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Proposal for Analysis of Snow Metrics in the Snohomish River Basin

SNOTEL is a widespread data collection system that provides hydrologists data on snowpacks. This data includes measurements on atmospheric conditions as well as snow metrics. Using this data, we can predict certain qualities of the snowpack and how it will behave. Data has been collected for decades, and long term trends are emerging from comparing past data to current data. Historically, these stations have been used to predict snow patterns, warn of avalanche threats, and provide data for recreation snow users.

This project is going to study long term changes in snow metrics in the Snohomish river basin. Recent changes in atmospheric conditions, including a rising in temperatures caused by rising greenhouse gas levels, have had an effect on various snow metrics of this river basin. This project will analyze changes in several snow metrics, including snow depth, snow water equivalent (SWE), and air temperature to determine any long-term trends in the changing of these metrics. Furthermore, this project will attempt to explain any changes in snow metrics. These trends will help to predict future snow metrics, which has implications in flooding risk, watershed capacity, and recreational usage. Air temperature in particular will be of great importance moving forward due to global climate change. As climate warms, it will affect snowpacks across the planet, and being able to quantify small scale changes in the snowpack will help with larger studies in the future.

The scope of this project will be limited to the Snohomish river basin. Findings from this project may have implications elsewhere, however due to the high variance between snowpacks, it can be difficult to apply these findings elsewhere without additional data. This project will focus more on providing an analysis of this particular river basin and determining any trends in Snohomish snowpacks.

To achieve this goal, data from SNOTEL stations from the Natural Resource Conservation Service (NRCS) will be collected and analyzed from two gauges in the river basin: Alpine Meadows and Skookum Creek. Data collection at the Alpine Meadows site started September 22nd, 1994 whereas the data collection started on August 30th 1995 for the Skookum Creek station. To maintain consistency between the two sites, the analysis will begin on the first day of data at the Skookum Creek station. From these two stations, data regarding the SWE, snow depth, and average air temperature will be collected and worked in MATLAB to create time-series plots to identify any potential trends/changes in these parameters. Additionally, with

data on estimations of how much temperatures are supposed to increase due to climate change, predictions can then be made as to how these parameters will change in the future.

The project has only just started, so preliminary review and inspection of the available data has begun. This data needs to be put into an excel spreadsheet with the appropriate formatting for insertion into a MATLAB document. Following the creation of the excel sheet, the MATLAB notebook will need to be created to generate the necessary plots for analysis. Following identification of trends emerging from the plots, predictions of future changes can then be made with temperature increase estimates. This information can then be applied in settings such as reservoir management planning, flood risk, and other watershed management practices.

Regarding the scheduling of this project, review and feedback on the proposal will be conducted this week: January 25th, 2021 to January 29th, 2021. Incorporation of said feedback will be implemented for a revised proposal the following week: February 1st, 2021 to February 5th, 2021. Following the completion of the proposal, work on data processing can begin and the development of a midterm report with initial findings, the week of February 8th to February 12th. It is expected that immediate findings will include the identification of the trends in these snow metrics, while future estimations and implications for watershed management will be included in the final report and presentation. This project will be completed by mid to late February, culminating in a final report and presentation yet to be scheduled. For a visual representation of the proposed schedule, please reference the table included below.

Date	Work to be Done
January 25th-29th	Review proposal and get feedback
February 1st-5th	Revise proposal- incorporate feedback received
February 8th-12th	Begin analyzing SNOTEL station data and creation of MATLAB notebook to create time series graphs
TBD	Completion of data analysis
TBD	Creation of presentation and report compiling results
TBD	Presentation of results