EGU23-15565
EGU General Assembly 2023

Reducing uncertainty in extreme weather vegetation stress modeling using satellite-model approach at high resolution

Arpita Verma[1], Louis Francois[1], Ingrid Jacquemin[1,2], Benjamin Lanssens[1], Alain Hambuckers[3], Alessandro Ugolotti[4], Merja Tölle[4], and Eric Hallot[5]

[1]University Of Liege, Astrophysics Geophysics and Oceanography, Unité de Modélisation du Climat et des Cycles Biogéochimiques(UMCCB), Liege, Belgium (arpitaverma08@gmail.com)

[2]Service public de Wallonie, Namur ,Belgium

[3]Behavioral Biology Department and UR SPHERE Research Unit, University of Liege, Belgium

[4]Center for Environmental Systems Research, University of Kassel, Kassel, Germany

[5]Scientific Institute of Public Service (ISSeP),Liege,Belgium

Vegetation is a key driver for carbon uptake from the atmosphere to the land. Yet episodes of plant stress and mortality associated with drought and heat waves due to persistent lack of precipitation have been reported over the last decades and are expected to increase under ongoing climate change. It is presumed that climate-related vegetation stress results in progressively worsening plant health and rising mortality. However, the mechanisms driving such mortality are still up for debate because of the complex interconnections between the processes and the factors. Monitoring plant stress and mortality at the ecosystem level remains challenging to quantify since long-term, tree-individual, reliable observations are uncertain. For this reason, here we adapted a satellite-model approach to work on regional forests, before up scaling the results to the global forest.

In Belgium, the Wallonia region is covered by 30% forests which are the highest among all the three regions. While with the consecutive recent extreme events especially the droughts and heat waves of 2018, 2019, 2020, and 2022 caused water stress and bark beetle attack. According to the 35 years (1985-2022), land use land cover change extracted by LANDSAT 5,7, and 8 satellites, there is no significant change in forest land in Wallonia, Belgium. Meanwhile, in the current years 2021-2022, there is a decrease in the tree canopy with intensive forest management due to tree plant stress. On the other hand, in Wallonia, the forest is distributed in a significant patch of broadleaves, coniferous leaves, and mixed forest. However, we found that consecutive drought events cause water stress on specific plant species like Norway spruce which are in vulnerable states. For example: in a mixed forest when bark beetle or *Scolytinae* attacked the spruce tree it is more attracted to the other trees and in this consequence tree species –like birch and oak –are now also in premature death or deteriorating tree health. In this study, we are using a high spatial resolution (25cm) remote sensing images using Artificial Intelligence and machine learning techniques to find out pixel-based individual plant stress or mortality. In addition, the high-resolution tree mortality extracted data will be used to calibrate CARAIB dynamic vegetation model and analyze the impact of extreme events on trees during the recent past and the future (until

2070). In conclusion, from this study, we plan to improve our model regarding the implementation of plant traits and species mortality aspects towards a better prediction of forest tree species' vulnerability to future extreme weather events.