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The impact of biomass burning emissions on sub-seasonal prediction: a study using the ECMWF's coupled Ensemble Prediction System

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Recent work has shown that the direct effect of aerosols may influence predictability at the S2S scales via the MJO modulation of the aerosol fields. Wind-emitted aerosols such as desert dust are the main contributors. However, sensitivity studies performed with the ECMWF's coupled Ensemble Prediction System have shown that biomass burning aerosols also play an important part. In particular for areas where extensive seasonal biomass burning takes place such as central Africa and Indonesia, the effect of aerosols can be very important.

The impact of aerosols for average conditions is taken account with a climatological distribution which is operational used at ECMWF. However, for exceptional years, it is only with prognostic interactive aerosols that the impact of biomass burning events can be properly accounted for.

This study presents simulations of the 2015 ENSO-enhanced Indonesian fire season using the ECMWF's coupled system with fully prognostic and interactive aerosols and prescribed fire emission based on MODIS Fire Radiative Power from the Global Fire Assimilation System database. The simulations are compared with a control run using the current operational set-up which includes an up-to-date aerosol climatology. It is shown that the system with interactive prognostic aerosols initialized with observed fire emissions is capable of predicting temperature anomalies in the Indonesian area with a six-month lead time in re-forecast mode. The success of this simulation is due to the use of observed fire emissions which provide the right amount of biomass burning aerosols. However, this indicates that if fire emission from a dynamical model were available it would be possible to predict anomalous events which have strong seasonality and are connected with large-scale climate patterns. Additionally a sensitivity experiment where biomass burning emissions are set to zero will also be presented, to show the relative impact of this type of aerosols on the meteorology at the S2S scales.