



Glaciers and climate during the last 2000 years: comparison with high- and low- resolution regional proxy records

O. Solomina (1), G. Wiles (2)

(1) Institute of Geography, Moscow, Russia (olgasolomina@yandex.ru)

(2) Wooster College, Wooster, Ohio, USA (gwiles@wooster.edu)

Despite relatively numerous climatic proxy records, a persistent challenge is extracting low frequency variations in temperature and precipitation for the last two millennia. The challenge is complicated because of the different capacities of proxies to reproduce climatic variations at different frequencies and the often combined signals reflected in the proxies (e.g. temperature and precipitation). The strength of inferring past climate changes from the glacial geologic record is many glacial systems integrate decadal to century-scale changes in temperature and precipitation. Glacier variations can be used for low frequency temperature and precipitation reconstructions when they are combined with other proxies (e.g. Nesje and Dahl 2003). Although there are many cases of asynchronous glacier fluctuations, a strong argument for the reliability of the glacier record is made by their uniform retreat to contemporary warming.

The goal of this paper is to compare regional climatic reconstructions both based on tree-ring, upper tree limit, ice cores, speleothem, and lake sediments proxies to glacier variations at several key regions. This is done to determine if either temperature or precipitation driver and then to assess the synchronicity of these fluctuations worldwide and to link the most prominent events to potential forcings. We discuss the glacial evidence for the long-term climatic anomalies during the last two millennia, including the “Little Ice Age”, the “Medieval Warm Period” and the previous coolings during the First Millennium .

Preliminary comparisons suggest that considerable variability exists at the decadal scale in both the relative extent and timing of glacier and climate changes over the

last two millennia, however, at the century and sub-century scale common pattern in glacier variations becomes evident. The comparison of the best-dated glacial records in Alps, Scandinavia, Alaska, British Columbia, Canadian Rockies, and Patagonia demonstrate a broad synchronicity of main glacial events over the last millennium in the extratropics of the Northern and Southern Hemispheres. These include an initiation of massive glacier advances in 13th through 14th centuries, with many attaining their maxima in 17th to 19th centuries and general retreat in 20th century including the modern accelerating recession.), made up of several periods each lasting a matter of decades when glaciers were enlarged. Between the advances from 13th to early 20th century glaciers retreated but generally not as far back as the positions they occupied about AD 900-1100.

Earlier advances during the First Millennium AD are being recognized and a general ice expansion during this interval brings to question the millennial-scale variability of the last two thousand years. The relatively low frequency signal in marine proxy records is consistent with the pace of the last two thousand years as recorded in the glacial record. The structure of the century-scale variability appears to be related to century-scale variability in solar irradiance, which is also invoked as a forcing for longer period variability. Supported by ISTC-2947 and RFBR-040564644.