EGU24-7210, updated on 20 May 2024
https://doi.org/10.5194/egusphere-egu24-7210
EGU General Assembly 2024

Drought risks based on changes in atmospheric evaporative demand due to plant response to CO2 levels

Kyung-Ja Ha[1], Ji-Hye Yeo[2], Daeha Kim[3], and **Hyeonho Lee**[4]
[1]Department of Atmospheric Sciences, Pusan National University, Busan, Republic of Korea (kjha@pusan.ac.kr)
[2]Department of Atmospheric Sciences, Pusan National University, Busan, Republic of Korea (jihye@pusan.ac.kr)
[3]Department of Civil Engineering, Jeonbuk National University, Jeonju, Republic of Korea (daeha.kim@jbnu.ac.kr)
[4]Department of Atmospheric Sciences, Pusan National University, Busan, Republic of Korea (hyeonho@pusan.ac.kr)

The temperature and CO_2 increase due to global warming are expected to exacerbate atmospheric water demand, worsening future drought conditions. Recent studies have revealed that evapotranspiration is regulated by stomatal response in response to CO_2 increase. However, understanding droughts defined based on evapotranspiration remains incomplete as it does not adequately integrate plant responses to anticipated drought conditions. In this study, we aimed to evaluate the frequency and extent of future drought events by comparing the Evaporative Stress Index (ESI) using two potential evapotranspiration (E_p) values capturing atmospheric evaporative demand. The first E_p utilized past data and predictions from the Coupled Model Intercomparison Project Phase 6, assuming a constant surface resistance (r_s) without considering plant responses. The second E_p accounted for the sensitivity of r_s to increased CO_2. Our findings indicate a significant increase in r_s due to elevated CO_2, leading to substantial changes in drought frequency and extent. While both non-vegetative response and plant response are expected to increase in future scenarios, an ESI that ignores plant responses tends to overestimate drought risk. Therefore, our study emphasizes the importance of integrating the sensitivity of r_s to evaporative demand and CO_2 level increases when assessing drought risk.