Clim. Past Discuss., 2, S745–S746, 2006
www.clim-past-discuss.net/2/S745/2006/

Climate of the Past Discussions

Interactive comment on "Multiproxy records of climate variability for Kamchatka for the past400 years" *by* O. Solomina et al.

Anonymous Referee #1

Received and published: 24 December 2006

Solomina et al. present an attractive combination of new and previously published, high-resolution proxy records for climatic change during the past 400 years from the northwest Pacific. One aspect of the study that I found particularly intriguing was the comparison of tree-ring (summer temperature) and ice-core (annual precipitation) records with the glacial record as represented by actual and modeled mass-balance measurements, and by moraines. As the authors point out, this approach provides a basis to interpret the geologic evidence of pre-historic glacier fluctuations in terms of climatic variability. In the end, however, I was left confused by the relation between glacier evidence and climate:

Glaciers were larger during the 19th century than during the 20th. Yet, a corresponding first-order trend is not exhibited by either the tree-ring or the ice-core record. Nor did

the “estimated” glacier mass balance decrease during the 20th century. This seems like a serious challenge to the proxy records and to the model used to reconstruct mass balance. Alternatively, this discrepancy might point to the sensitivity of glacier size to subtle variations in meteorological forcing and to non-linear glacier-hypsometric controls. For example, glacier length might respond more sensitively to variations in the seasonal timing of warmth (late season might be more important than early) and precipitation (transitional seasons might be key) compared to the other proxy records.

A related concern is the variable response time of glaciers to changes in temperature versus precipitation. Whereas I agree with the authors that low summer temperature and high winter precipitation are conducive to glacier growth, in detail, the two parameters will influence the position of the glacier terminus on different time scales. The effect of reduced summer melt on the terminus position is realized during the same year, whereas propagating a pulse of snowfall through the glacier depends on ice velocity and glacier size, among other factors.

Finally, when attempting to infer climate from glacier extent as represented by moraines, the lag between the positive mass-balance interval that lead to an advance versus the formation of the moraine is important. Moreover, lichenometric ages represent the stabilization of a moraine upon ice retreat, not advance. The term "advance" should be used only when describing the interval of glacier growth, not the period of glacier maximum extent, and certainly not the initiation of a glacier retreat.

Understanding the role of glacier lag times, the sensitivity of glacier size to detailed aspects of various meteorological factors, and the relation between the timing of climate change to moraine formation presents a major challenge to glacial geologists aiming to reconstruct climate from geomorphological evidence. The datasets presented by Solomina et al. present an untapped opportunity to explore some of these key issues.

Interactive comment on Clim. Past Discuss., 2, 1051, 2006.