Rupert Ford Award - Report

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First and foremost I would like to express my deepest gratitude to the Rupert Ford Award, administered by the Royal Meteorological Society, for their extremely generous financial support of my two month research visit to the University of Washington. The trip was a great success and laid the groundwork for collaboration between the Department of Atmospheric Sciences at the University of Washington and the Department of Mathematics at the University of Exeter.

The objective of the research visit was to study how the plant physiological response to rising CO_2 levels in the atmosphere influences precipitation change (ΔP) in the tropics. Based on previous work by Skinner et al. (2017), Chadwick et al. (2017) and Kooperman et al. (2018) we hypothesised that the response of vegetation to elevated CO_2 would result in an amplification of the ΔP seen in simulations where this effect is neglected. The net response of vegetation to CO_2 forcing is to reduce evaporation over land due to a decrease in stomatal conductance, at least in one Earth System Model (Skinner et al., 2017). After implementing a representation of CO_2 dependent stomatal conductance in 'Isca', our framework for constructing idealized Atmospheric General Circulation Models (Vallis et al., 2018), we quickly discovered that a reduction in stomatal conductance with warming does indeed result in an amplification of ΔP compared to our simulations without vegetation.

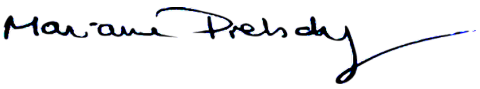
In order to study the different ΔP responses over Africa, America and the Maritime Continent we conducted a series of experiments with rectangular continents of varying size and different strengths of the stomatal response to CO_2. Those experiments yielded interesting insight into the ΔP dependence on moisture advection versus moisture recycling for a given continental size. We are currently undertaking more research and preparing a paper discussing the impact of vegetation on tropical precipitation change, which we hope to submit in the near future.

The above research was conducted together with Prof. Abigail Swann, who is an expert on the interaction between vegetation and the atmosphere (see e.g. Swann et al. (2016) and Swann (2018)). Prof. Swann also invited me to participate in her group's weekly team and reading group meetings, which gave me the opportunity to work and discuss our research with a very welcoming group of enthusiastic and highly knowledgeable scientists. Furthermore, Prof. Swann put me in contact with Prof. Dargan Frierson (Dept. of Atmospheric Sciences, UW) which resulted in another project.

The motivation for the project with Prof. Frierson was to understand whether it rains over land or ocean in the framework of the moist static energy (MSE) of the atmosphere. The modelling experiments undertaken for this research project have already lead to very interesting insight on the effects of humidity and temperatures on continental precipitation. Prof. Frierson, my supervisors at the University of Exeter (Dr. Hugo Lambert and Prof. Geoff Vallis) and I are very keen to continue the collaboration and possibly submit a short paper on this topic in the future.

In conclusion, this research visit was very fruitful since it lead to possibly two joint publications with the Department of Atmospheric Sciences at the University of Washington and has also greatly contributed to my development as a scientist. None of this would have been possible without the extremely generous support form the Rupert Ford Award, administered by the Royal Meteorological Society and I sincerely thank the Society for choosing to fund my research visit to the University of Washington.

Kind regards,



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