Geophysical Research Abstracts
Vol. 18, EGU2016-7070, 2016
EGU General Assembly 2016

Global Distribution of Pyrogenic Carbon

Moritz Reisser, Samuel Abiven, and Michael W. I. Schmidt
Soil Science and Biogeochemistry, Department of Geography, University of Zurich, Zurich, Switzerland

Pyrogenic Carbon (PyC) is ubiquitous in the environment and represents presumably one of the most stable compounds of the total organic carbon. Due to its persistence in the soil, it might play an important role in the global carbon cycle. In order to model future CO_2 emissions from soils it is thus crucial to know where and how much of PyC exists on a global scale.

Yet, only rough estimates for global PyC stocks in soils could be made, and even less is known about the distribution across ecosystems. Therefore we propose here literature analysis of data on PyC concentrations and stocks worldwide.

We extracted PyC values in soils from the literature (n = 600) and analysed the percentage of PyC in the soil organic carbon (SOC) as a function of climate (temperature, precipitation), soil parameters (pH, clay content), fire characteristics (fire frequency and fire regime) and land use. Overall, the average contribution of PyC to SOC was 13 %, ranging from 0.1 % up to 60 %. We observed that the PyC content was significantly higher with high clay content, higher pH, and in cultivated land as compared to forest and grassland. We did not observe any relationships between fire activity, frequency or intensity and PyC % at a global scale. When the fire regime was monitored on site (only 12 % of the data we collected), we observed higher PyC concentrations with higher fire frequencies. We hypothesise that the resolution of global fire datasets is neither temporally nor spatially high enough to explain the very local fire history of the soil samples.

Data points were not homogeneously distributed on the globe, but rather aggregated in places like Central Europe, the Russian Steppe or North America. Therefore, a global interpolation is not directly possible.

We modelled PyC concentrations, based on the five most significant parameters, which were clay content, pH, mean annual temperature and precipitation as well as land use. We then predicted worldwide PyC using global datasets existing for these five variables. We present a global map of PyC concentrations as well as it stocks. In arid ecosystems, where SOC is generally low, stocks of PyC are also low, even though concentrations can be very high. On the other hand, stocks are mostly very large in temperate and boreal ecosystems, even if concentrations are rather low, because total SOC stocks are very high there. Integrating our modelled data, we result in a total global stock of about 230 Pg PyC, corresponding to about 10 % of the total soil organic carbon stock. This value lies well in range with current rule-of-thump estimates of previous studies.