Geophysical Research Abstracts
Vol. 21, EGU2019-956, 2019
EGU General Assembly 2019

Downscaling land surface temperature for the Antarctic Dry Valleys using multi-sensor data and machine learning

Maite Lezama Valdes (1), Marwan Katurji (2), Hanna Meyer (1,3)

(1) Department of Geography, Philipps Universität Marburg, Marburg, Germany (mlezamavaldes@gmail.com), (2) Department of Geography, University of Canterbury, Christchurch, New Zealand, (3) Institute for Geoinformatics, University of Münster, Münster, Germany

The McMurdo Dry Valleys are a hotspot of biodiversity and vulnerable to climate change. As biodiversity is driven by local characteristics, high resolution data on terrain and climate are needed to monitor and predict the Antarctic biodiversity in the context of Climate Change. Land surface temperature (LST) is a major driver of biodiversity for which high resolution information is currently missing as the resolution of spaceborne LST products such as from MODIS Terra/Aqua is too coarse to describe habitats of the prevailing organisms.
Thus, the aim of this study is to downscale land surface temperature (LST) from 1km^2 (=1 MODIS pixel) to 1m resolution based on high resolution terrain properties and multispectral remote sensing data. The pilot study is carried out on a 1km^2 plot close to Spaulding Pond in the Taylor Valley of the Antarctic Dry Valleys.
The statistical downscaling of MODIS LST is being conducted using machine learning algorithms with IR brightness temperature and multispectral information (VIS, NIR, RedEdge) acquired during a UAV mission, a high resolution Lidar derived DEM and derived terrain and shading information, as well as land cover as predictor variables. The model was validated via blockwise spatial cross-validation and the relative importance of predictor variables was assessed via forward feature selection.
A first validation of the downscaled LST based on a single UAV flight indicated a high performance of the approach (R^2=0.52, r=0.72, RMSE= 1.56°C). Hence, the downscaled data provides a useful indication of temperature patterns in the study area.
This pilot study serves as a baseline to test the approach but also to plan a next field campaign which should allow to move from a case study to an improved and larger scale provision of downscaled LST data. In this context, the resolution of UAV-based IR data will be resampled to match Landsat 8 Thermal Infrared channel's resolution so that the feasibility of using such data can be tested which would allow covering the entire Dry Valleys. This is promising as the first results of this study showed that high resolution LST can be derived from satellite data with high performance and will provide valuable data to determine implications of local temperature patterns for the Antarctic ecosystem.