YELLOW CEDAR RECORDS VOLCANIC CLIMATE SHIFTS IN SE ALASKA

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INTRODUCTION

Research Focus

Utilize yellow cedar (*Cupressus nootkatones*) chronology from Dude Mountain (860m) to explain mechanisms of the PDO in relation to large volcanic eruptions that have occurred in the past 300 years.

Site Location and Climate Variables

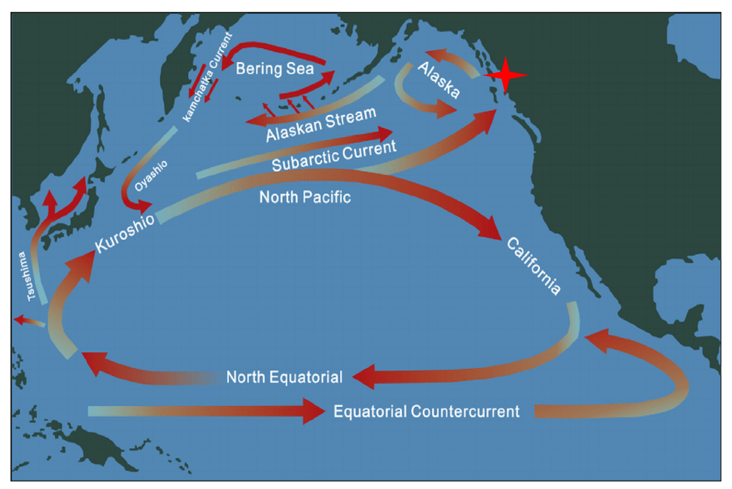

Figure 1 – Ocean currents in North Pacific Gyre, located between the equator and 50°N latitude. Dude Mountain marked by red star [1]

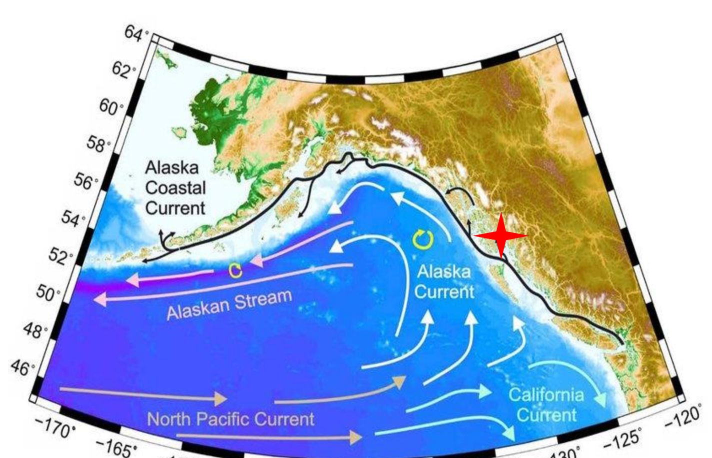

Figure 2 – Gulf of Alaska ocean circulations. Dude Mountain sits at 50°N (marked by red star) [2]

- Gulf of Alaska (GOA) climate influenced by North Pacific Ocean (Figure 1 & 2); decadal climate driven by the Pacific Decadal Oscillation (PDO). Stratospheric volcanic eruptions cool global climate (Figure 3)
- PDO pattern of climate variability, warm-cold phases in the GOA (Figure 4). Impacts GOA ecosystems and economies through variations of salmon abundance relative to each phase of the PDO.

Volcanic Cooling and PDO

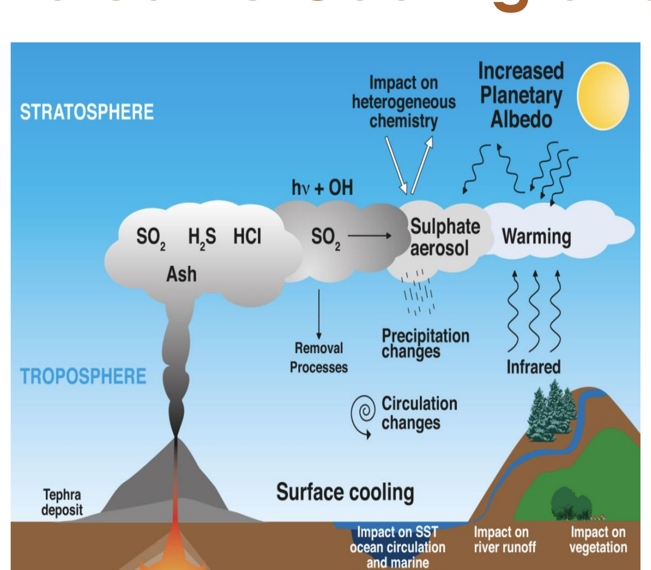

Figure 3 - A schematic diagram of stratospheric volcanic eruptions effects on regional climate. [3]

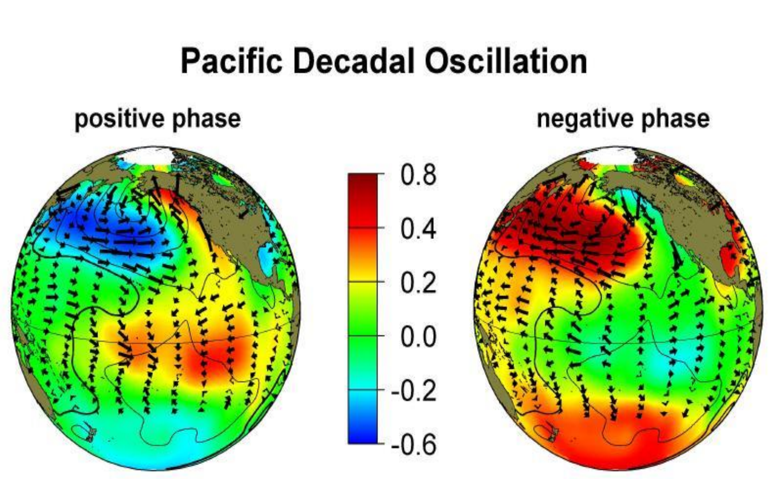

Figure 4 - The Pacific Decadal Oscillation (PDO) standard "horseshoe" pattern positive phase (warm) versus negative phase (cold). [4]

METHODS

Field Collection and Core Preparation

Figure 5 - A increment borer in a yellow cedar in SE Alaska collecting a tree ring core.

Figure 6 – Yellow cedar tree ring core mounted on a wood block, scanned and ready for counting.

- Site selected for old-growth, stand health, and elevational tree line.
- Extract core using increment borer, then dry, mount, sand, scan and count ring-width. (Figure 5 & 6)
- Analysis of individual cores (Figure 7), raw chronology, and sample depth (Figure 8) highlights mistakes and informs what spline to us.

Data Analysis

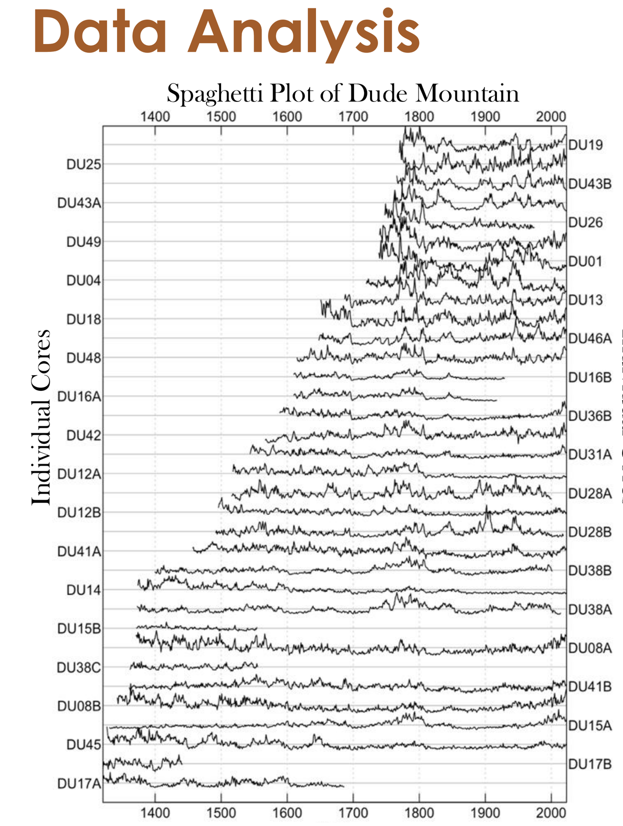

Figure 7 – Spag plot showing individual core length and characteristics.

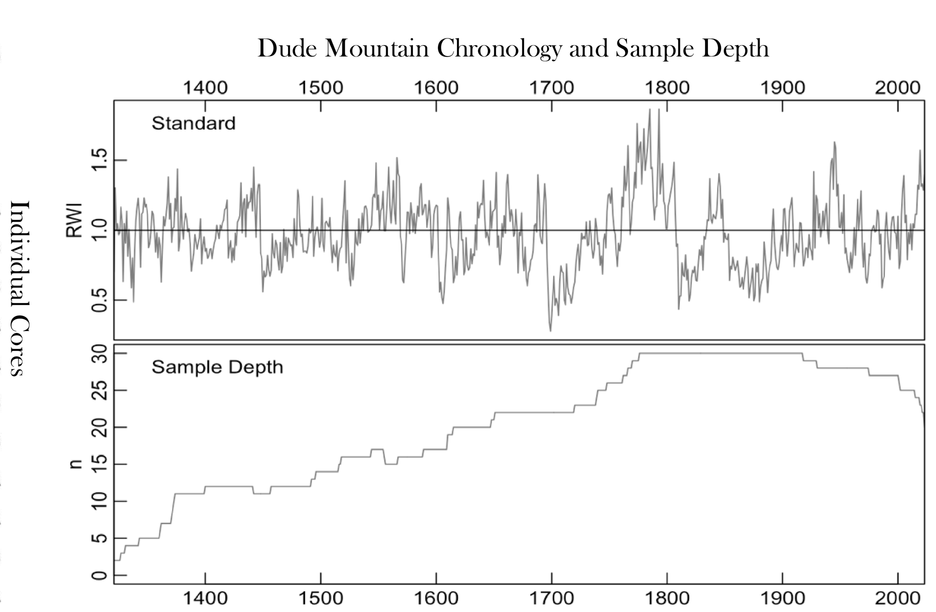

Figure 8 – Dude Mountain yellow cedar chronology (top) with sample depth (bottom).

RESULTS AND DISCUSSION

Dude Mt. Chronology and Correlations

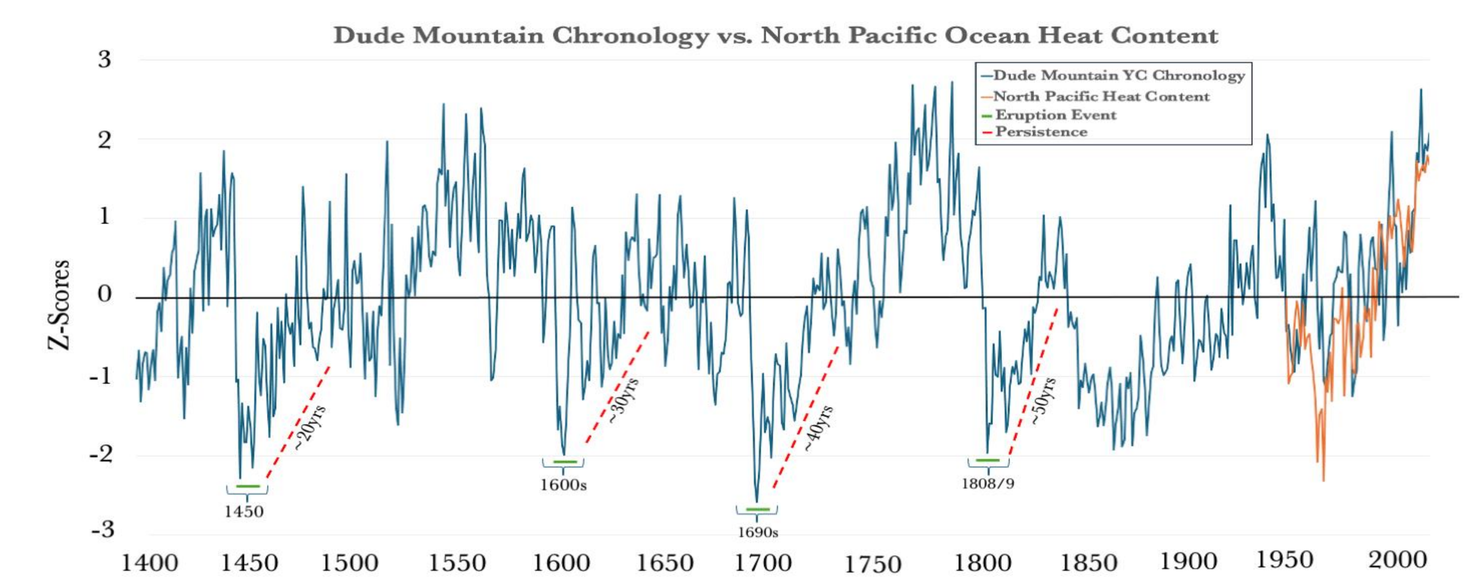

Figure 9- Dude Mountain chronology (blue line), volcanic eruptions (green line), persistence (dashed red line), and North Pacific Ocean Heat Content (OHC) (orange line).

- Four volcanic eruptions (1450, 1600, 1698/9, 1809) and correlations to North Pacific OHC. (Figure 9) [5]
- Negative correlations to May, June, July temperature, shift in 1910-1940 (12 months). (Figure 10 & 11)
- Models suggest volcanic eruptions cool ocean currents and drive atmospheric alterations [6]

Climate-Growth Response Analysis

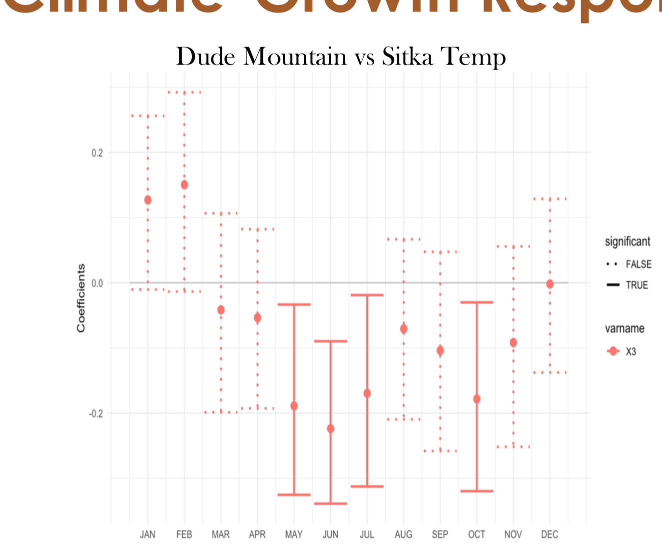

Figure 10 - Static monthly Sitka temperature correlations with chronology.

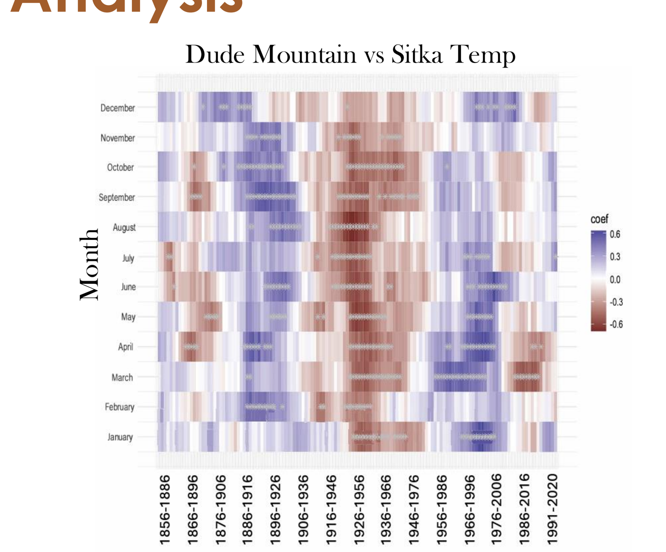

Figure 11 – Running correlations with a 31-yr period between the Sitka temperature data and chronology.

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