The impact of aerosol on cloud properties represents one of the largest uncertainties in computer simulations of climate change, in large part because of a poor understanding of aerosol characteristics under natural conditions that were prevalent during pre-industrial era; The Amazon rainforest is one of the few continental regions where aerosol properties and processes can be studied under near-natural conditions; We present aerosol size distribution and its evolution during the wet season in the Amazon basin using measurements at two background sites, the Amazon Tall Tower Observatory (ATTO) and the ZF2 site upwind of the Manaus city; The evolution of the aerosol size distributions under clean conditions is affected by precipitation and potentially the aqueous phase production of secondary organic aerosols.

Site Description:
- TOA: Amazon Tall Tower Observatory, ~ 150 km upwind of Manaus
- TOZ: ZF2, ~ 70 km north of Manaus (upwind)

This study focuses on the aerosol size distribution evolution under clean conditions during the wet season:
- Wet season: few biomass burning, total aerosol number concentration ~ 600 cm⁻³
- Criteria of “clean conditions”: total aerosol number concentrations less than 450 cm⁻³, black carbon (BC) concentrations lower than 25 ng m⁻³, and CO mixing ratios less than 130 ppb.

This study analyzed the evolution of aerosol size distributions during the wet season under clean conditions, the increase of the accumulation mode aerosol during the daytime is likely caused by convective downdraft and removed accumulation mode by washout; Under clean conditions, minimal impact of pollution observed:
- BC concentrations remained relatively constant;
- Due to the formation of nocturnal boundary layer, CO released by soil accumulated overnight and dissipate during the daytime;
- No evidence for the direct emission of accumulation mode aerosols from the biosphere;
- The accumulation mode aerosols were unlikely grown by condensation, since continuous growth from Aitken mode to accumulation mode was not observed.

4. Summary
- This study analyzed the evolution of aerosol size distributions during the wet season under clean conditions in the Amazon basin;
- Precipitation introduced Aitken mode aerosols by downdraft and removed accumulation mode by washout;
- Given the low BC and CO concentrations under the clean conditions, the increase of the accumulation mode aerosol concentration during the daytime is likely caused by the in-cloud processing of aerosols.

Given the low SO₂ concentration under the natural conditions in the Amazon basin, the in-cloud processing of aerosol particles may be dominated by aqueous phase production of secondary organics from biogenic volatile organic compounds.

5. References