EGU21-8331
https://doi.org/10.5194/egusphere-egu21-8331
EGU General Assembly 2021

Vegetation responses to climate extremes recorded by remotely sensed atmospheric formaldehyde

Catherine Morfopoulos[1,2], Jean-François Müller[3], Trissevgeni Stavrakou[3], Maite Bauwens[3], Isabelle De Smedt[3], Pierre Friedlingstein[4], Ian Colin Prentice[1,5,6], and Pierre Regnier[2]

[1]Imperial College of London, Department of Life Sciences (Silwood Park), Berks, United Kingdom of Great Britain – England, Scotland, Wales (c.morfopoulos@imperial.ac.uk)

[2]Department of Geoscience, Environment & Society, Université Libre de Bruxelles, Brussels, Belgium

[3]Royal Belgian Institute for Space Aeronomy, Brussels, Belgium

[4]College of Engineering, Mathematics and Physical Sciences, University of Exeter, Exeter, UK

[5]Ministry of Education Key Laboratory for Earth System Modeling, Department of Earth System Science, Tsinghua University, Beijing 100084, China

[6]Department of Biological Sciences, Macquarie University, North Ryde, NSW 2109, Australia

Accurate monitoring of vegetation stress is required for better modelling and forecasting of primary production, in a world where heatwaves and droughts are expected to become increasingly prevalent. Variability in formaldehyde (HCHO) concentrations in the troposphere is dominated by local emissions of short-lived biogenic (BVOC) and pyrogenic volatile organic compounds. BVOCs are emitted by plants in a rapid protective response to abiotic stress, mediated by the energetic status of leaves (the excess of reducing power when photosynthetic light and dark reactions are decoupled, as occurs when stomata close in response to water stress). Emissions also increase exponentially with leaf temperature. New analytical methods for the detection of spatiotemporally contiguous extremes in remote-sensing data are applied here to satellite-derived atmospheric HCHO columns. BVOC emissions are shown to play a central role in the formation of the largest positive HCHO anomalies. Although vegetation stress can be captured by various remotely sensed quantities, spaceborne HCHO emerges as the most consistent recorder of vegetation responses to the largest climate extremes, especially in forested regions.