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Blue Intensity based experiments for reconstructing North Pacific temperatures along the Gulf of Alaska

Rob Wilson (1,2), Rosanne D'Arrigo (1), Laia Andreu-Hayles (1), Rose Oelkers (1), Greg Wiles (1,3), Kevin Anchukaitis (1,4), Nicole Davi (1,5)

(1) Columbia University, Lamont-Doherty Earth Observatory, United States (lah@ldeo.columbia.edu), (2) University of Saint Andrews, Saint Andrews, UK, (3) The College of Wooster, Wooster, Ohio, USA, (4) University of Arizona, USA, (5) William Paterson University, New Jersey, USA

The Gulf of Alaska (GOA) is highly sensitive to the variability of the North Pacific climate system. Ring-width (RW) records from the GOA have yielded a valuable long-term perspective for North Pacific changes on decadal to longer time scales in previous studies, but can be less robust on interannual time scales due to autocorrelation and other factors. Similar to maximum latewood density (MXD), the novel Blue Intensity (BI) parameter has recently been shown to correlate strongly with year-to-year warm-season temperatures for a number of sites at northern latitudes. Since BI is much less expensive and labor intensive to generate than MXD, it has much value for future tree-ring studies in the GOA where few MXD records have been developed. Here we highlight the potential for improvement of reconstruction models using various combinations of RW and BI-related parameters (latewood BI and delta BI) measured from eight hemlock (Tsuga mertensiana) sites along the GOA. This is the first such study for the hemlock genus using BI data. We find that a combined experimental model using RW, delta BI and latewood BI best reflects inter-annual to multi-decadal temperature variability for the North Pacific sector, particularly during the warm-season months. A resulting test reconstruction (1792-1989 CE) of GOA CRUT 3.24 land JJAS temperatures (57-60ºN/154-134ºW) is significantly improved over that based on RW alone (58% vs 36% variance explained). Significant validation is also found with 19th century temperature data from Sitka, Alaska and using the BEST gridded data product. We therefore find that BI has considerable potential to become a sensitive, readily accessible alternative proxy for understanding past ocean-atmosphere variability in the GOA and elsewhere around the globe. A key need in furthering the utility of BI as a proxy is experimentation in the extraction of lower frequency variability.