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Biomass burning influences on ozone during the SAMBBA aircraft campaign.

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Ozone (O_3) is an air pollutant and a greenhouse gas. It is detrimental to human and plant health, damaging plant stomata and therefore limiting photosynthesis. O_3 is both formed and lost via the interconversion between nitric oxide (NO) and nitrogen dioxide (NO_2); the relative amount of O_3 produced depends on the amount of NO_x (NO + NO_2) and volatile organic compounds (VOCs), which indirectly compete with O_3 to oxidise NO back into NO_2, leading to more O_3. The Amazon region has some of the lowest background O_3 levels on the planet ($\sim$20 ppb) and is a NO_x-limited environment for ozone production. During the tropical dry season emissions of NO_x and VOCs from both tropical and savannah fires lead to a large increase in O_3mixing ratios over the Amazon.

With a predicted increase in non-agricultural fire activities, due to a changing climate it is important to understand how much $O_3$is being formed in the Amazon and the sensitivity of this to fire and other emissions. The amount of O_3 is potentially of additional importance as the Amazon forest is the largest single land carbon sink on the planet, with an estimated net annual sink of 2.4 pG C yr^{-1}, which could be limited by O_3 plant damage. Despite this, detailed observation of $O_3$and its precursors in the Amazon have been limited. However, the SAMBBA field campaign (September- October 2012) provides an opportunity to observe in-situ O_3formation.

The ECMWF C-IFS (Composition Integrated Forecast System) developed under MACC and continued under CAMS, provides global operational forecasts and re-analyses of atmospheric composition at high spatial resolution (T255, $\sim$80km). In this study, we present results from C-IFS experiments for the SAMBBA period, with and without composition data assimilation, exploring how well the C-IFS represents biomass burning influences on O_3in the Amazon. The aim is to test our understanding of O_3formation and precursor emissions as well as the capability of the C-IFS for air quality forecasts.

The flight campaign showed average O_3 values of 43 ppb, over tropical vegetation in the dry season with larger values observed in the upper troposphere during the wet season (61ppb). The largest surface O_3values were observed over the eastern savannah region (75 ppb), where NO_x emissions were most significant. Comparisons to the C-IFS show that the model persistently underestimated O_3value compared to the in-situ observations (MFB -39%). The bias is thought to be caused by an underestimation of both fire and lightning NO_x emissions in the model. When NO_x emissions are improved by assimilation of OMI satellite NO_2 data in the Eastern region, O_3values show a smaller overestimation compared to the observations (MFB 4%).