



Modeling forest fires dynamics in Europe using the Community Land Model

Mirco Migliavacca, Alessandro Dosio, Alessandro Cescatti, Andrea Camia, Jesus San Miguel-Ayanz, and Tracy Durrant Houston

European Commission - DG Joint Research Centre, Institute for Environment and Sustainability, Ispra, Italy

Forest fires are one of the main disturbances affecting carbon sequestration of European forests. Although it is generally recognized that the occurrence of forest fires in Europe is due mainly to causes of an anthropogenic nature, year to year total burned area and CO₂ emitted from forest fires is also linked to meteorological conditions. Moreover, the projected decrease in summer precipitation in southern Europe and the increase in the frequency of summer droughts will probably induce greater risks of forest fires, ultimately resulting in strong impacts on natural resources and ecosystem stability, with consequent direct and indirect economic losses.

This study is focused on the assessment of the spatial and temporal variability of the total area burned, regional release of CO₂ as consequence of forest fires and changes in spatial pattern of fire risk level in Europe using a process-based modeling approach.

To this purpose the Community Land Model version 4.0 (CLM-CN), the land component of the Community Climate System Model (CCSM), was used. We performed offline CLM-CN simulations forcing the model with two different climate drivers: the NCAR/ NCEP atmospheric reanalysis dataset for the period 1948-2004 and the ECMWF ERA-Interim reanalysis for the period 1989-2009. Model runs were performed at a resolution of 1°x1°, at each model time-step the total area burned, fire probability and CO₂ emitted from forest fires were computed by the embedded forest fires routine.

To evaluate the accuracy of CLM-CN we used different products for the different output provided by the model. For the evaluation of forest fires probability and total area burned simulated we used the European Fire Database. This database contains the forest fires information compiled by European countries and it is part of the European Forest Fire Information System (EFFIS). For the evaluation of the CO₂ emitted the results were compared with the available satellite-based estimates reported in the Global Fire Emissions Database, Version 2 (GFEDv2).

The uncertainty in total area burned, forest fires probability and regional CO₂ emissions from forest fires related to the climatic forcing was quantified comparing the results of the different runs conducted with the different forcing.