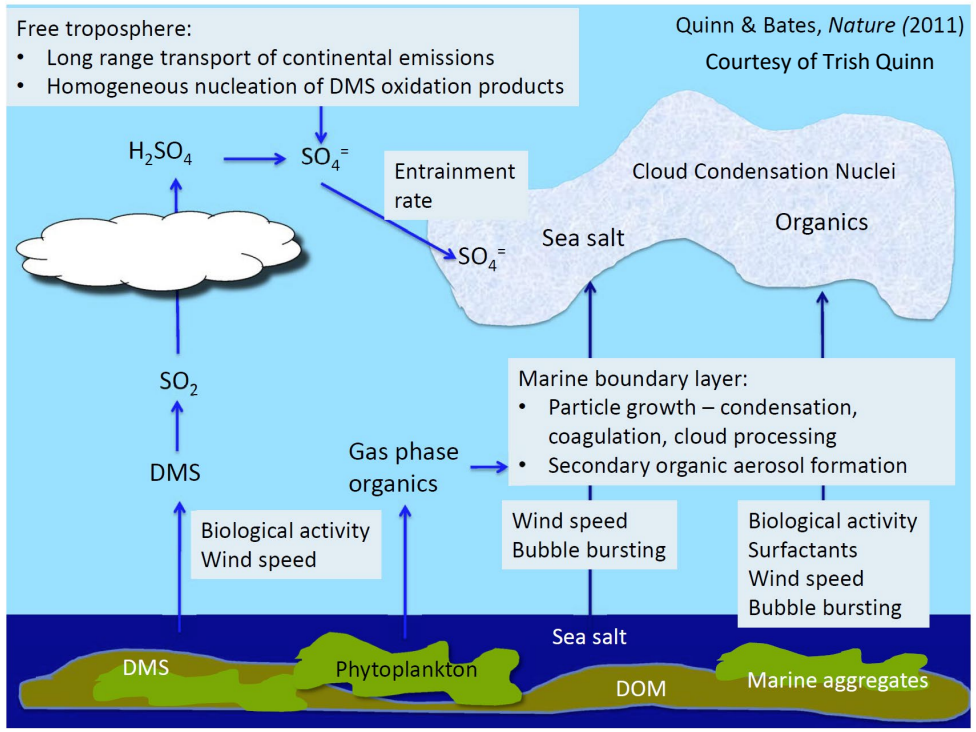
Aerosol and Cloud Experiments in the Eastern North Atlantic (ACE-ENA)

Conveners: Jian Wang, Jason Tomlinson, and Beat Schmid

- Main discussion points

Thursday, June 25th, 2020, 11:00 am -1:00 pm (EDT) Registration: https://zoom.us/webinar/register/WN_fgOPdsVrR3SXHVA4OKVfaQ		
11:00-11:01	Brief introduction and announcements	Jian Wang
11:01-12:38 16 presentations 5 min + 1.5 min (questions and transition) for each presentation	Evaluating the E3SM and CESM simulations of aerosols and CCN with the ACE-ENA campaign and ARM ground-based observations	Xiaohong Liu
	Impact of Seasonal Variabilities and Synoptic Conditions on Vertical Profiles of Trace Gas and Aerosol Properties over the Eastern North Atlantic	Yang Wang
	Aerosol and gas chemistry in the Eastern North Atlantic during ACE-ENA	Maria A. Zawadowicz
	Condensational growth by organics produces cloud condensation nuclei over remote oceans	Guangjie Zheng
	Impact of dry intrusion events on composition and mixing state of particles during ACE-ENA study	Alex Laskin
	Micro-spectroscopic examination of free troposphere and marine boundary layer ice nucleating particles during ACE-ENA	Daniel Knopf
	High Concentration Aerosol Event Mask	Allison Aiken



Key findings:

- Xiaohong Liu (Texas A&M University)
  - ✓ E3SM and CESM models agree reasonably well with observed CCN (0.1% and 0.2%) number concentrations in terms of seasonality, magnitude, and vertical distribution.
  - ✓ However, E3SM strongly overestimates while CESM underestimates observed number concentrations of smaller particles, indicating model biased size distribution. Both models overestimate sulfate and organics.
  - ✓ E3SM may have too weak condensational growth of Aitken-mode aerosol, and CESM has too weak long-range transport.

- Yang Wang (Washington University in St. Louis)
  - ✓ On average, entrainment of FT aerosol is not a direct source of boundary layer CCN in the ENA.
  - ✓ Entrained FT Aitken-mode particles represent an indirect source of boundary layer CCN.
  - ✓ Seasonal variation of boundary layer CCN is likely due to a combination of (1) stronger influence of long range transported pollution, (2) faster condensational growth of Aitken-mode particles, and (3) slower wet scavenging during summer.
  - ✓ Stronger impact from NPF during winter.

- Maria Zawadowicz (Pacific Northwest National Laboratory)
  - ✓ Aerosol chemistry vertical profiles revealed local and continental sources.
  - ✓ Scavenging ratio was found to correlate with the cloud droplet number concentration.
  - ✓ Droplet residuals were found to be relatively enriched in nitrate and amines.
  - ✓ Droplet residuals are less oxidized than ambient aerosol at ACE-ENA.

- Guangjie Zheng (Washington University in St. Louis)
  - ✓ Organics contribute significantly to the condensation growth and the formation of CCN over remote oceans like ENA.
  - ✓ Condensing species were dominated by NH_4HSO_4 / H_2SO_4 during only 11 of 62 (18%) growth events observed.
  - ✓ During most (58%) of the growth events, the condensing species is a mixture of sulfate/SOA.
  - ✓ This contribution is usually not included in current global models.

Key findings:

- Jay Tomlin/Alex Laskin (Purdue University)
  - ✓ DI events bring new types of particles (organic/nitrates/sulfates) into the region.
  - ✓ Organic volume fractions of individual particles are higher during DI events. Observed in both FT and MBL.
  - ✓ Free troposphere aerosols contain large contribution of organic particles chemically different from those present in MBL.
  - ✓ Biological particles were observed in the FT. Possible long-range transport due to DI events.

- Daniel Knopf (Stony Brook University)
  - ✓ During IOP1, particles were collected at ground site during night- and day-time. During IOP1+2, particles were collected onboard G-1 aircraft.
  - ✓ Particles and INPs have been physicochemically characterized and identified.
  - ✓ INPs reflect typical aerosol population composition.
  - ✓ Free troposphere aerosol exerts about one order of magnitude greater ice nucleation rate coefficients!
  - ✓ Differences in ice forming propensity are partly explained by composition, however, open questions remain.

- Allison Aiken (Los Alamos National Laboratory)
  - ✓ An algorithm is developed to mask periods that do not represent regional aerosol.
  - ✓ The mask is validated with a temporary Supplementary site (S1), collocated measurements and observations.

Future Plans – Action Items

- Combine model simulations and observations to
  1. Understand aerosol processes responsible for large model biases (e.g., SO_2, organics, biomass burning emissions at surface for CESM2 while E3SM emits at high elevations).
  2. Analyze the budget of marine boundary layer CCN in the ENA.