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Climate Feedbacks on Smouldering Earth: Enchantment of Moisture deficit and self-heating of fossil and pre-fossil soils

Guillermo Rein
University of Edinburgh, School of Engineering, United Kingdom (G.Rein@ed.ac.uk)

Global smouldering phenomena, the slow, low-temperature, flameless burning of organic soils, is the most persistent type of combustion phenomena and the longest continuously fires on Earth (>6,000 years).
It take place since deep times and in many ecosystems, special boreal and tropical ones. These are accidental sources of carbon emissions that during millennia have been slowly burning fuels with zero energy efficiency, consuming large amounts of fossil energy resources (coal seams), destroying natural ecosystems (peatlands) and emitting greenhouse gases and pollutants. The global problem has grown in the last decades to an estimated release varying between 10 to 40% of the man-made carbon emissions, and a coal consumption rate at least 5 times that of Germany.

Because it involves the burning of fossil and pre-fossil fuels, this is the only carbon-positive wildfire phenomena. This creates feedbacks in the climate system because moisture deficit and self-heating of organic soils are enchanted under warmer climate scenarios and would lead to more frequent smouldering fires. Warmer temperatures at high latitudes are resulting already in more Artic fires and unprecedented permafrost thaw exposing large soil carbon pools to smouldering for the fist time since millennia.

While flaming fires have been a central focus in fire research, smouldering fires are as important in terms of ecosystem damage, atmospheric emissions and socioeconomic threats but have received little attention. Moreover, these fires are difficult or impossible to detect with current remote sensing methods because the chemistry is significantly different, their thermal signature is much smaller, and the plume is much less buoyant.