Geophysical Research Abstracts
Vol. 16, EGU2014-1283, 2014
EGU General Assembly 2014

Computational Study of Smouldering Fires and the Fate of Organic Soil Matter

Xinyan Huang and Guillermo Rein
Imperial College London, London, United Kingdom (x.huang12@imperial.ac.uk)

Smouldering combustion is the slow, low-temperature, flameless burning of porous fuels and is the most persistent type of combustion phenomena. It is the driving phenomenon of wildfires in organic soils (eg, peatlands), like those causing haze episodes in Southeast Asia and Northeast Europe. These are the largest fires on Earth and extensive sources of greenhouse gases, but poorly understood, becoming an emerging research topic in climate-change mitigation. In this work, we find the multistep heterogeneous reaction scheme of soil organic matter (SOM) describing the drying and thermal and oxidative degradation during smouldering combustion. The kinetics parameters of four different peat samples are inversely found from thermogravity experiments in the literature. These kinetics are then implemented in a multi-physics 1-D model of a reactive porous media with the open-source code Gpyro to investigate the phenomenon with an emphasis on the role of the moisture and inert contents. The predicted smouldering thresholds for the critical moisture and inorganic contents show a very good agreement with the 1987 and 1997 experiments of Frandsen for a wide range of peat types and organic soils. The influences of the kinetic parameters, SOM physical properties, and ignition sources are investigated. We envision that this physics-based model of smouldering peat fires will help to understand this important natural and widespread phenomenon.