SMOKE PARTICLES FROM PEAT FIRES IN INDONESIA 1997/1998: A MODEL STUDY

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INTRODUCTION

Every year during the dry season land clearing fires are inflamed in Indonesia. Usually, the burning ceases in October / November with the beginning of the northern monsoon rains. In 1997 / 1998, however, the strong El Nino lead to severe drought conditions. Small land clearing fires became uncontrolled mainly on Kalimantan (Borneo) and Sumatra and caused several smoke-haze pollution episodes heavily affecting Indonesia, but also Malaysia and Singapore (Heil and Goldammer, 2001).

MODELLING

We applied the regional 3d atmosphere-chemistry model REMO (Langmann, 2000) to study the emissions, transport and removal processes of the Indonesian fire aerosols during the period July 1997 to June 1998. Additionally, the potential of the high atmospheric particle load from these fires to modify cloud properties is investigated. The REMO model resolves the region of Indonesia and adjacent countries by 100 x 50 grid points of 0.5 degree. Vertically 20 layers are used.

To determine the temporal and spatial distribution of the fire aerosol emissions, first the area burned was estimated by scaling ATSR1 hot spots (Along Track Scanning Radiometer, Arino and Rosaz, 1999) weekly in 0.5 degree resolution to a total of 9 655 000 ha area burned in Indonesia as reported by Goldammer and Hoffmann (2002). Considering a vegetation distribution based on Loveland et al. (2000) with modifications for peat areas we received for the total particulate matter (TPM) emissions (see Levine, 1999 for more details) over Indonesia the temporal evolution as shown in Fig. 1. It should be emphasized that smouldering peat fire emissions contribute more than 90 % to the vegetation fire emissions.

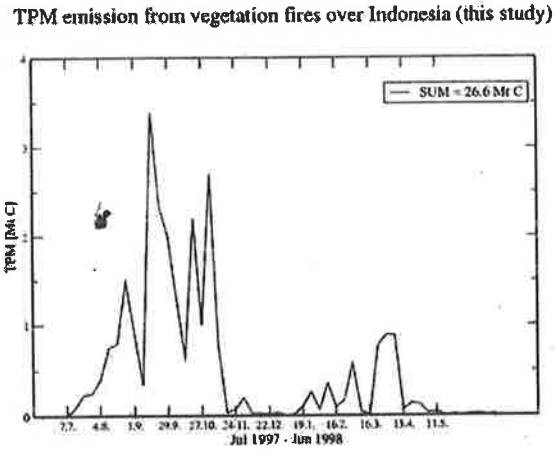

Figure 1: Total Particulate Matter (TPM) emissions from vegetation fire over Indonesia from July 1997 to June 1998

Comparisons with observations (TOMS Aerosol Index and ground based measurements at Malaysian sites) show that REMO is able to reproduce the spatial and temporal distribution of the aerosols released from the fires. If we consider a part of TPM to act as cloud condensation nuclei (due to their high sulfur content) which can modify convective precipitation formation according to Nober et al. (2003) the REMO model determines a suppression convective precipitation near the fire aerosol sources. More water vapour stays in the atmosphere to form elsewhere precipitation. Thus, less TPM is removed from the atmosphere close to the fires, but even more can be removed by wet deposition along the transport path way. These results will be presented and the special character of the peat fire aerosols (Langmann and Graf, 2003) will be discussed.

CONCLUSIONS AND OUTLOOK

Our preliminary study shows that aerosols from vegetation fire emissions in Indonesia are mainly released from smouldering peat fires. The modelled TPM distribution and precipitation formation are significantly modified taking into account peat fire aerosols as cloud condensation nuclei – due to their high sulfur content. We plan to carry out more detailed studies focussing on TPM – cloud interactions. We also want to investigate the high sulfur load in the peat fire aerosols, which might be explained by permanent sulfur degassing of the island arc volcanoes in and around Indonesia since thousand of years and the efficient wet deposition of that sulfur (Langmann and Graf, 2003) in the Indonesian peat areas. Field campaigns, laboratory experiments and model simulations will be carried out.

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