EGU24-6385, updated on 08 Mar 2024
https://doi.org/10.5194/egusphere-egu24-6385
EGU General Assembly 2024

Relationships between temperature, elevation, and surface exposure age in the McMurdo Dry Valleys, Antarctica

Taylor Bourikas et al.

The McMurdo Dry Valleys are an ice-free region along the coast of the Transantarctic Mountains that display well-preserved polar desert morphologic features, particularly at high elevations. The extent of these well-preserved features suggests that cold-desert conditions have been present for millions of years. This is thought to be because average summer air temperatures in much of the McMurdo Dry Valleys remain below -3°C, preventing significant amounts of liquid water from forming and in turn keeping erosion rates low. Recent climate simulations suggest that these freezing temperatures persist during summer months at high elevations in the McMurdo Dry Valleys, even during past warm periods characterized by significant ice sheet recession. Surfaces at lower elevations in the McMurdo Dry Valleys, subject to warmer temperatures during warm periods and interglacials, are thought to experience overall faster erosion rates compared to high elevation outcrops.

Here, we examine the relationships between elevation, temperature, and apparent surface exposure age for outcrops of the Beacon Sandstone in the McMurdo Dry Valleys. We use a compilation of cosmogenic nuclide measurements available in the ICE-D database to evaluate the correlation between apparent surface exposure age and elevation for outcrops of the Beacon Sandstone across the McMurdo Dry Valleys. At or near a number of the cosmogenic nuclide sites, local summertime ground and air surface temperature data are available from weather stations. We use these weather station data to document how ground temperatures, which ultimately control the availability of liquid water and therefore rates of surface processes, correspond with the apparent exposure ages and site elevations of Beacon Sandstone outcrops. In addition, we investigate whether field observations indicating a relationship between the coloration and surface appearance of Beacon Sandstone outcrops and the surface weathering/erosion rate can be quantified using satellite remote sensing data and the spectral properties of the outcrops. Tying all of these results together, we assess the role of temperature and other physical parameters on the rates of surface processes in the McMurdo Dry Valleys during the last few million ice-free years.

How to cite: Bourikas, T., Tremblay, M., Lamp, J., Balco, G., and Granger, D.: Relationships between temperature, elevation, and surface exposure age in the McMurdo Dry Valleys, Antarctica, EGU General Assembly 2024, Vienna, Austria, 14–19 Apr 2024, EGU24-6385, https://doi.org/10.5194/egusphere-egu24-6385, 2024.