

Kunashir (Kurile Islands) Oak Response to Temperature and relation to the Pacific Decadal Oscillation



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Abstract:

Studies of North Pacific variations, e. g. PDO, show it to be an important influence in larger-scale climate. Long-term records of the variations are scarce but can be extended by proxy records from old-aged trees around the Pacific Rim. In July of 2001 on Kunashir Island, tree cores were extracted from centuries-old oaks (*Quercus crispula*) and developed into a 400-year tree-ring width index series. Analyses showed the ring-width indices to correlate strongly with summer temperatures (Jun-Sept.) as recorded at Ugno-Kurilsky on the Island. The summer temperatures were reconstructed using the tree-ring data and 52 % of the variance was explained by the tree-ring indices. Both the recorded temperature data and the tree-ring data were compared to sea-surface temperatures of the North Pacific and showed similar correlation patterns for the North Pacific. This tree ring series alone can explain over 30% of the variation in summer (July-Sept.) PDO. This new series is a valuable addition to the regional temperature record and aids in analyses



Figure 1: Map of Kunashir Island, at the southern extent of the Kurile Islands, Russia. Location of Kunashir and the sampling site are indicated by *.

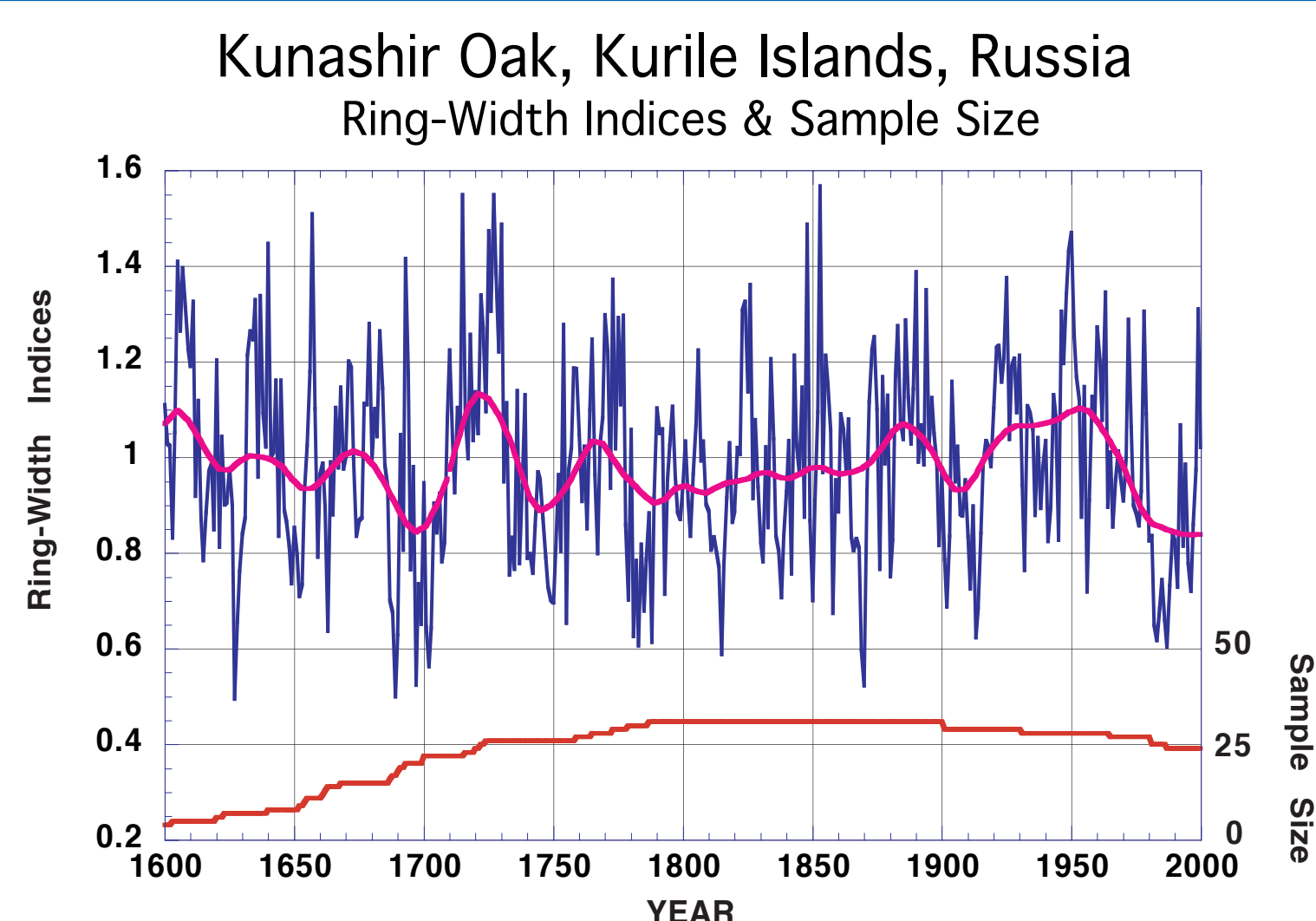


Figure 2: Plot of the ring-width indices and sample size for the oak chronology. The smoothed red line is a 25-year filter to show the low frequency variations more clearly.

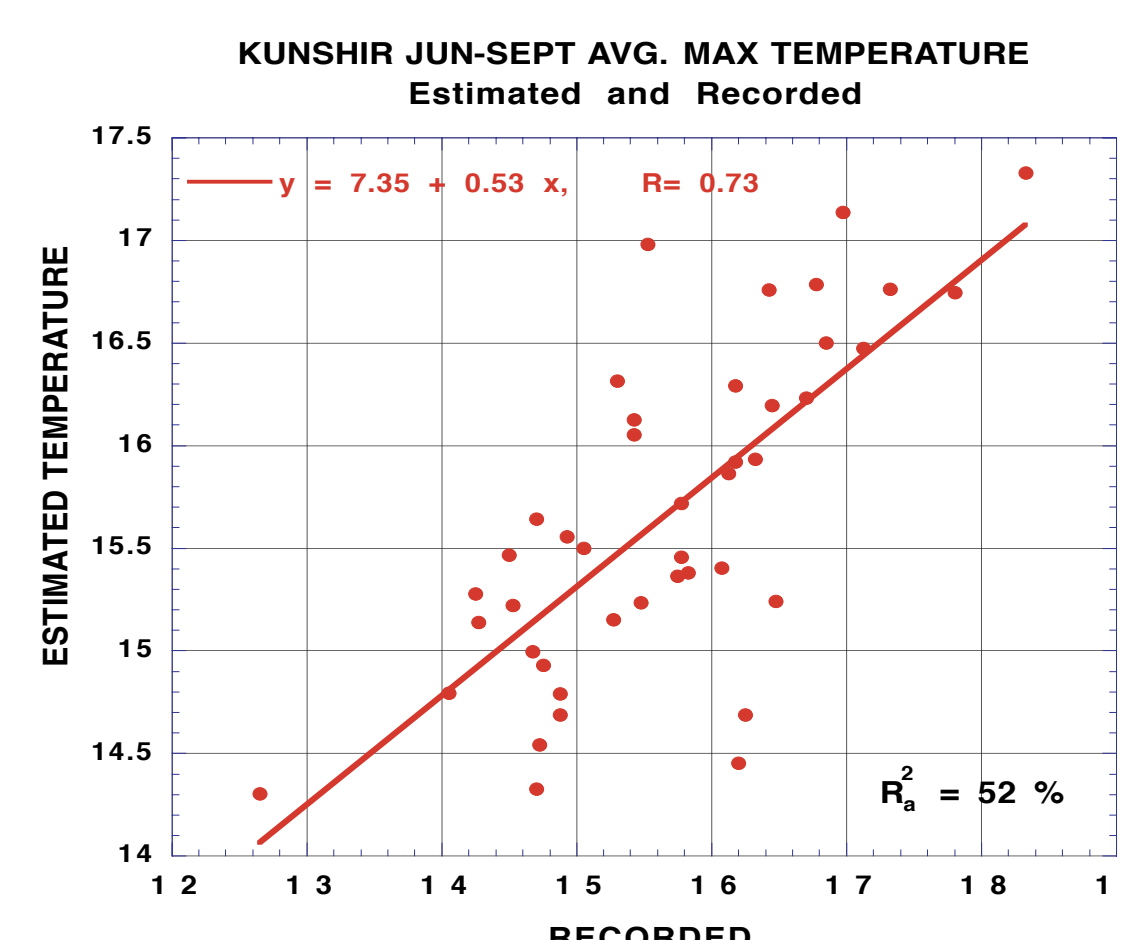
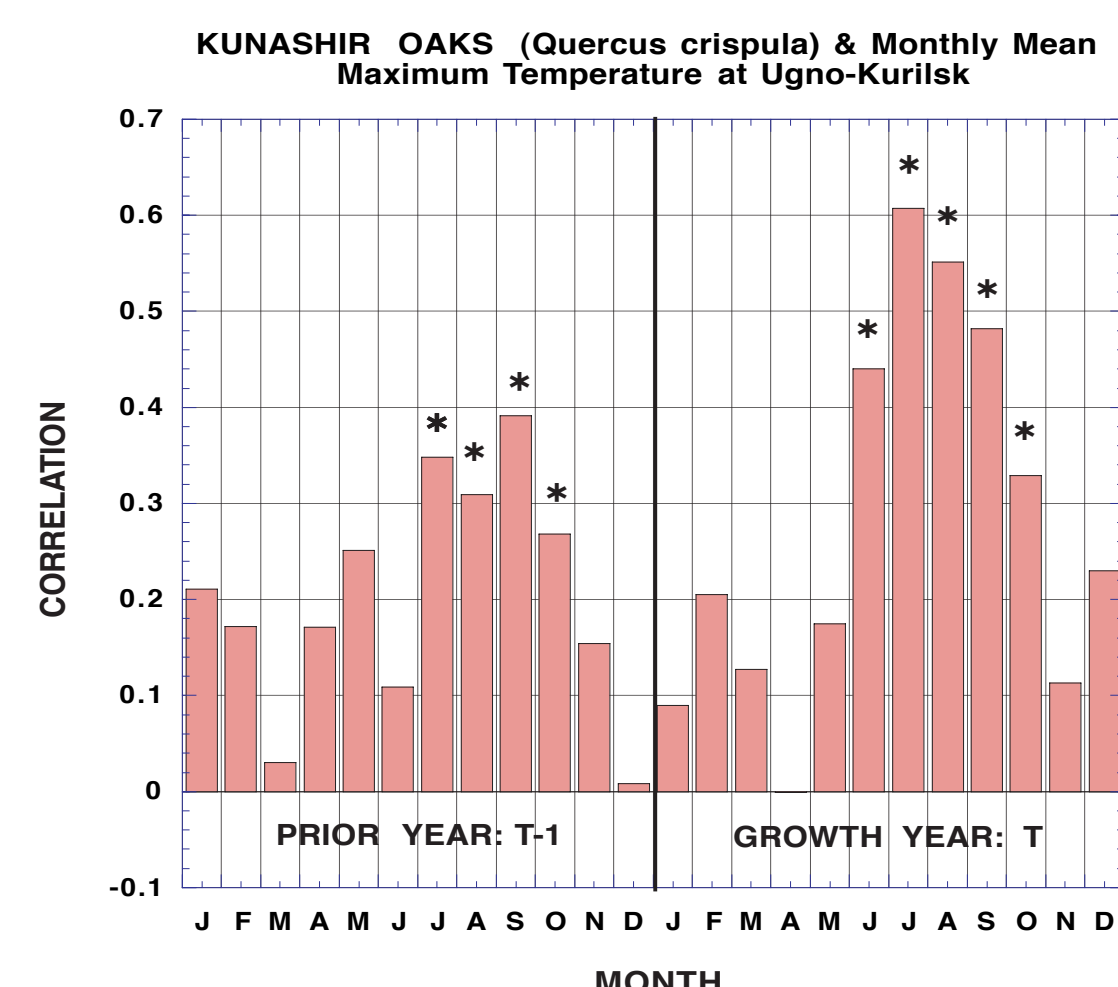


Figure 3 (upper frame): Plots of the correlations between Kunashir Oak ring-width indices and monthly mean maximum temperatures for the growth year and the preceding year (1947-1989). The correlations are indicated by the height of the bars. The asterisks mark correlations above the 0.05 significance level. Correlations are lower for the mean minimum and the mean temperatures.

Figure 3 (lower frame): This plot shows the results of the regression between the standard tree-ring chronology and the mean maximum temperature for June-September. The regression uses only the growth-year indices as predictors.



Figure 5: One of the oak (*Quercus crispula*) trees sampled. These trees have many branches and curved trunks. This makes them less desirable for structural or cabinet-making use and maybe helped them survive the woodsman's axe and saw until the Preserve was established.

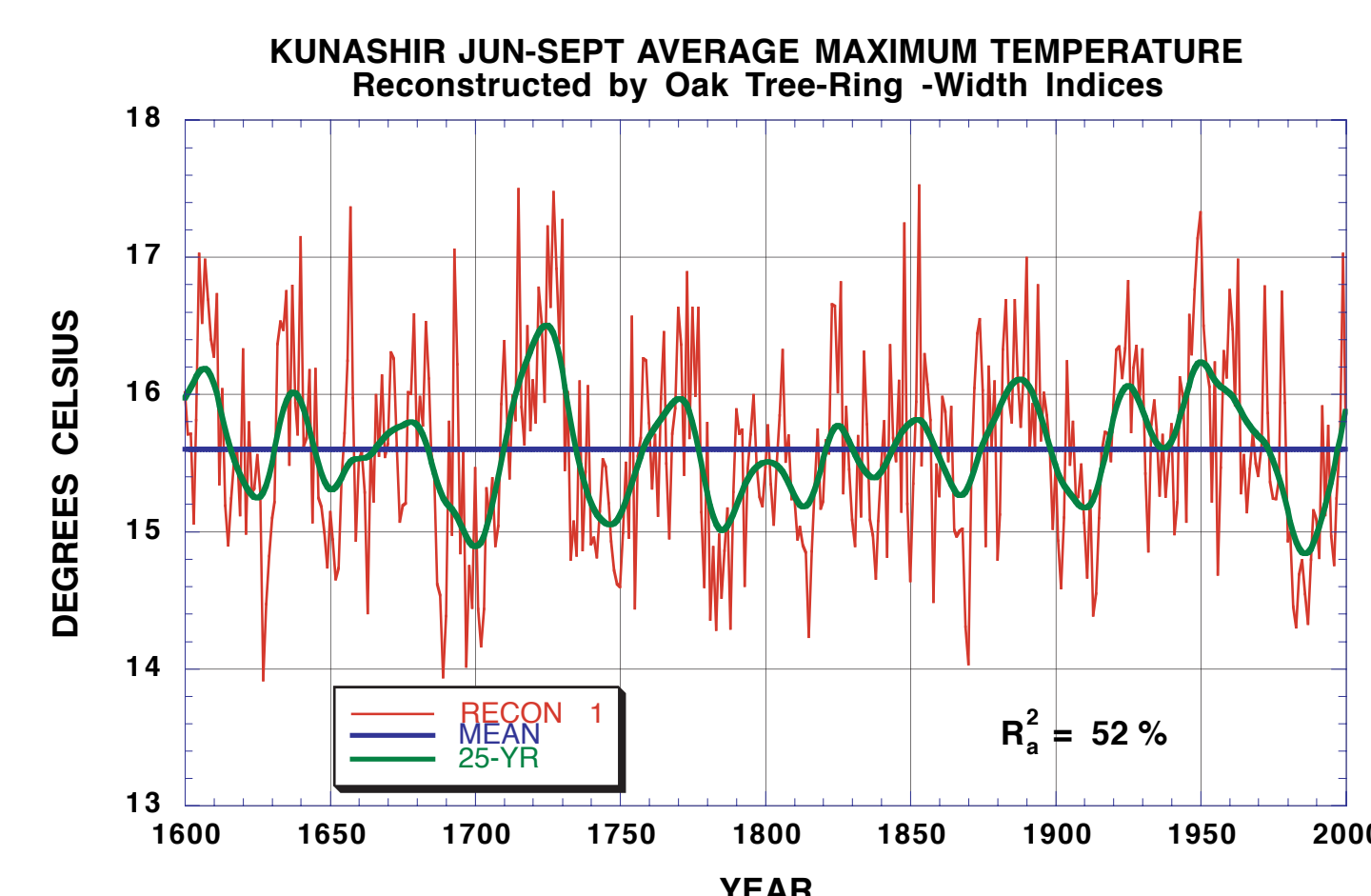


Figure 4: June-September mean maximum temperature reconstructed for the Ugno-Kurilsk station on Kunashir Island using tree rings. The reconstruction explains 52 % of the variance in temperature.

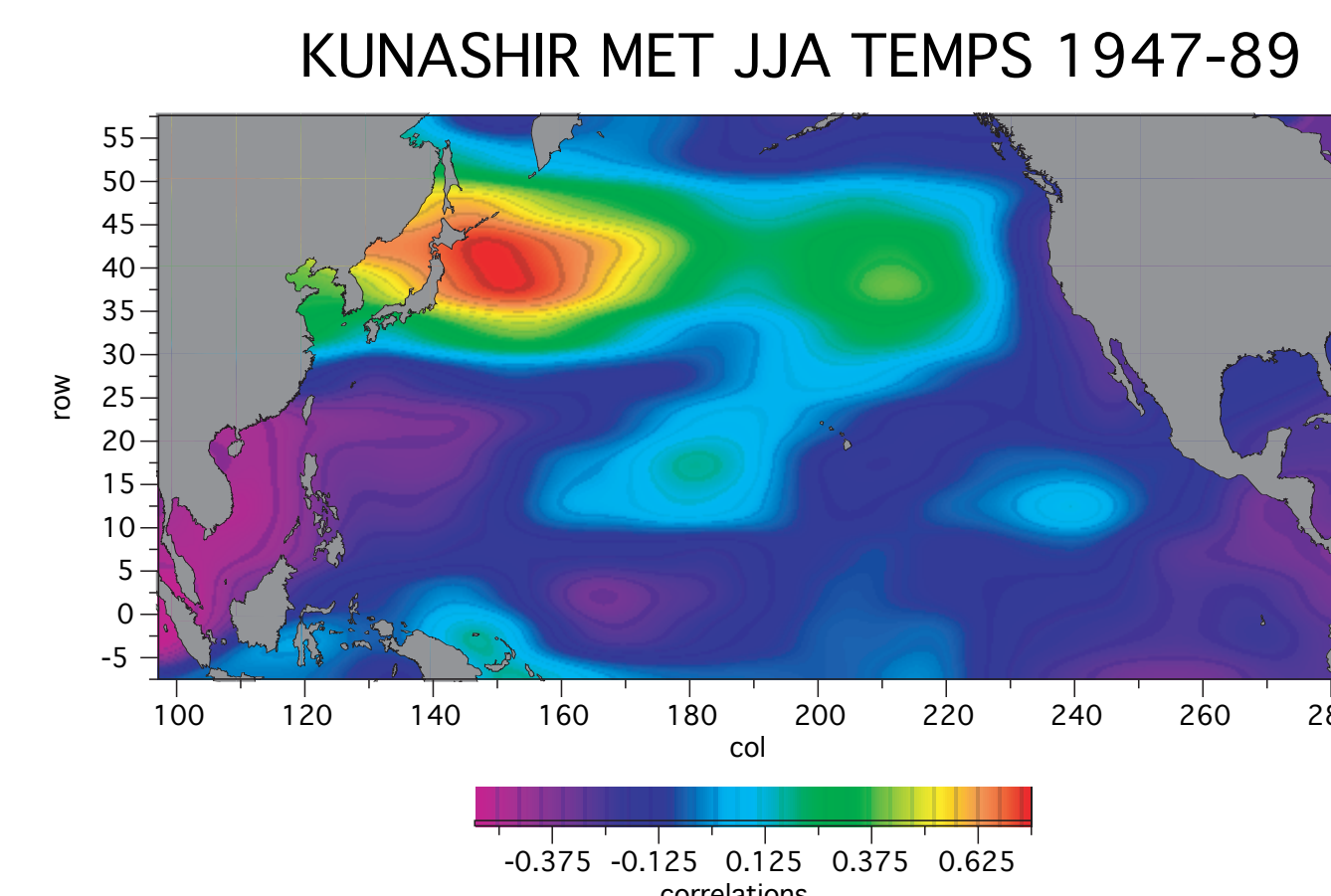
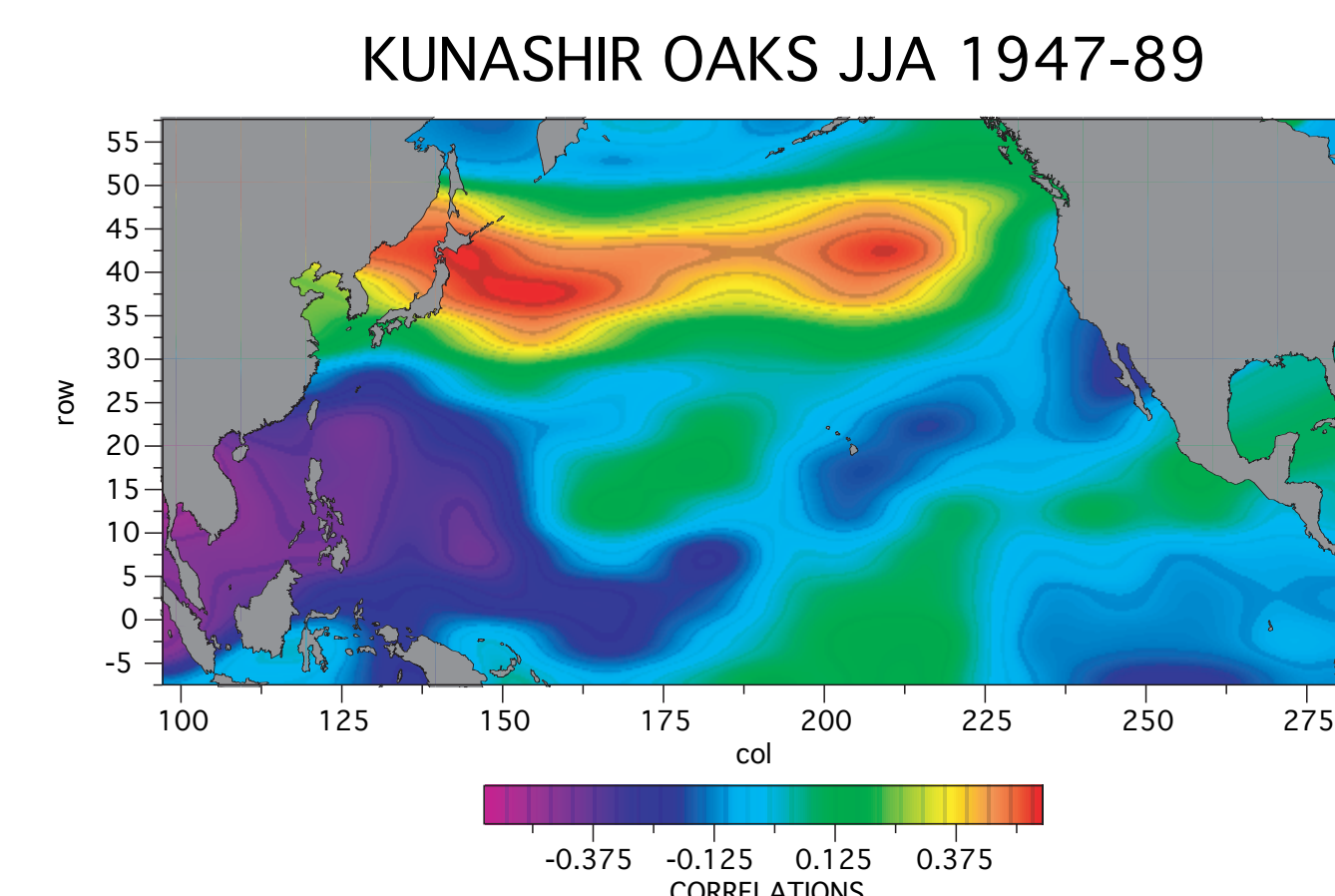
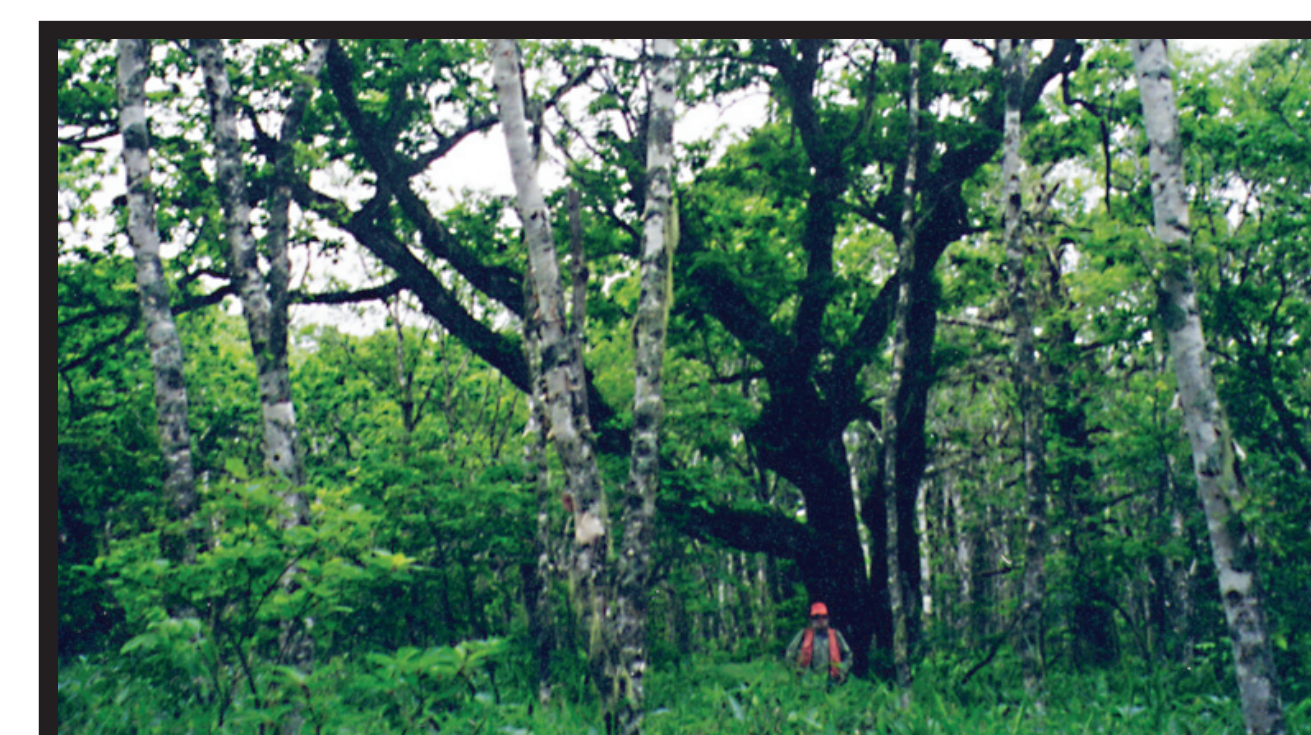


Figure 6: Correlation maps with sea-surface temperatures (SST). To test for regional climatic information the tree-ring data and the recorded temperatures were both compared to SST data. These correlation maps show significant and similar correlations and patterns with the SST data. The upper map is the tree-ring data and the lower map is the recorded temperature data from Ugno-Kunashir. Also, in a direct regression the tree-ring data explained about 30 % of the variance in the



Gordon in an oak-birch Kunashir forest