Geophysical Research Abstracts
Vol. 18, EGU2016-10790, 2016
EGU General Assembly 2016

The Fire Energetics and Emissions Research (FEER) Biomass Burning Emissions Inventory: Modeling, Analysis, and Upcoming Improvements

Luke T. Ellison (1,2), Charles M. Ichoku (2), Xiaohua Pan (2,3), Huisheng Bian (2,4), Mian Chin (2), Yun Yue (5), Jun Wang (5), Johannes W. Kaiser (6), and Meinrat O. Andreae (6)

(1) Science Systems and Applications, Inc., Lanham, MD, USA, (2) NASA Goddard Space Flight Center, Greenbelt, MD, USA, (3) Earth System Science Interdisciplinary Center, University of Maryland, College Park, MD, USA, (4) Joint Center of Earth Science and Technology, University of Maryland-Baltimore County, Baltimore, MD, USA, (5) University of Nebraska-Lincoln, Lincoln, NE, USA, (6) Max Planck Institute for Chemistry, Mainz, Germany

The Fire Energetics and Emissions Research (FEER) top-down biomass burning (BB) emissions inventory is based on an original algorithm that capitalized on the empirical and linear relationship found between a fire's radiative power (FRP) measurements and its instantaneous smoke-aerosol emission rates, resulting in a set of "coefficients of emission" (Ce). The first version of the FEER emissions product (FEERv1, available at http://feer.gsfc.nasa.gov/) combines the resulting global map of Ce at $1^\circ \times 1^\circ$ resolution with the daily-integrated FRP values obtained from the Global Fire Assimilation System (https://atmosphere.copernicus.eu/fire/) to generate global daily maps of total particulate matter (TPM) at $0.1^\circ \times 0.1^\circ$ resolution from 2003 to the present. From these values of TPM and using an updated data set of traditional BB emission factors, estimates of a number of other BB emissions species were generated as part of the FEERv1 product. Global annual averages of FEERv1 emissions fall between some commonly used biomass burning emissions inventories, with bottom-up inventories generally underestimating and other top-down inventories generally overestimating as compared to FEERv1, which averages 80 Tg/yr of TPM between 2003-2014. Uncertainty in global fire emissions have historically been on the order of 100%. A study to estimate FEERv1 uncertainty in African anthropogenic shrubland fires has shown that the emissions estimates for larger fires results in an uncertainty of 50% for TPM, increasing to $\geq$100% for the smallest fires. Modeling efforts are ongoing to identify the regions of the FEERv1 product's strengths and weaknesses, in order to gain an understanding of how the product needs to be updated in the next major product release. In at least one case studied, WRF-Chem simulations in Africa have shown FEERv1 to produce a representative spatial distribution of smoke aerosol loading as observed from satellite. The FEERv1 emissions product is also being evaluated with the NASA GEOS-5 Goddard Chemistry Aerosol Radiation and Transport model (GOCART). Initial results indicate that the simulated aerosol optical depth (AOD) with FEERv1 compares fairly well with ground measurements from the AERONET network (http://aeronet.gsfc.nasa.gov/) in the major BB regions. Future version updates to the FEER emissions inventory will include further constraints on the uncertainty by improving the native resolution of the algorithm and providing a means of identifying some of the main factors that contribute to the uncertainty in different regions.