Combining Mongolian Herder and Station Observations of Hydro-climate Change

Sukh Tumenjargal
ESS-Watershed Science, Colorado State University
National Security Council, Government of Mongolia, Ulaanbaatar, Mongolia

Steven R. Fassnacht*, Arren Mendezona Allegretti, Niah B.H. Venable
ESS-Watershed Science, Colorado State University

Maria E. Fernandez-Gimenez
Rangeland Ecosystem Science, Colorado State University

Batjav Batbuyan
Institute of Geography and Geo-ecology, Mongolian Academy of Sciences, Ulaanbaatar, Mongolia

Melinda J. Laituri
ESS-Watershed Science, Colorado State University

Abstract. The global climate has changing dramatically in recent decades, more than in most previous time periods. This changing climate has been identified by analyzing the climate from station measurements, paleo-proxies, such as tree rings and sediment cores, and indigenous knowledge (IK). Station-based analysis is used to quantify the actual change. However, in some parts of the world, such as Mongolia, stations are few and far-between and may not have a complete record. Here, we investigate the climate change estimates from station data and IK, in particular, herder observations. We administered questionnaires to herders in two different areas around the Khangai Mountains of Central Mongolia to estimate their observations of changes in precipitation and streamflow characteristics. The herder observations were on a five-point scale (e.g., large increase, increase, no change, decrease, large decrease) for each question. These data were assessed using the Potential for Conflict Index (PCI), that ranges from 0 (complete consensus) to 1 (least amount of consensus and the greatest disagreement). PCI results are displayed as bubble plots reflecting the amount of consensus on a specific question with y–axis or center of the bubble representing the mean rating. Trends in the time series of station data were analyzed using the Thiel-Sen's slope to identify rate of change and the Mann-Kendall test to assess the significance of the change. The rates of change for each of four stations per variable were scaled from -2 to +2 based on the maximum change and significance. These scaled station trends were then added to the plot of the PCI bubble for the series of herder observations. The combined plot illustrates the amount of agreement or disagreement between the station-trend and herder-PCI. Since each climate station only represents a small area, the herder-PCI value can be used to estimate uncertainty of the station data value across space.