Changing ground water level and severe smoke haze from Indonesian peat fire

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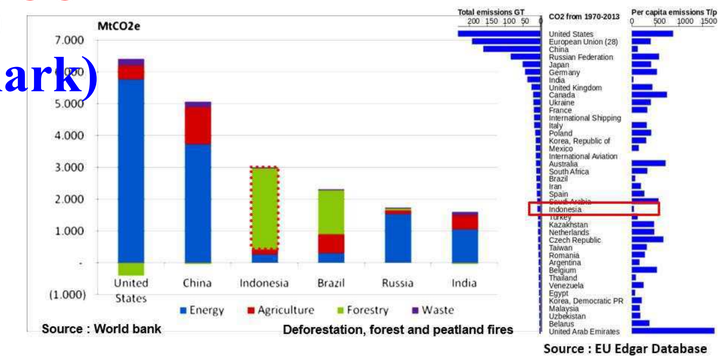
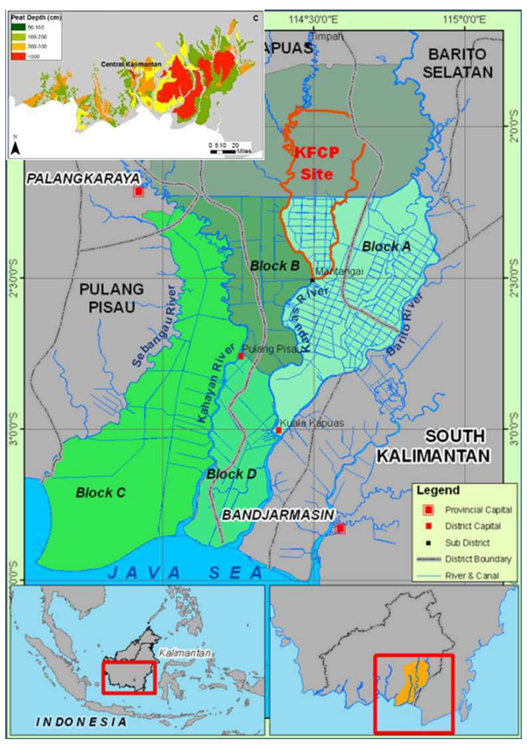
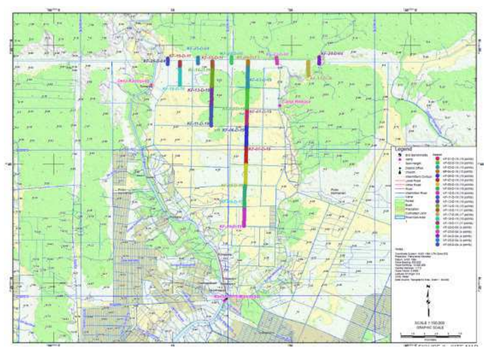
Introduction

- ✓ Peat fires are a recurrent phenomenon in Indonesia and represent a problem for the country. Each year thousands of hectares of peatland burn in Indonesia emitting tonnes of greenhouse gasses, particulates, and aerosols.
- ✓ Peat fires have been identified as the primary source of the country's carbon emissions, making Indonesia the world's 3rd largest carbon emitter. However, the calculation of Indonesian carbon emissions from fires are currently subject to large uncertainties. Methodology and data on tropical peat fires' behaviour and emissions need to be improved for Indonesia to participate fully in carbon accountancy, to manage their peatlands, and to prevent peat fires.
- ✓ To get a better understanding of this issue, we studied fire conditions in a portion of the Mega Rice Project (MRP) area, Central Kalimantan.



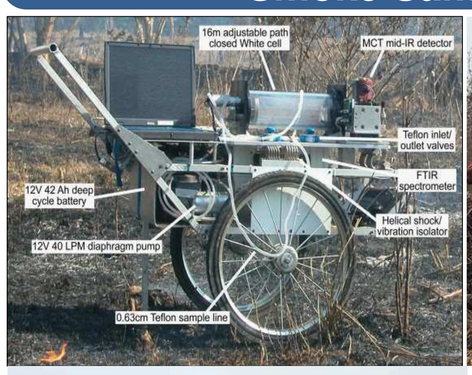


Methods



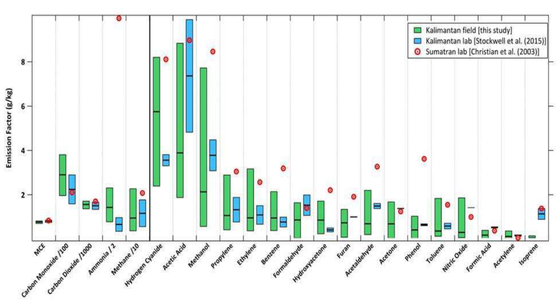
- ✓ 4 TRMM Pixels: 4 different precipitation regions; analyzed daily and monthly
- ✓ Ground Water Level data from 300 dipwells
- ✓ Nino 3.4 SST Anomalies
- ✓ Yearly burned area analyzed from Landsat L5 TM, L7 ETM+ and L8 OLI using the NBR method
- ✓ Static DGPS Survey to provide exact peat surface elevation for 300 dipwells

Smoke Sampling



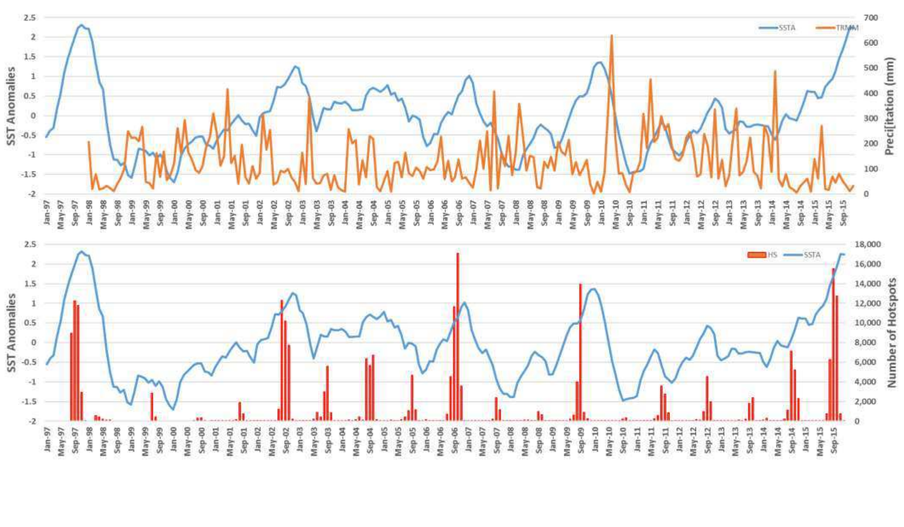
Result: Emission Factors from Peat Fires

Stockwell et. al., Atmospheric Chemistry and Physics 16, 2016(18):11711–11732



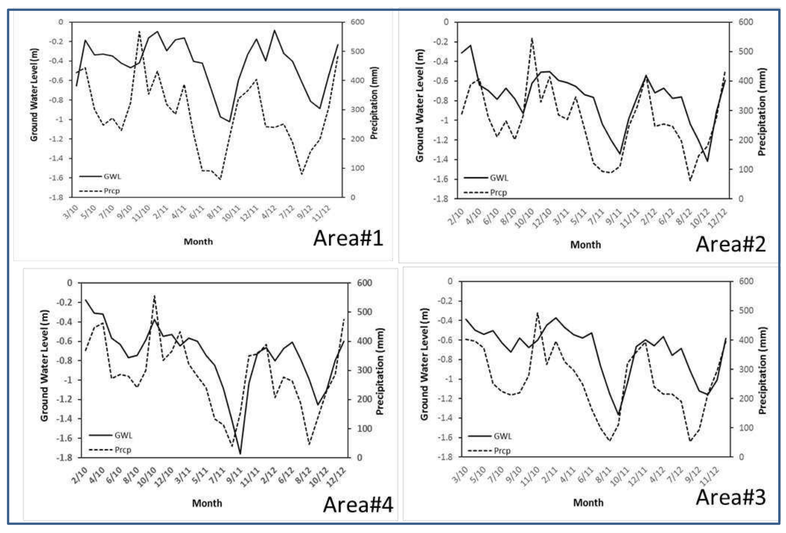
- ✓ Current IPCC EFs are derived from limited pre-existing regional data from Sumatra (Christian et al. 2003) and indicate considerable variation in emissions may exist between peat fires of Indonesia's three major peat formations.
- ✓ From IPCC data, expected CO_2, and CH_4 values for Indonesian peat fires would be 1703 g kg^{-1} and 20.8 g kg^{-1} , while the corresponding actual field-measured emissions (Kalimantan) were 1564±77 g kg^{-1} and 9.51±4.74 g kg^{-1}. Based on just these two gas emissions, Indonesian carbon equivalent measurements (100 year) may have been 19% less than what current IPCC emission factors indicate.
- ✓ Our field data suggest needed revisions to previously recommended IPPC's emission factors (EFs) from peat fires that were based on a limited amount of lab measurements, notably: CO_2 (-8%), CH_4 (-55%), NH_3 (-86%), and CO (+39%).

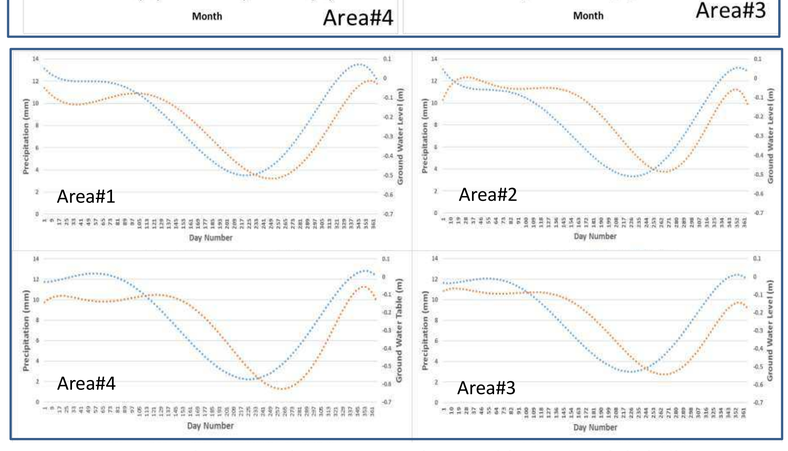
Preliminary Result: SST Anomalies and Critical Ground Water Levels



- ✓ The rise of Nino 3.4 SST Anomalies to positive values may initiate the driest months, yielding large fire occurrences

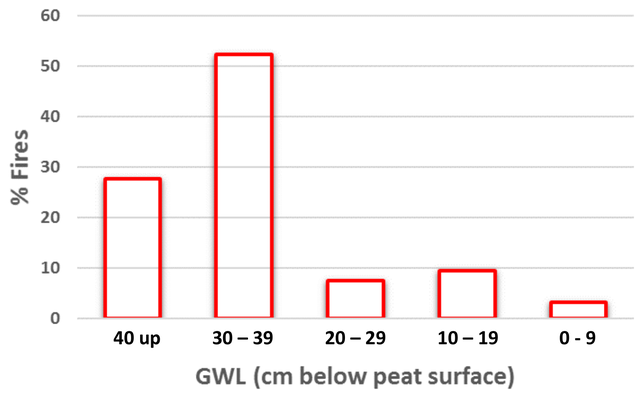
Peat surface and Ground Water Level elevation during dry and wet seasons for some example dipwells in the study area





Precipitation and GWL tendency at 4 pixels, monthly (top) and daily (bottom)

- ✓ A time-lag between the lowest precipitation and the lowest GWL: high risk of future fires in the area due to the loss of the peat's future ability for absorbing and storing water
- ✓ All of the regions experienced similar U-shaped monthly precipitation patterns with peak dry season between July and September and a trough reaching minimum in August.
- ✓ GWL in the study area now remains in deficit for the whole of the year: unnatural for the system and resulting in severe dry conditions for peat in the area.
- ✓ Most of fires occur in areas with GWL 20 cm below the peat surface, but fire occurrences with GWL of less than 5 cm below peat surface strongly suggest that degraded peatlands are vulnerable to fires even under relatively moist conditions



Fire occurrences under certain GWL condition

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