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Using random forest machine learning algorithm to help investigating the relationship between subglacial sediments and ice flow in Antarctica

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The presence of subglacial sediments is important in enabling streaming ice flow and may be a critical controlling factor in determining the onset regions of ice streams. Improving our knowledge of the location of sedimentary basins underlying large ice sheets will improve our understanding of how the substrate influences the ice streams. Advancing our understanding of the interaction between subglacial sediments and ice flow is critical for predictions of ice sheet behavior and the consequences on future climate change. To date, no comprehensive distribution of onshore and offshore sedimentary basins over Antarctica has been developed. The goal of this project is to use a combination of large-scale datasets to characterize known basins and identify new sedimentary basins to produce a continent-wide mapping of sedimentary basins and provide improved basal parametrizations conditions that have the potential to support more realistic ice sheet models. The proposed work is divided into three main steps. In the first step, the Random Forest (RF), a supervised machine learning algorithm, is used to identify sedimentary basins in Antarctica. In the second step, a regression analyses between aerogravity data and topography is done to evaluate the gravity signal related to superficial heterogeneities (i.e. sediments) and compare the results to the depth of magnetic sources using the Werner deconvolution method. Last, the correlation between sedimentary basins and ice streams is investigated. Here, we will present the preliminary results from Step 1. The Random Forest uses ensemble learning method for classification and regression. The classification rules for this present work are based on the geophysical parameters of major known sedimentary basins. First we classify the known basins with all available geophysical compilations including topography, gravity and magnetic anomalies, sedimentary thickness, crustal thickness, geothermal heat flux, information on the geology, rocky type and bedrock geochemistry, and then use the Random Forest machine learning algorithm to classify the geology underneath the ice into consolidated rock and sediments based on these parameters.