# Fog and low cloud interactions with biomass burning aerosols in the Namib

Alexandre Mass | Hendrik Andersen | Jan Cermak | Eva Pauli
alexandre.mass@kit.edu

Karlsruhe Institute of Technology

## 1. Introduction

- In the coastal parts of the Namib desert, fog is the most relevant water source for animal and plant species.
- Each year between June and October, absorbing biomass burning aerosols (BBA) are overlying the fog and low clouds (FLC) in the region.
- However, the potential effects of aerosols on FLC in the region have yet to be investigated.
- **Hypothesis:** During the biomass burning season, BBA plumes lead to a stronger, lower-lying inversion and slower early morning planetary boundary-layer development, resulting in a longer FLC lifetime.

## 2. Data & Methods

**Datasets:**
- Geostationary satellite-based (SEVIRI) FLC dissipation and formation times for a 15 years period (2004 – 2018) with a 3km resolution
- ERA5 & CAMS reanalysis data for the same time period

**Study area:** Two areas of the Namib Desert with high frequency of FLC occurrence (see Fig. 1):
- Angolan Namib (AN: 15 – 17°S)
- Central Namib (CN: 22 – 24°S)

**Different BBA loading:** Black carbon aerosol optical depth at 550 nm (BCAOD) from CAMS was used to define two groups:
- High BBA days (BCAOD > 75th percentile)
- Low BBA days (BCAOD < 25th percentile)

**Ridge regression:** Used to build a meteorologically constrained statistical model ensemble to predict FLC dissipation times with reanalysis data as predictors.

## 3. Characterization

**Dissipation occurs significantly (p < .01) later during high BBA days**

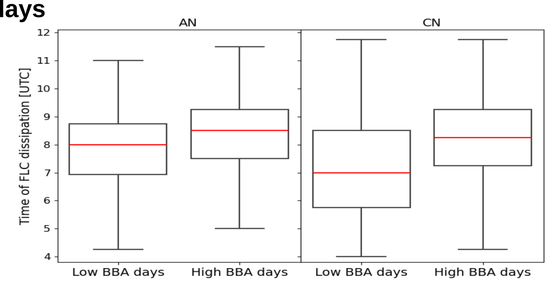


*Figure 1.* Observed time of dissipation of FLC events, for the high and low BBA days during the biomass burning season in the 2004 – 2018 period

## 4. Meteorological sampling biases

**There are clear synoptic-scale differences between high and low BBA days:**

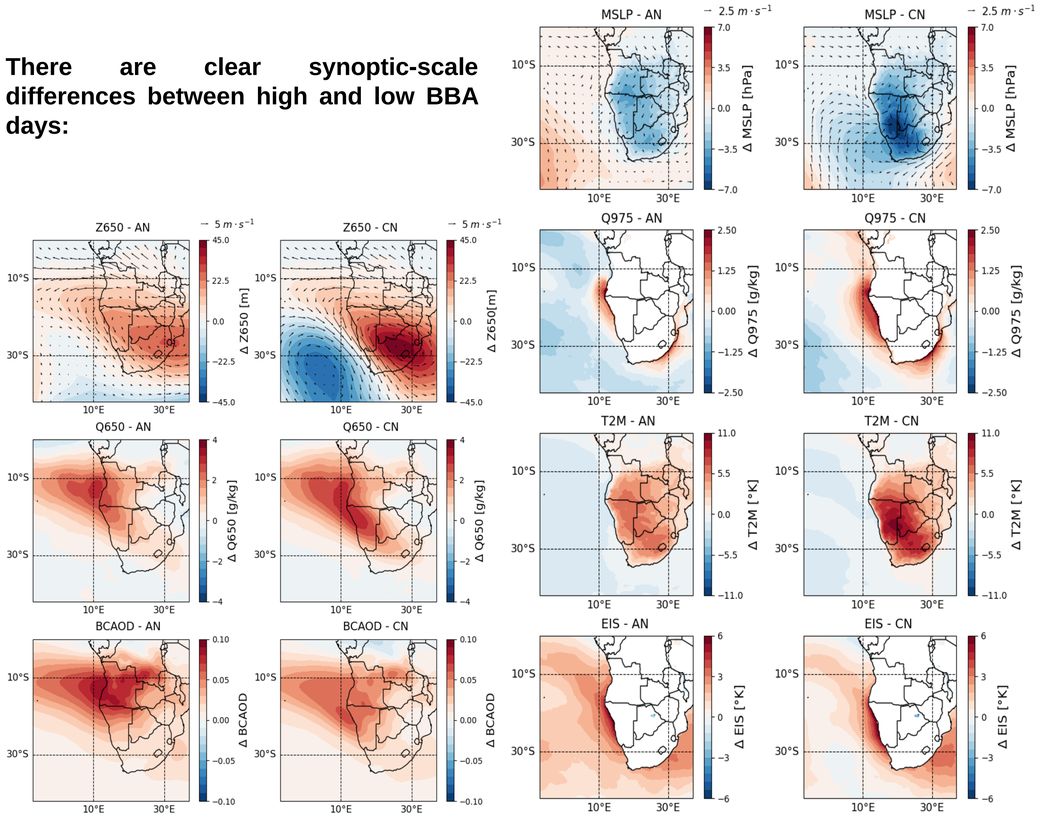


*Figure 2.* BBA season mean climatological (2004 – 2018) differences (high-low BBA days) in the free troposphere (at 650 hPa) at 08:00 UTC

*Figure 3.* BBA season mean climatological (2004 – 2018) differences (high-low BBA days) in the planetary boundary layer at 08:00 UTC

## 6. Conclusions & Outlook

- During the BBA season (June--October) FLC dissipation time occurs significantly later on high BBA days.
- BBA are transported along moist free-tropospheric air by a large-scale recirculation pattern. This causes a continental heat low, which modifies the coastal circulation and boundary layer humidity along the coastline.
- The statistical model is able to reproduce the observed differences in FLC dissipation time. These differences are mainly attributed to differences in synoptic-scale meteorology with some hints of BBA effects.
- To further investigate and fully disentangle meteorological and BBA effects, numerical modelling of the processes in play is required.

## 5. Statistical estimation

**The statistical models also captures significantly (p < .01) later dissipation times on high BBA days**

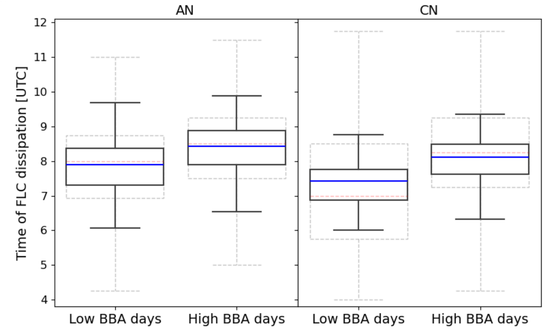


*Figure 5.* Ensemble mean predicted time of dissipation of FLC events in AN during the biomass burning season during the 2004–2018 period

**Presence of BBA effects in the spatial contributions ?**

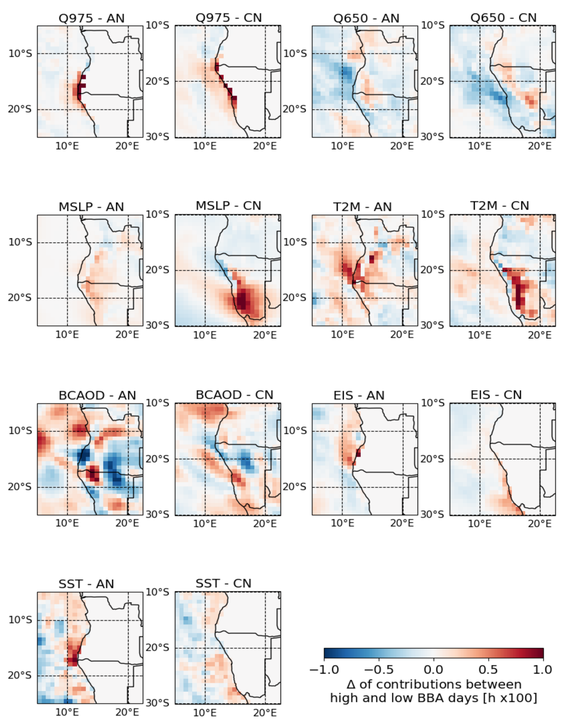


*Figure 6.* Ensemble mean differences (high-low BBA days) of spatial contributions (hours x100) for each predictor

**References**
Andersen, H. and Cermak, J., 2018, Atmos. Meas. Tech., https://doi.org/10.5194/amt-11-5461-2018.
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Andersen, H., Cermak, J., Fuchs, J., Knippertz, P., Gaetani, M., Quinting, J., Sippel, S., 2020, Atmos. Chem. Phys., https://doi.org/10.5194/acp-20-3415-2020.