Project: **1001**
Project title: **Marine Stratocumulus Cloud Cover and Climate (MSCCC)**
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Transitions between fully cloudy to broken marine stratocumulus clouds (Sc) regimes are driven by complex microphysical and dynamical feedbacks. These feedbacks begin to act once the fully cloudy regime starts to precipitate, and are followed by a rapid decrease of the cloud fraction (CF). Using ECHAM6-HAM2 [Stevens et al., 2013, Zhang et al., 2012], we have shown that, yet very simple, the autoconversion parameterization [Khairoutdinov and Kogan, 2000], being responsible for the rate of rain generation from cloud water, is able to adequately capture the rapid breakup of Sc clouds (Goren et al., in preparation).

This was shown by simulating a case study, in which a fully cloudy Sc deck over the north east Atlantic ocean was associated to anthropogenic pollution from Europe [Goren and Rosenfeld, 2015]. The set of simulations differ only by the anthropogenic emissions, assuming that higher emissions would lead to a delayed onset of precipitation (via the autoconversion parameterization), and therefore also to a delayed transition of the Sc.

Figure 1 shows the simulated CF for clean and polluted runs along the 3 days of the case study. The CF represents the CF within the polluted plume, defined by the plume in the polluted run. It can be seen that while the CF is similar at the beginning and end of the simulation (high and low CF, respectively), the decreasing rate of the CF is different. This strengthens the hypothesis presented in Goren and Rosenfeld [2015], in which the observed deck of fully cloudy Sc can be attributed to the anthropogenic aerosols that delayed the breakup of the clouds.

References

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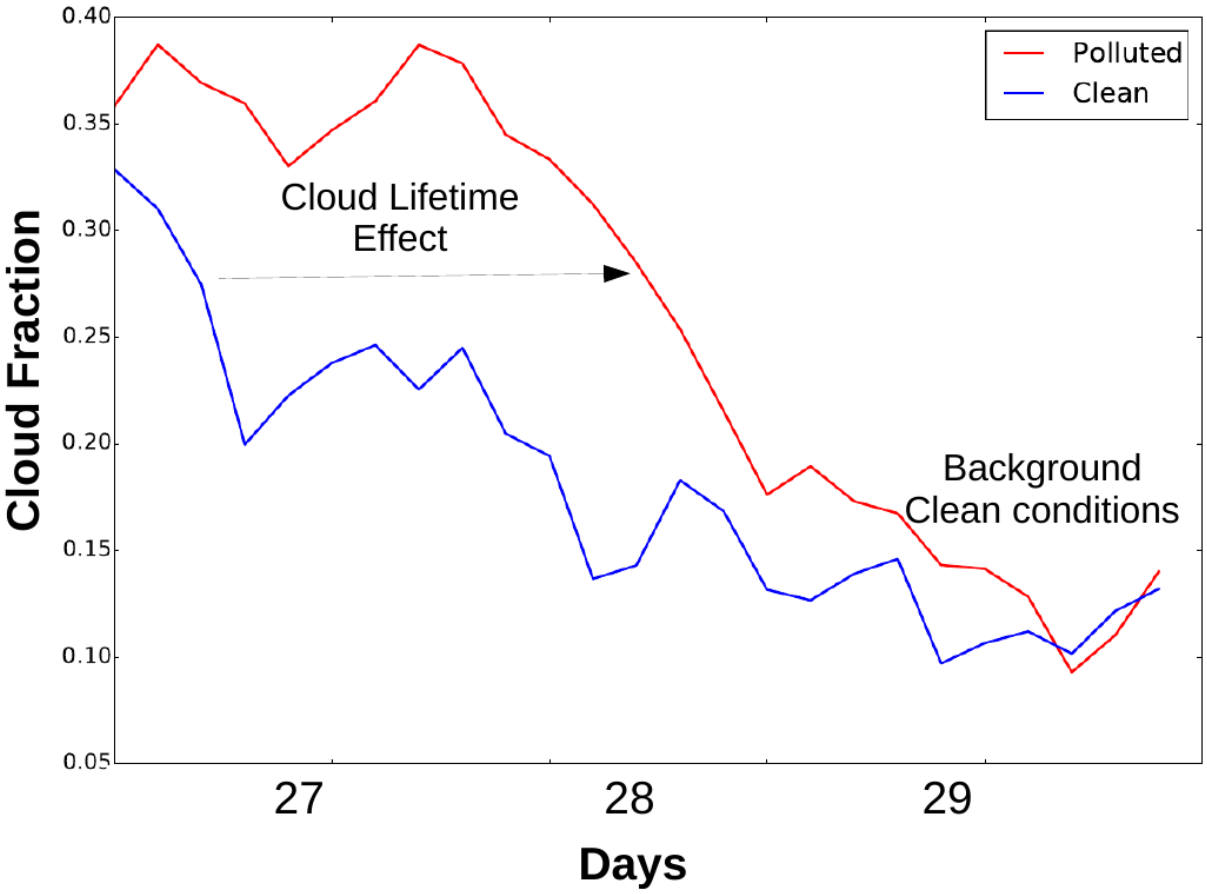

Figure 1: Cloud fraction change along 3 days of simulation (27-29 of January, 2010) for polluted and clean runs. The CF represents the CF within the polluted plume, as defined in the polluted simulation.