Atmospheric Rivers in Southeast Alaska: Meteorological Conditions Associated with Extreme Precipitation & Differentiating between impactful and non-impactful Atmospheric River events

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Increased extreme precipitation events in Southeast Alaska (SEAK) are destabilizing infrastructure and threatening food security and safety, particularly in rural and Alaska Native communities. While atmospheric rivers (ARs) are the primary cause of these events, the atmospheric conditions linked to landslides, floods, and avalanches remain unclear. This study combines ERA5 data and station observations to develop a climatology of AR-related extreme precipitation events across six SEAK communities. The findings highlight the role of AR-related integrated vapor transport (IVT) direction in influencing precipitation outcomes, with stronger moisture transport contributing to extreme events. Although ARs occur 8–15 days per month, only nine ARs annually account for up to 90% of extreme precipitation.

The study also explores the relationship between AR-induced extreme precipitation and associated hazards like flooding and landslides. It shows that 80–96% of extreme precipitation days have high IVT, but AR intensity alone does not explain the full range of impacts. The study is developing AR-based forecasting tools that also account for freezing levels, low-level winds, and IVT direction. Furthermore, the research demonstrates the use of a model climate (M-Climate) based on NOAA's Global Ensemble Forecast System re-forecast data, improving forecast accuracy and situational awareness. This work aims to enhance forecasting, Impact Decision Support Services, communication, and preparedness in vulnerable SEAK communities before and during high impact weather events.

This presentation will summarize the AR climatology for selected cities in SEAK. Then highlight new Center for Western Weather Water Extremes (CW3E) AR Alaska tools developed for NWS forecasters and introduce another tool in development that will inform how impactful an AR will be based on selected elements.