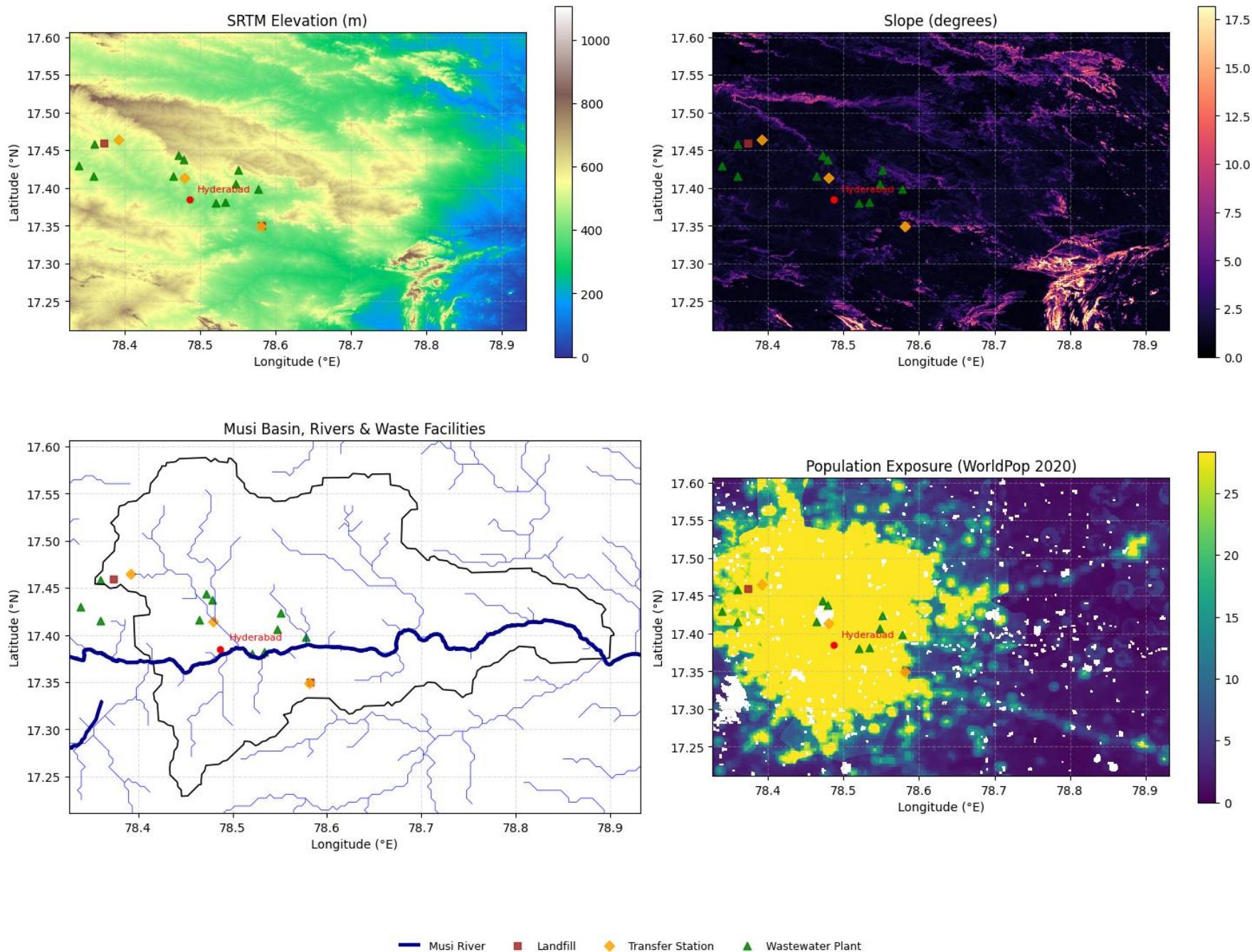


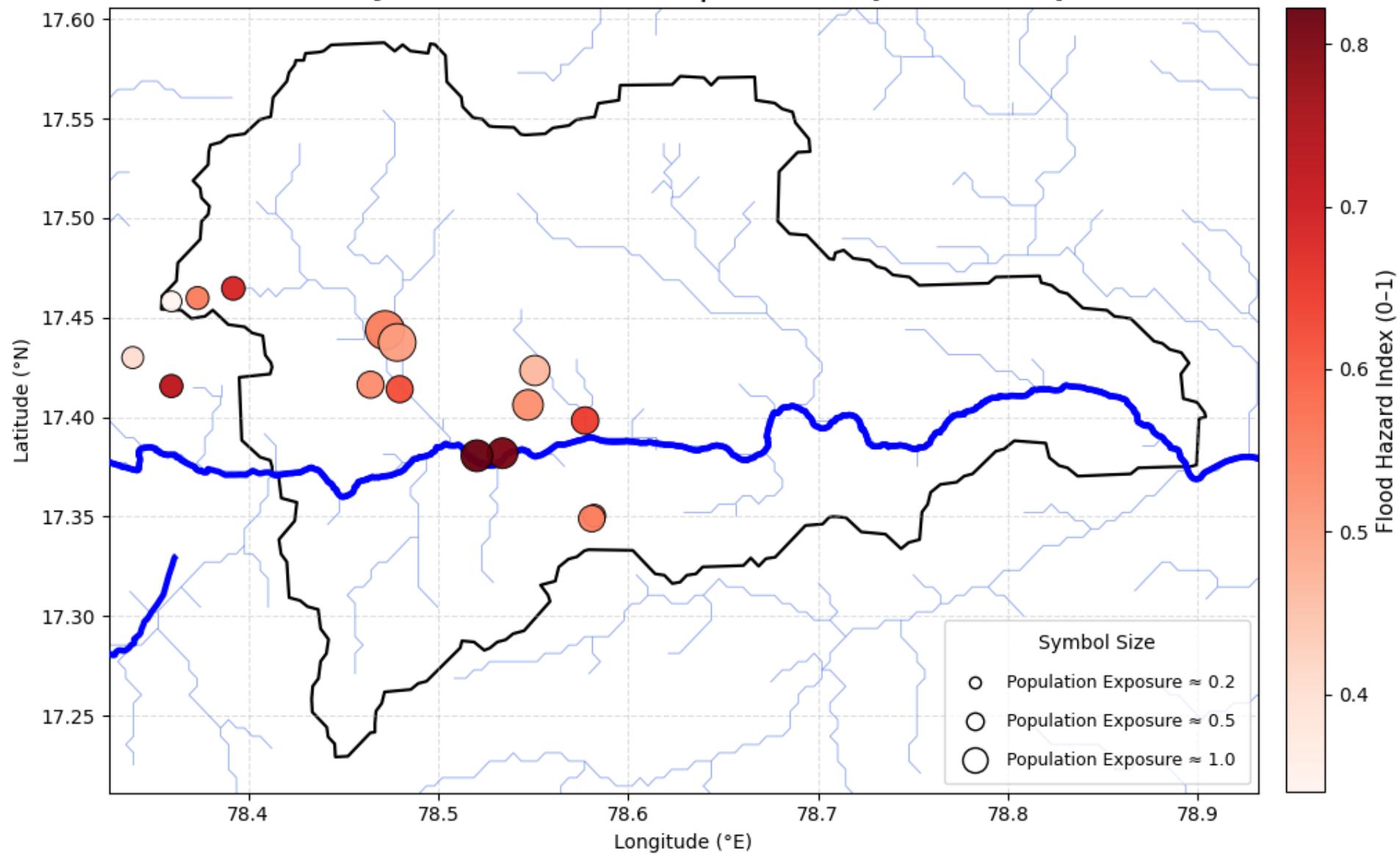
Static Hazard and Exposure Baseline

Musi Basin-Scale Integrated Exposure, Hydro-Terrain & Waste Infrastructure Context



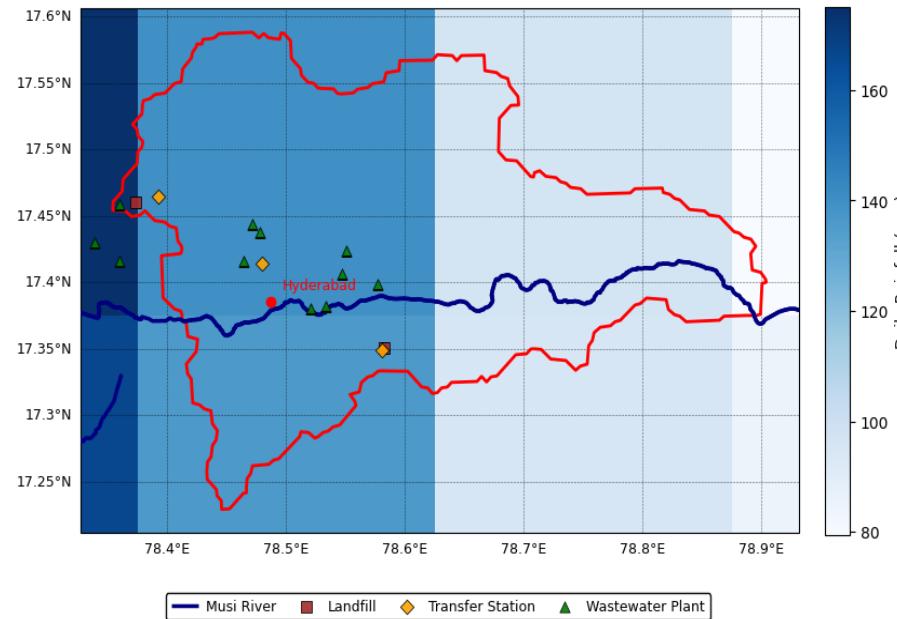
Musi Basin - Flood Hazard Index of Waste Facilities

Color = Physical Flood Hazard | Size = Population Exposure

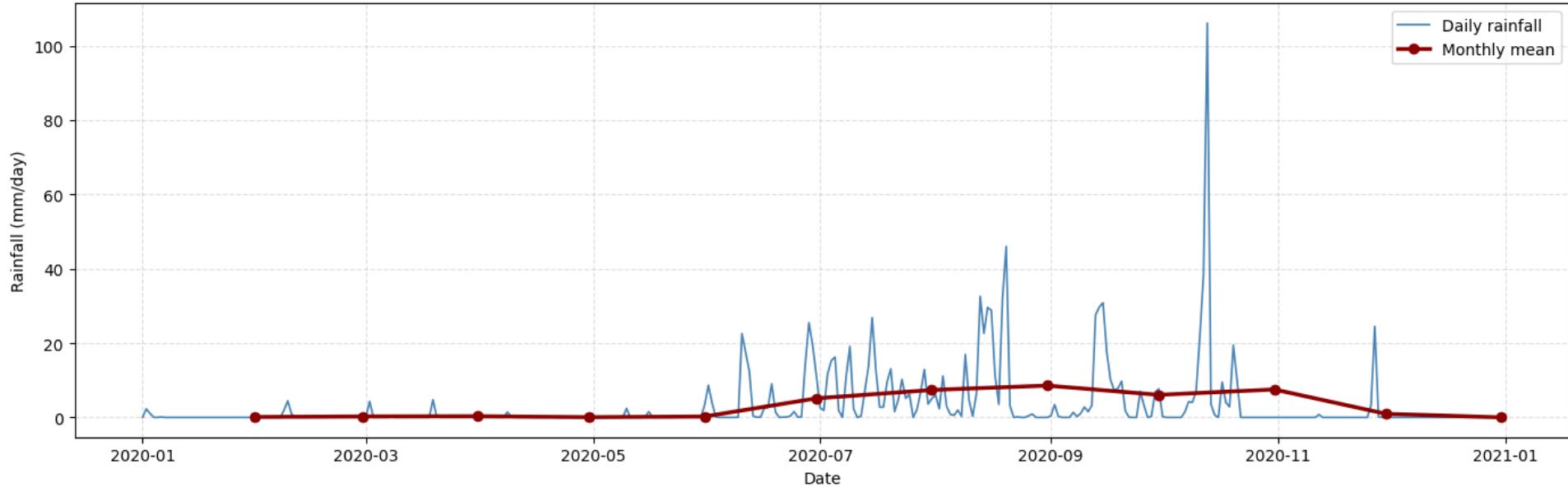


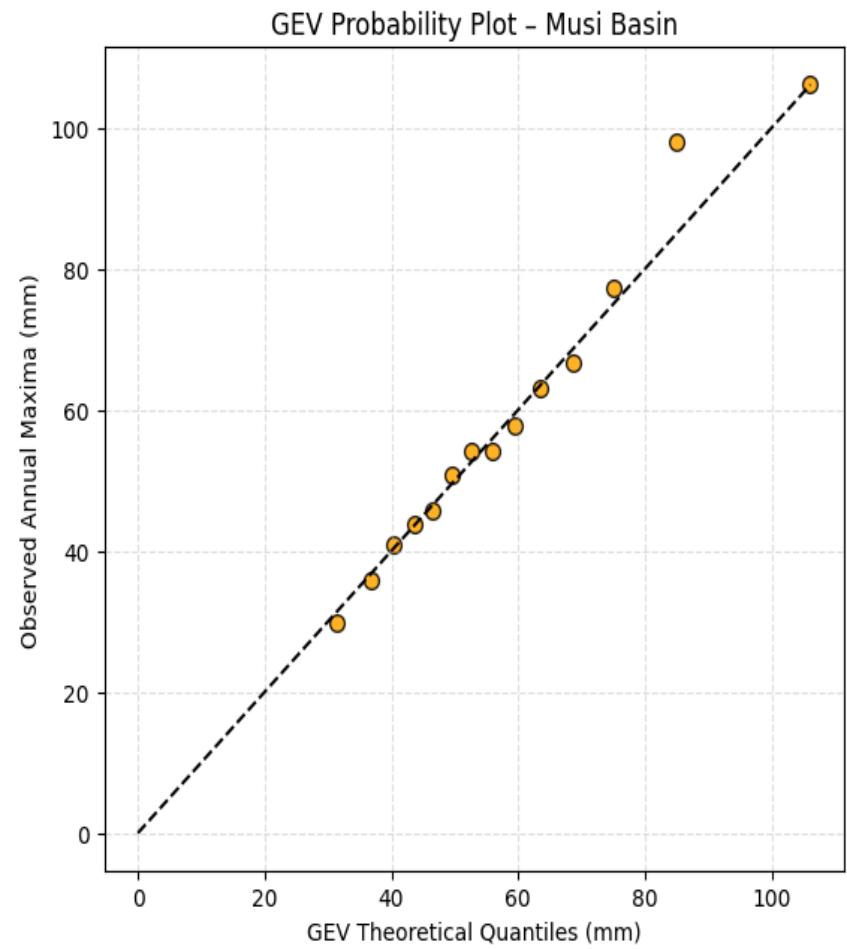
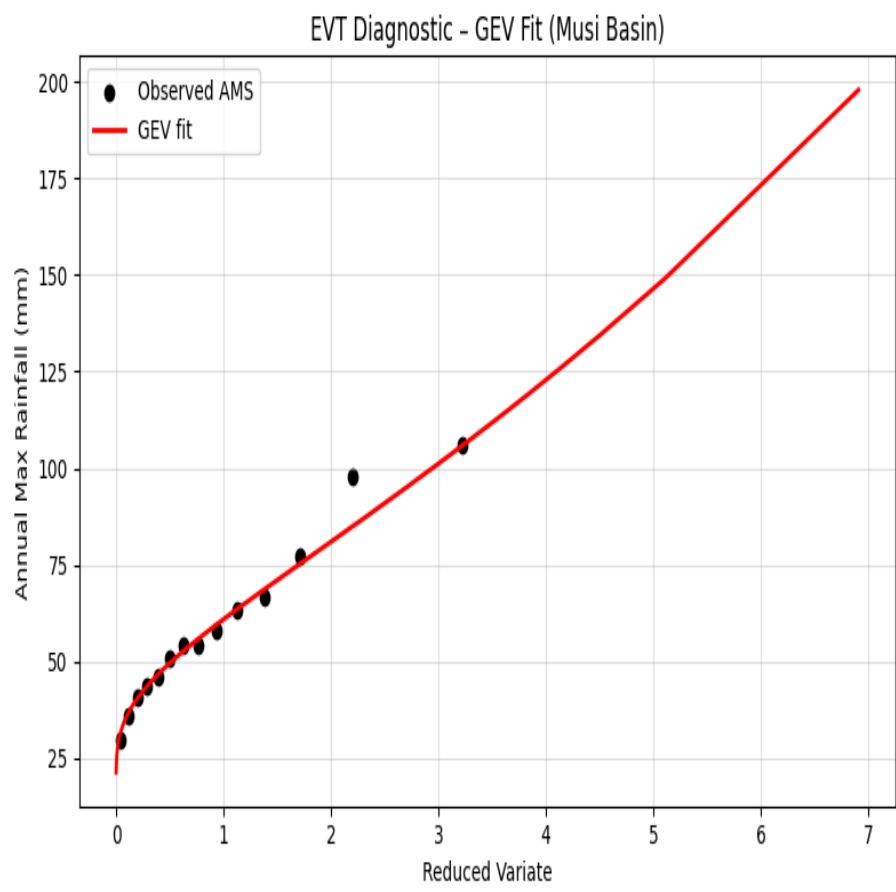
**DYNAMICS, EVT & DAMAGE
(Rainfall, Bias Correction, EVT, Hazard Scaling)**

ERA5 Daily Rainfall - Wettest Day in Musi Basin Region (2024-09-01)

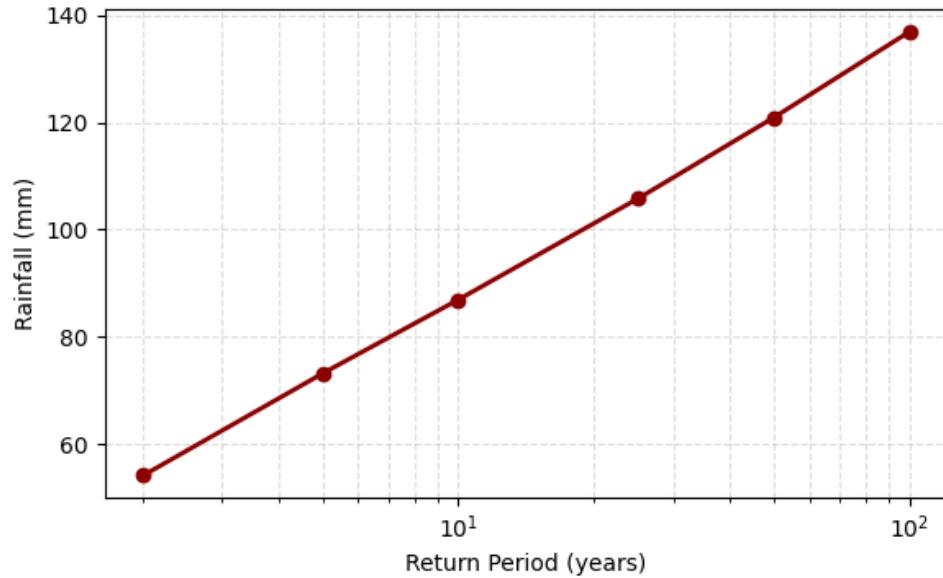


Musi Basin - Bias-Corrected Daily Rainfall (2020) ERA5 corrected using IMD observations

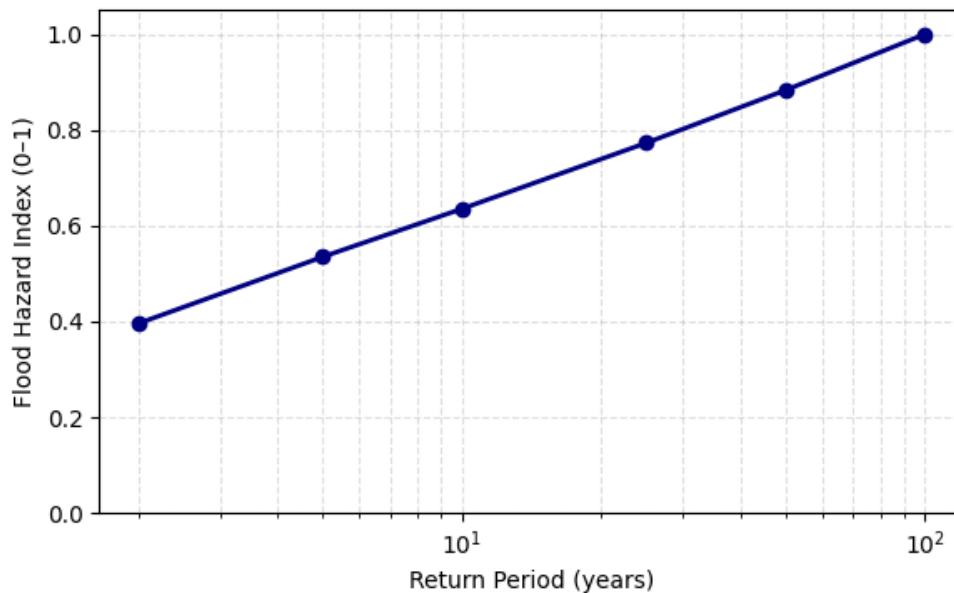




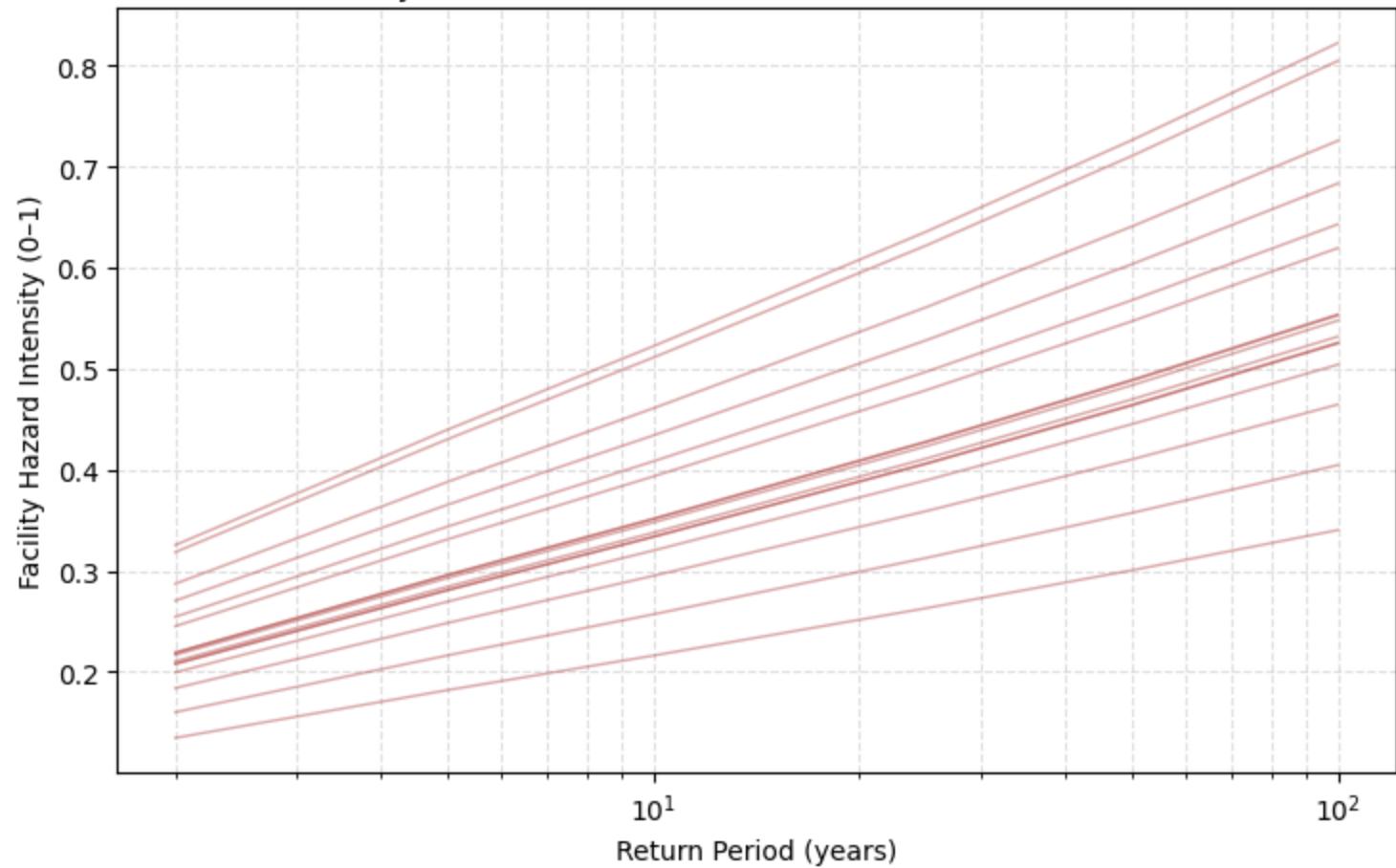
EVT Return Level Curve - Musi Basin



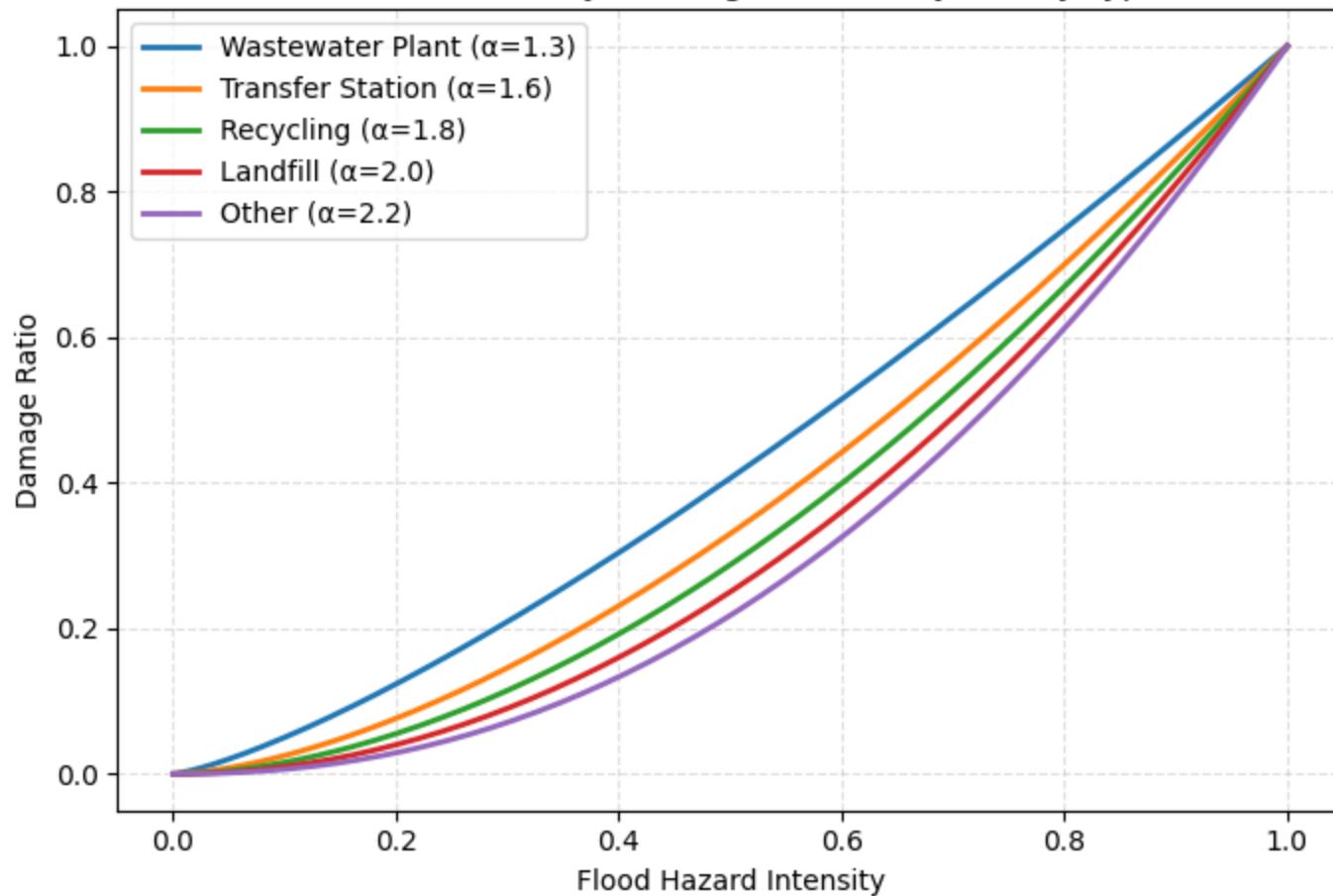
Basin-Level Flood Hazard Index - Musi Basin



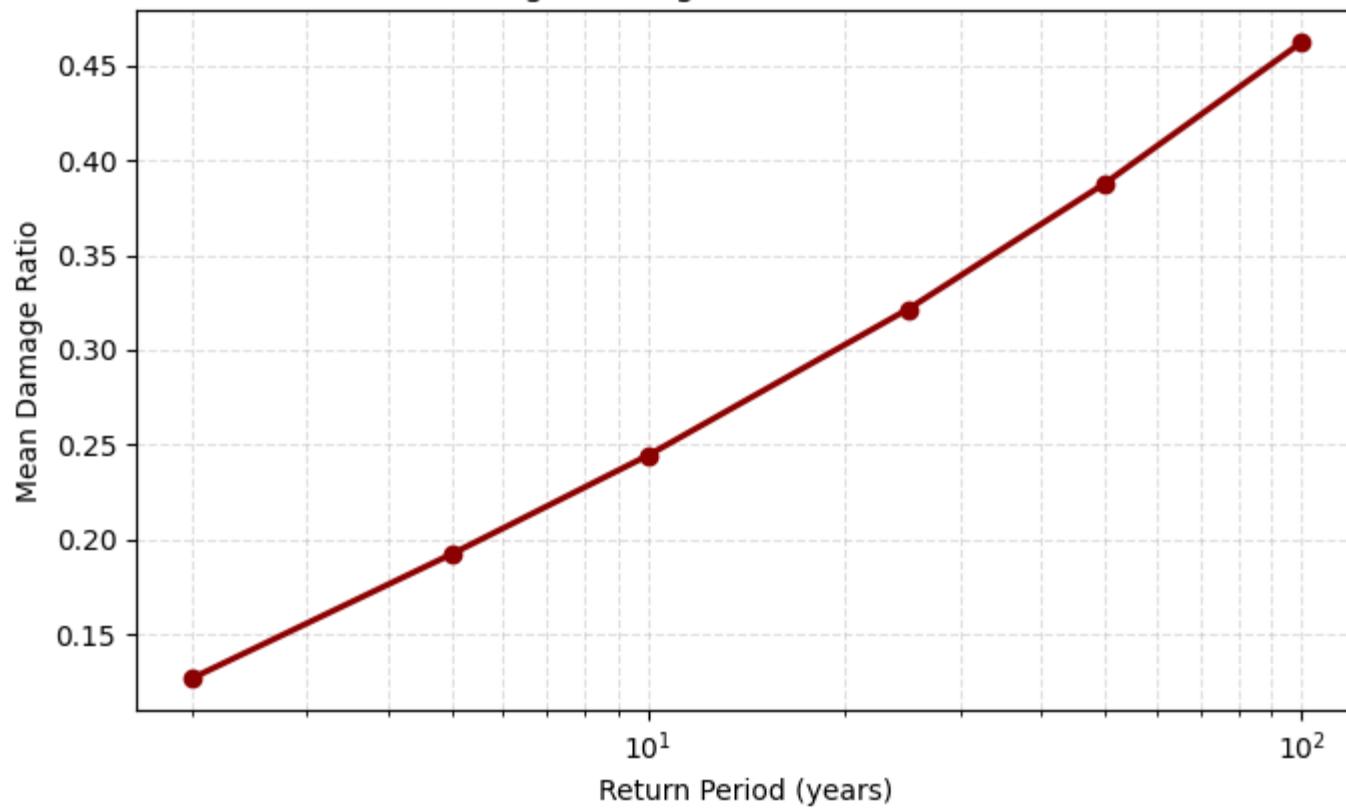
Facility-Level Flood Hazard vs Return Period - Musi Basin



Flood Vulnerability (Damage) Curves by Facility Type

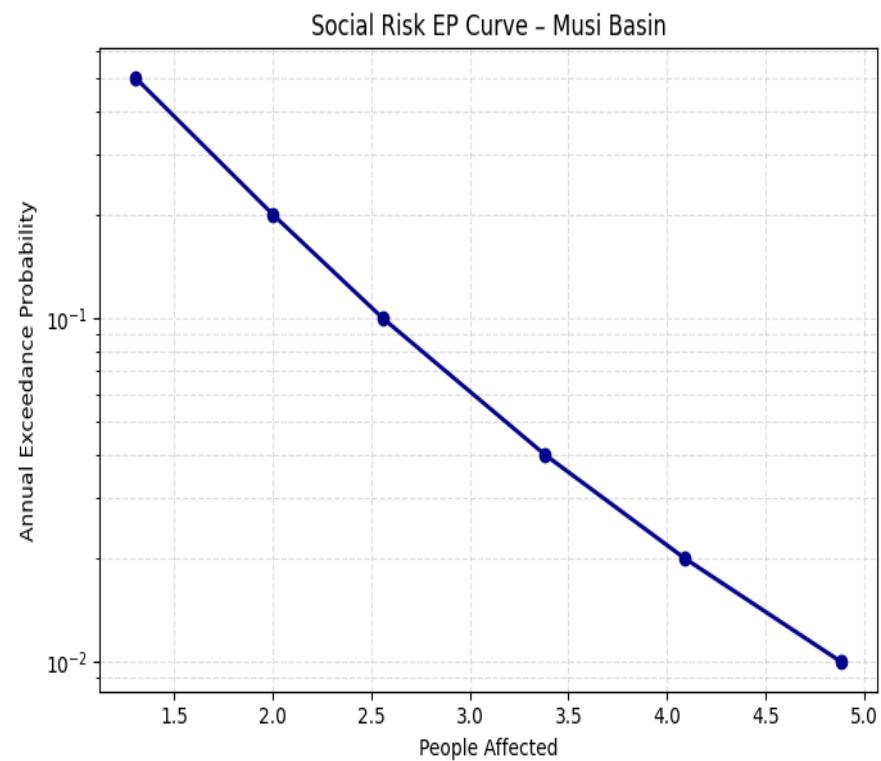
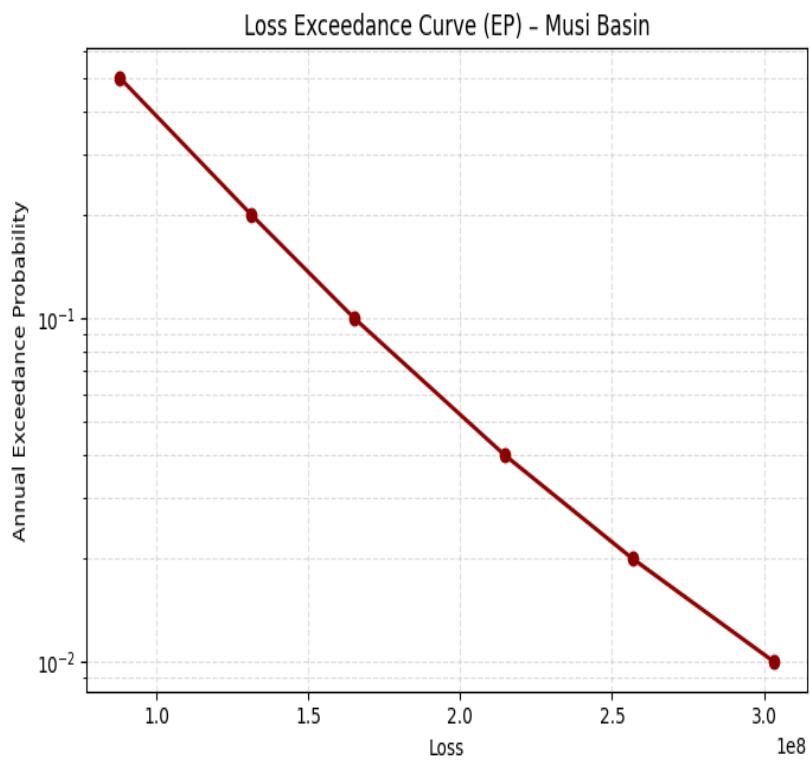


Portfolio-Average Damage vs Return Period – Musi Basin



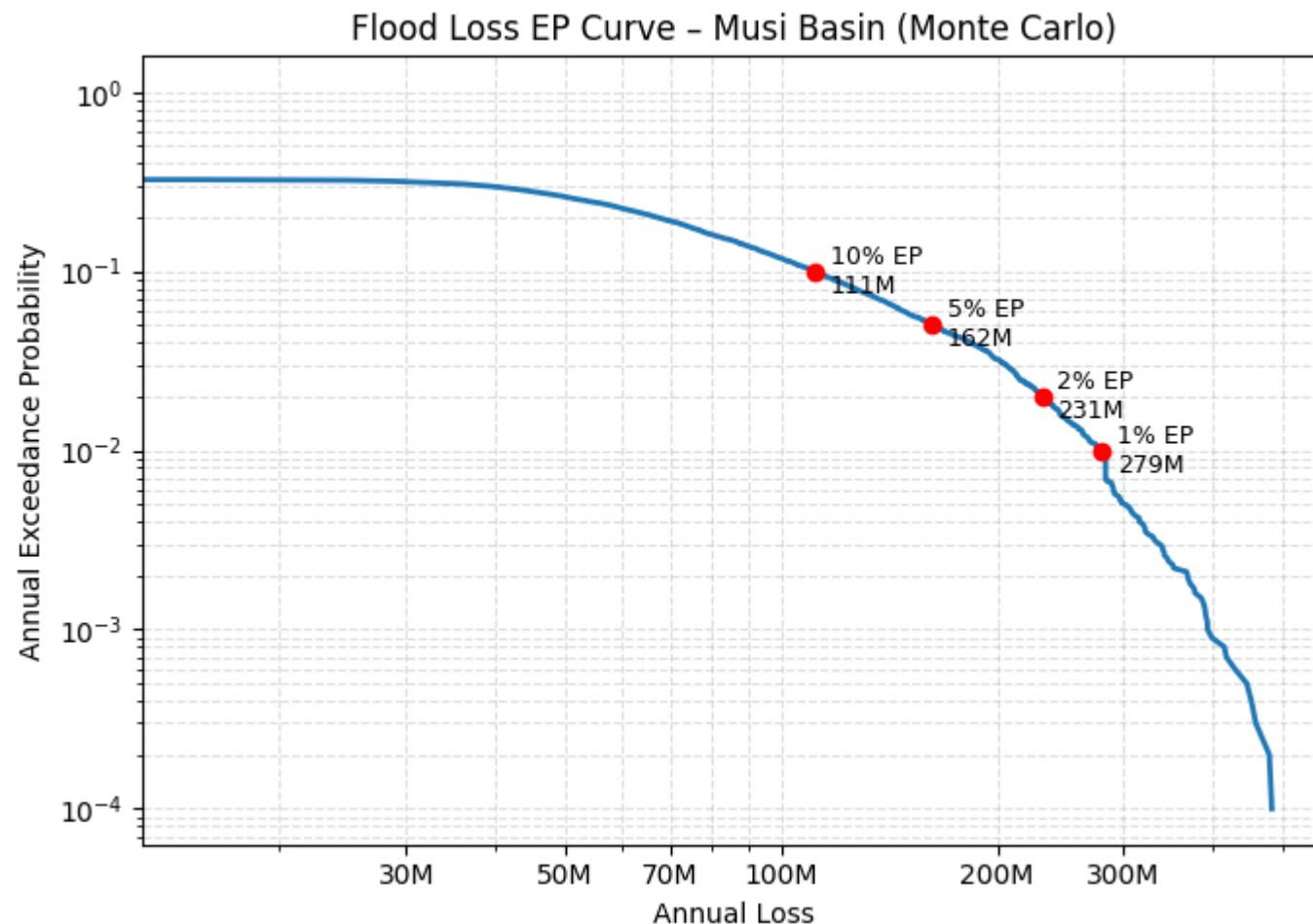
EVT Based Loss, EP curves, AAL, Casualties

Average Annual Loss (AAL): 66,545,749.65

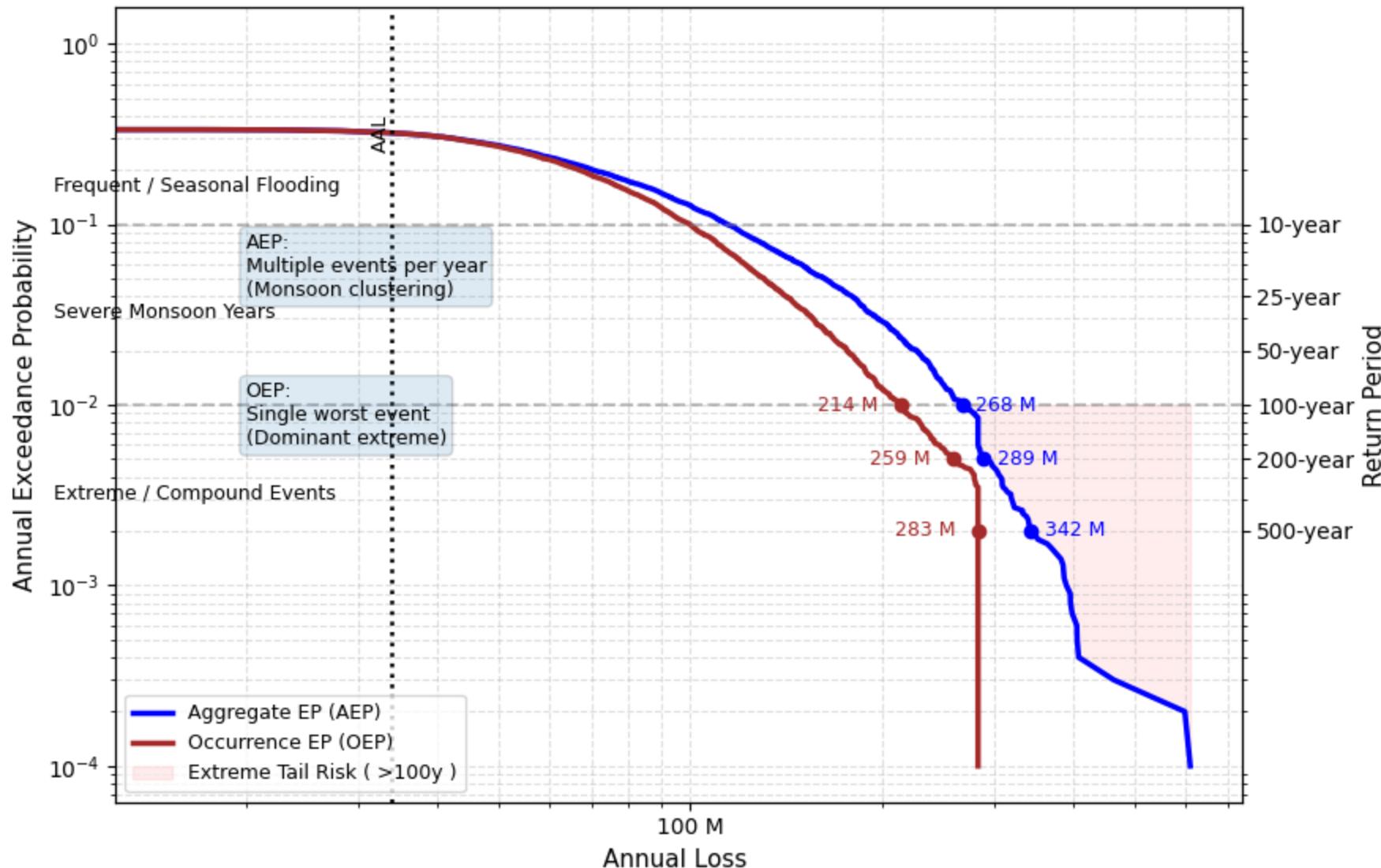


Monte Carlo

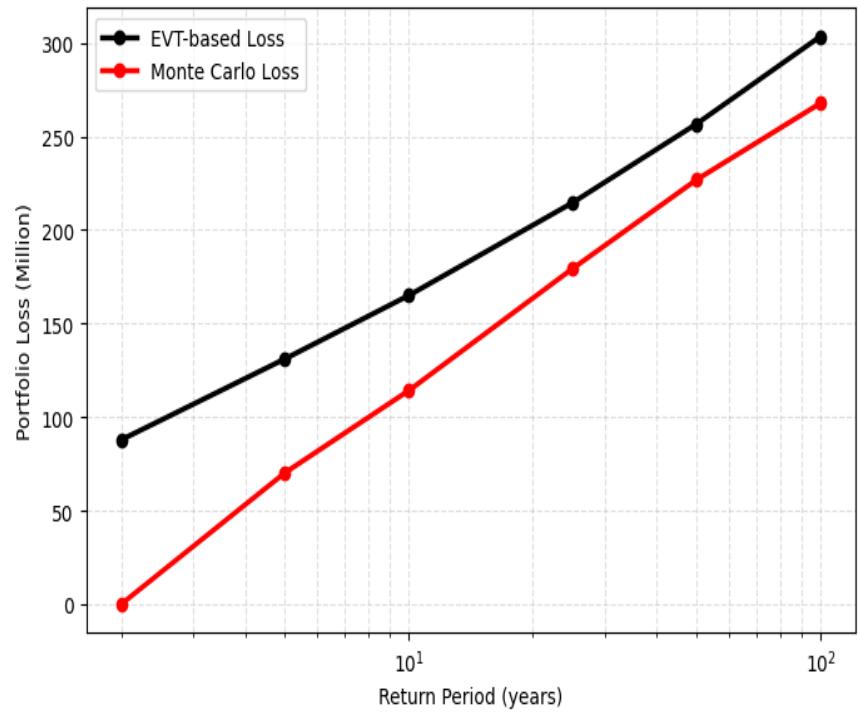
Average Annual Loss (AAL): 32,889,135.07



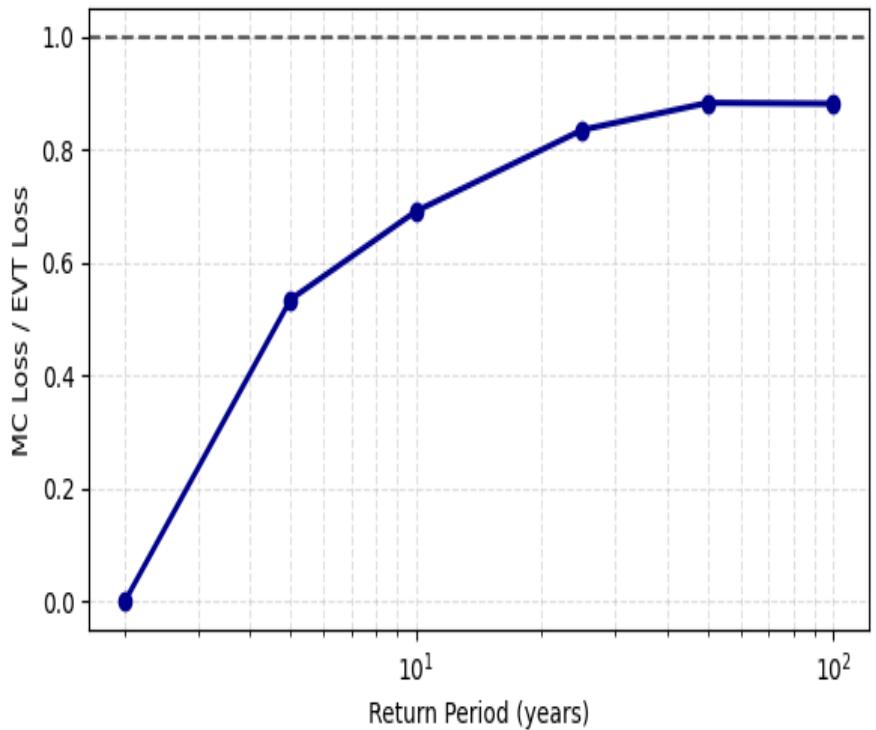
OEP vs AEP - Musi Basin Flood Risk



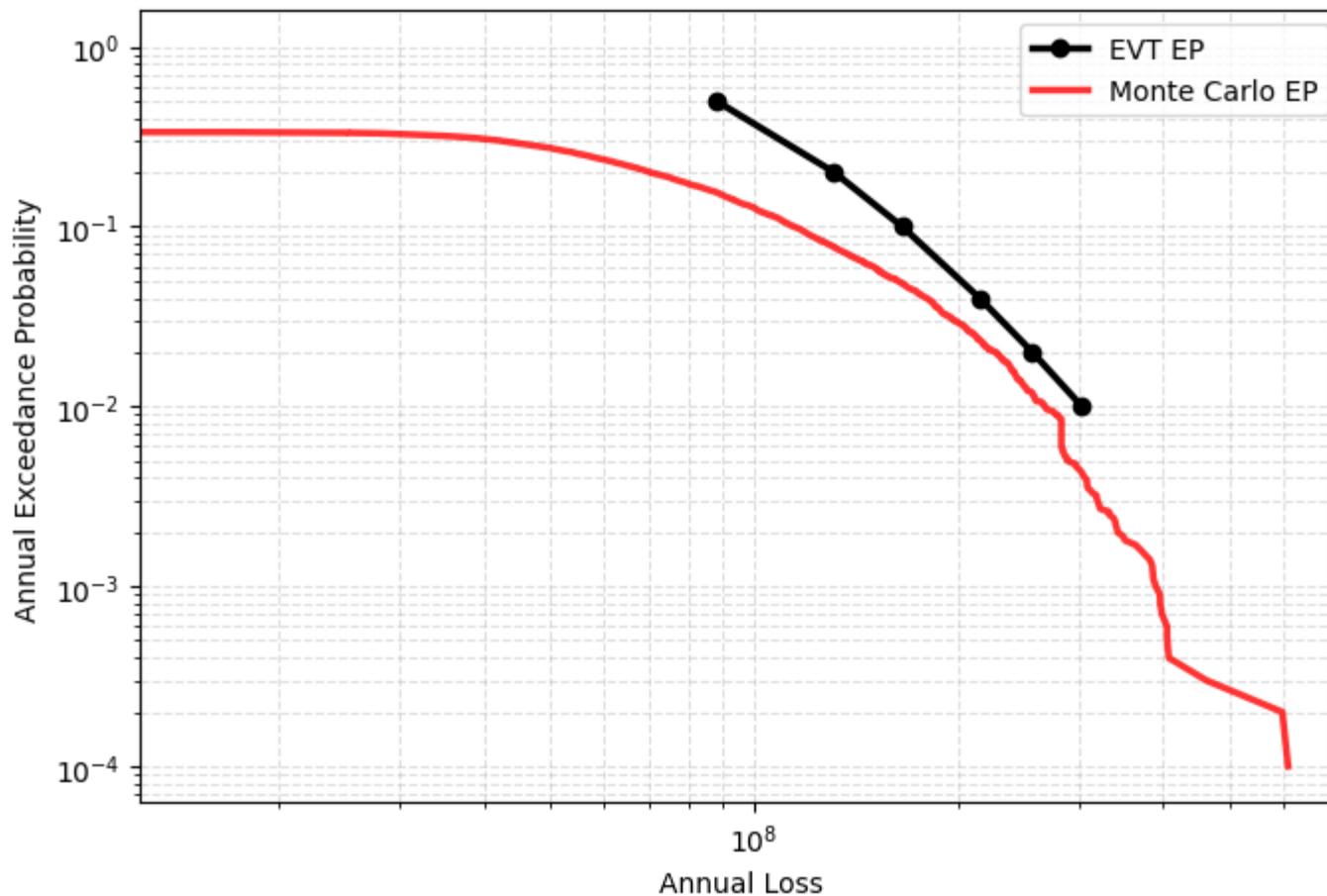
EVT vs Monte Carlo Portfolio Loss - Musi Basin

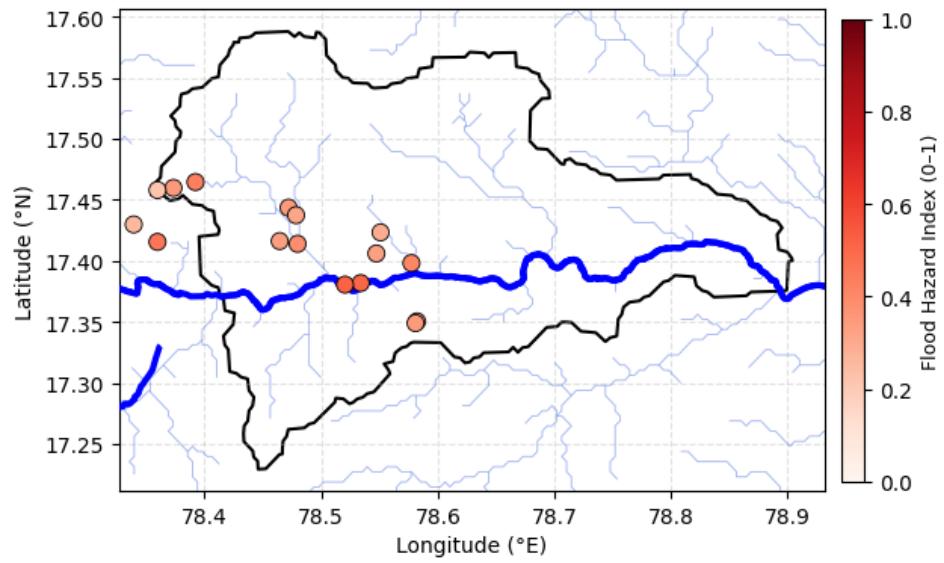
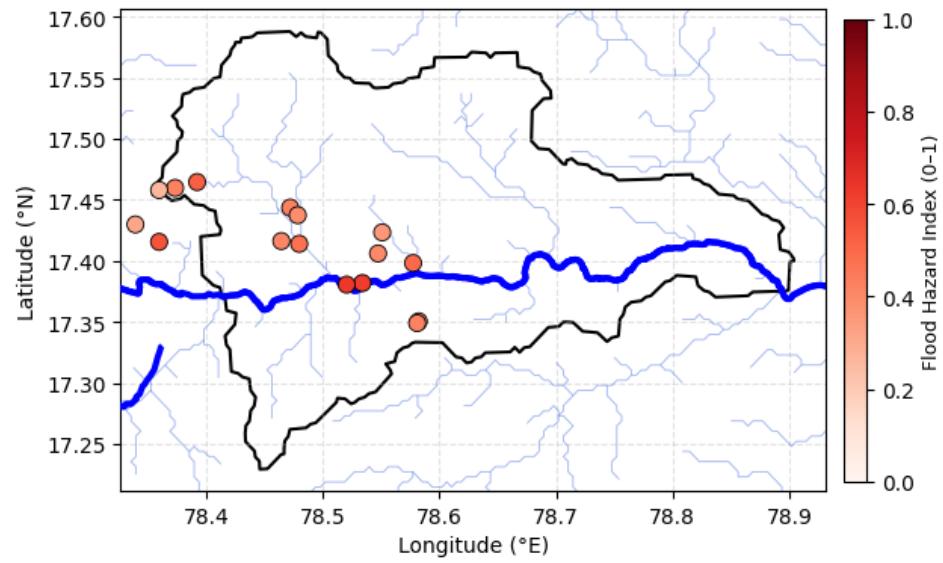
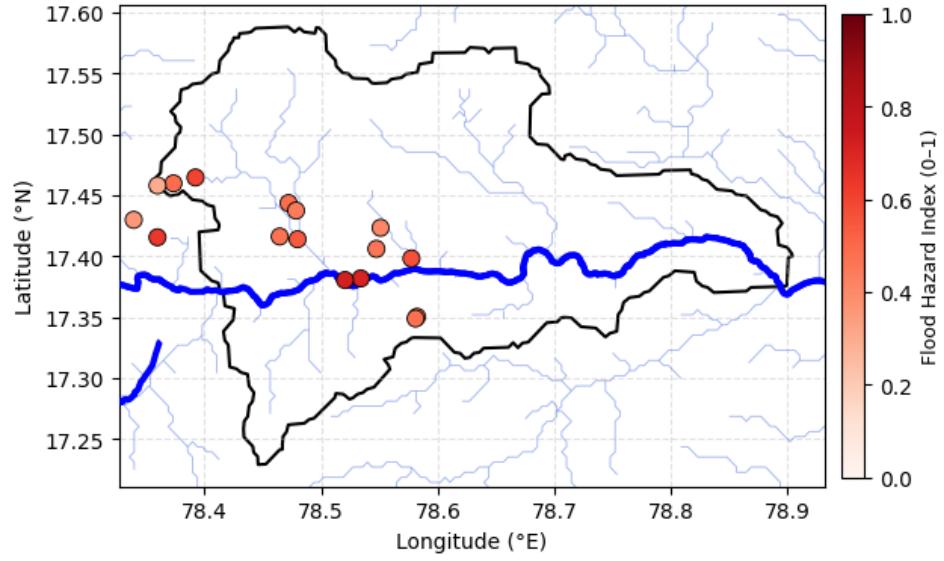
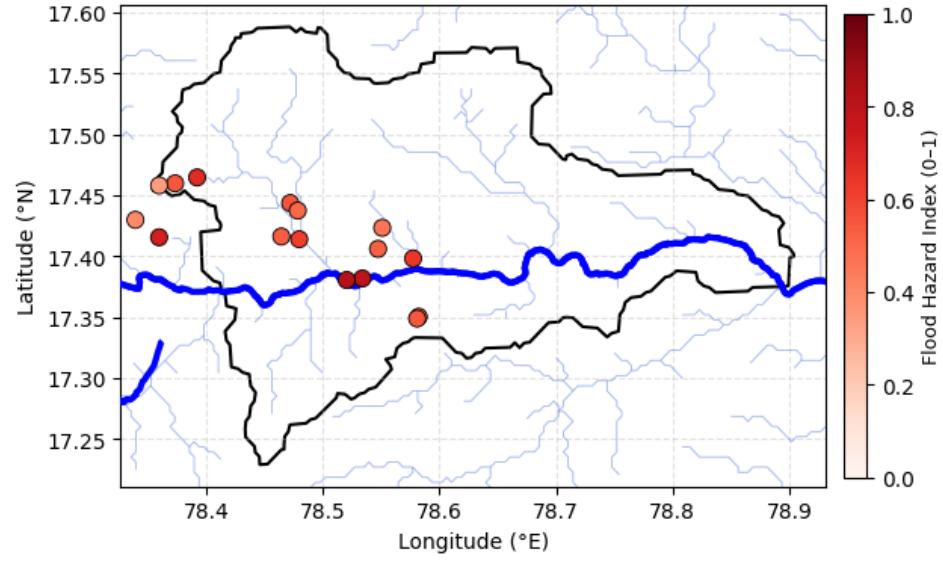


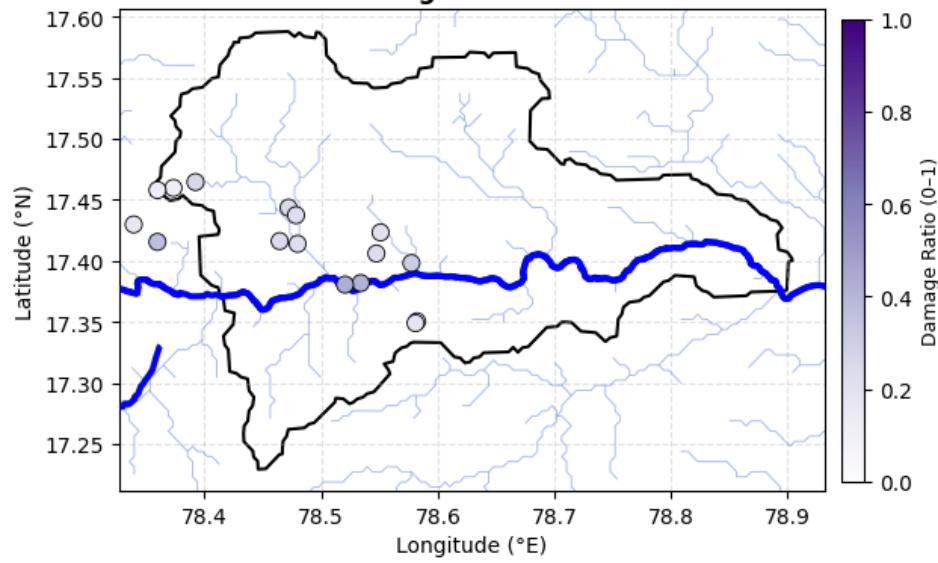
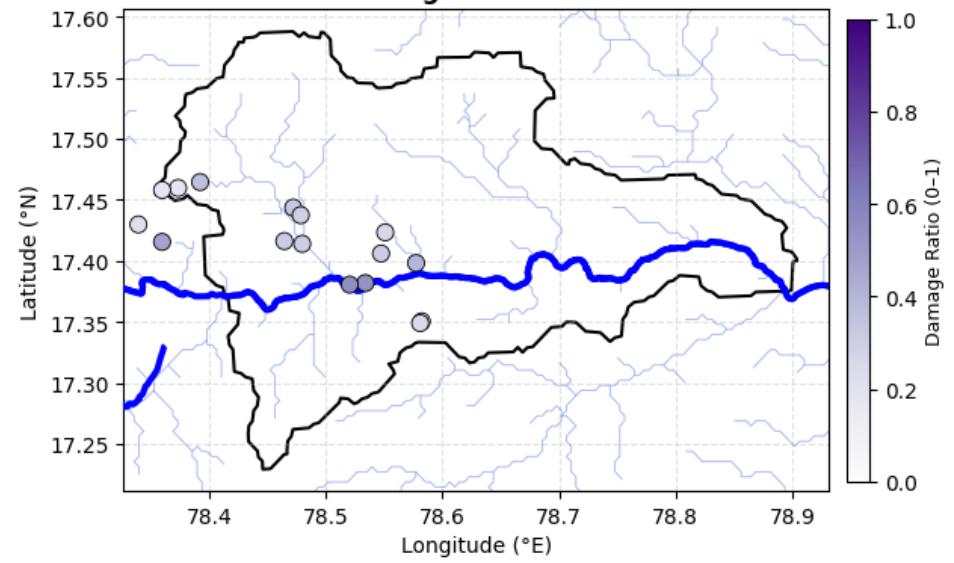
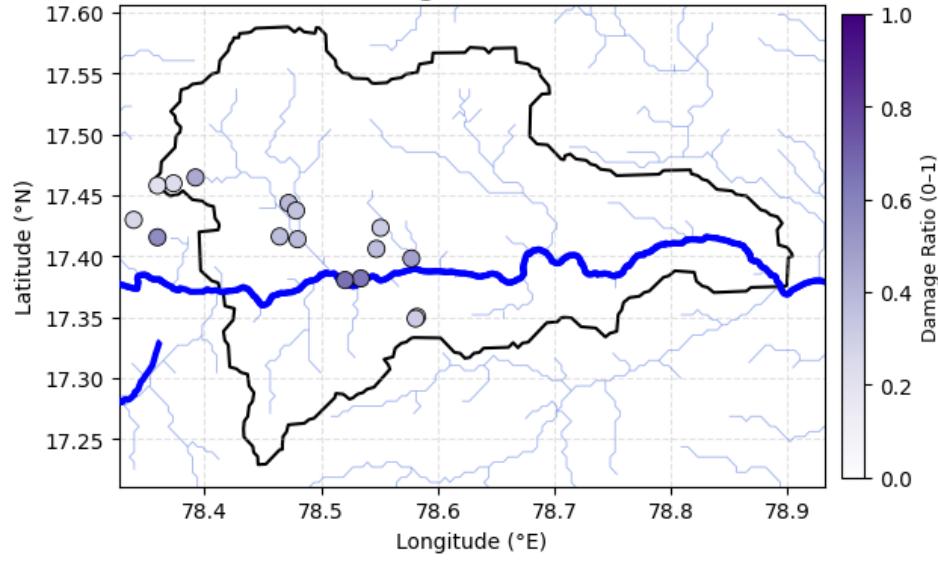
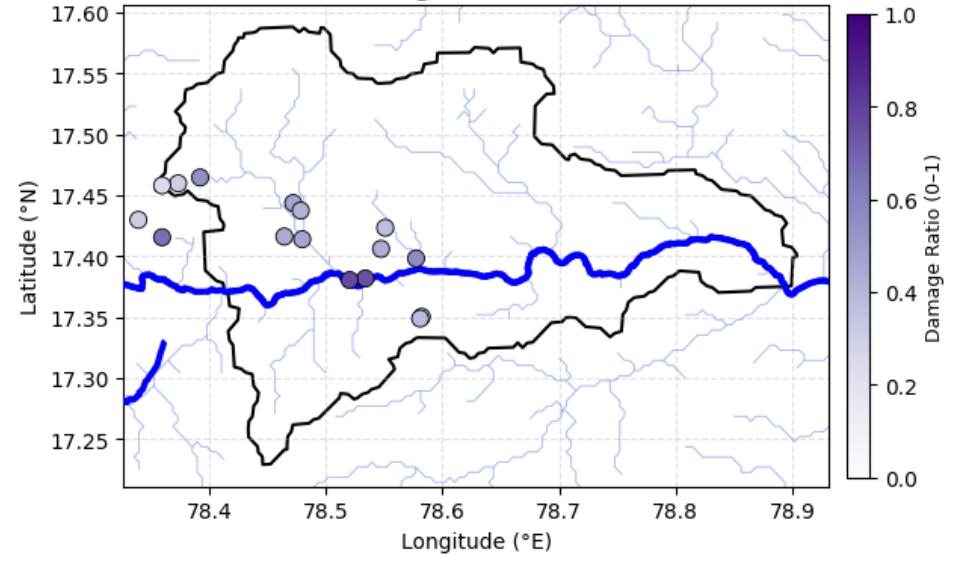
Monte Carlo vs EVT Loss Ratio

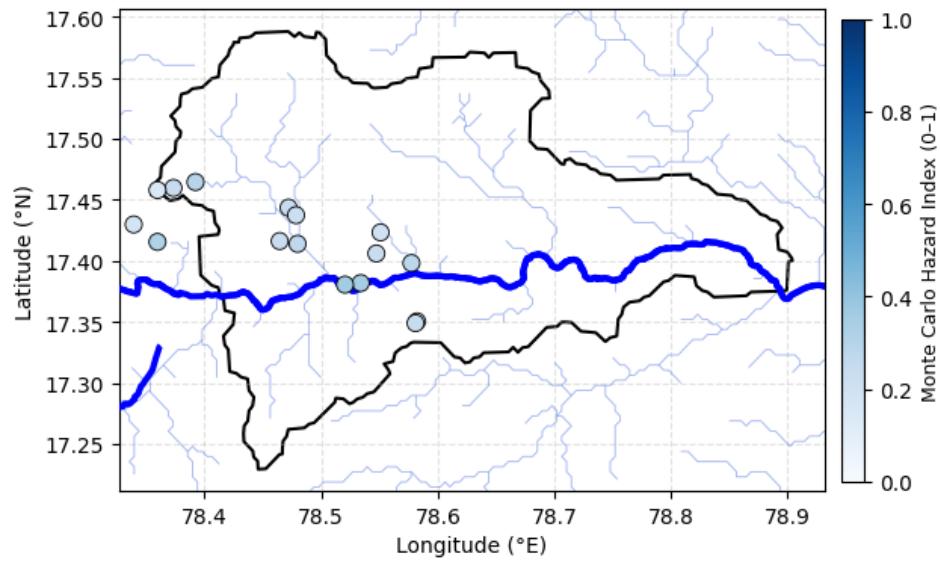
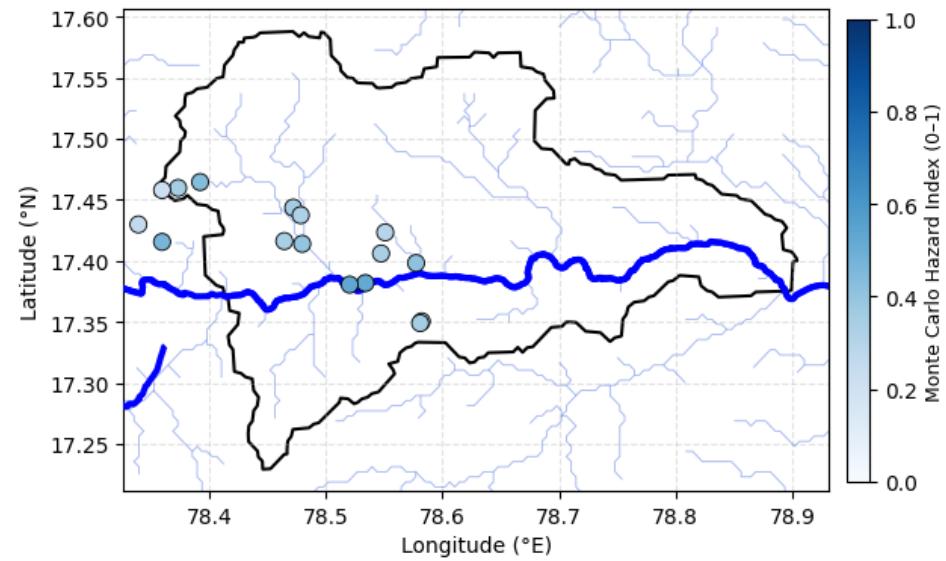
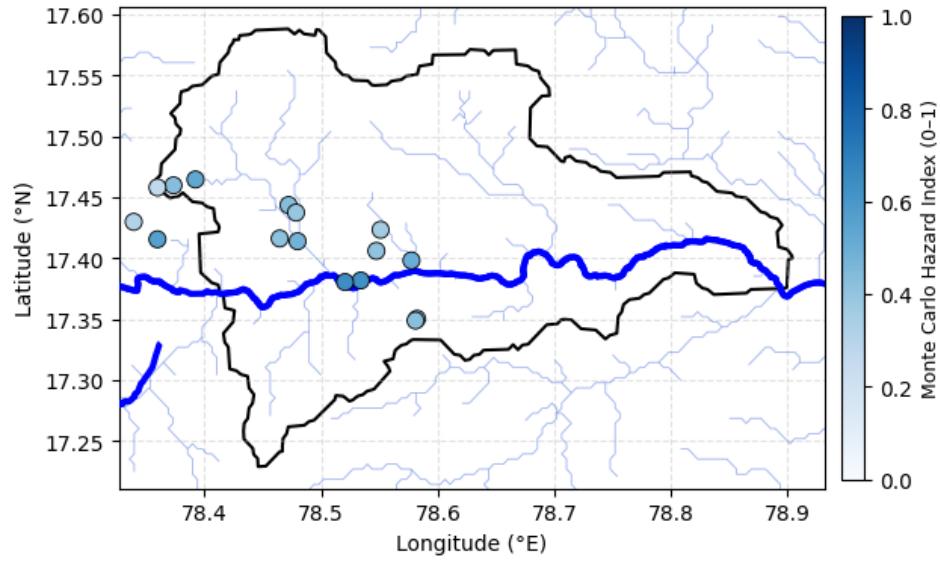
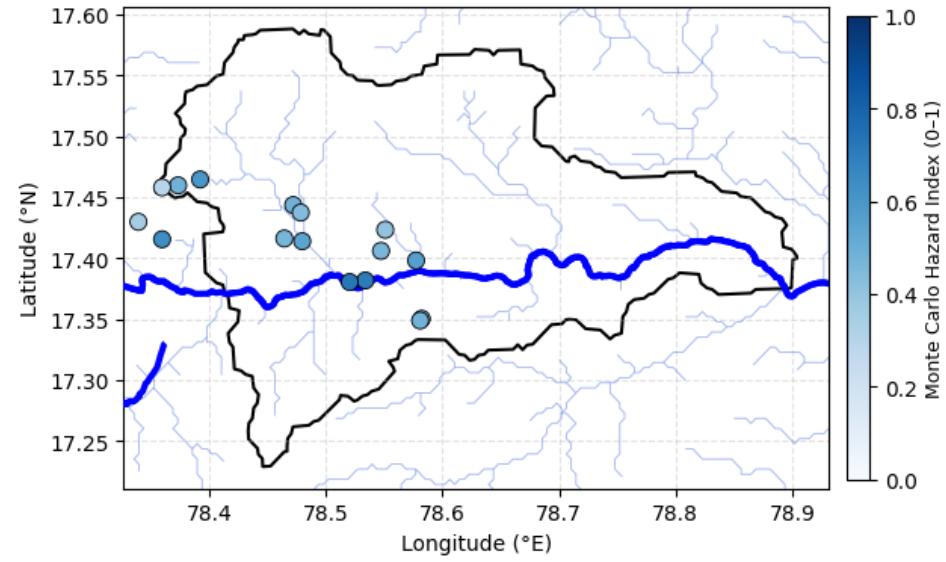


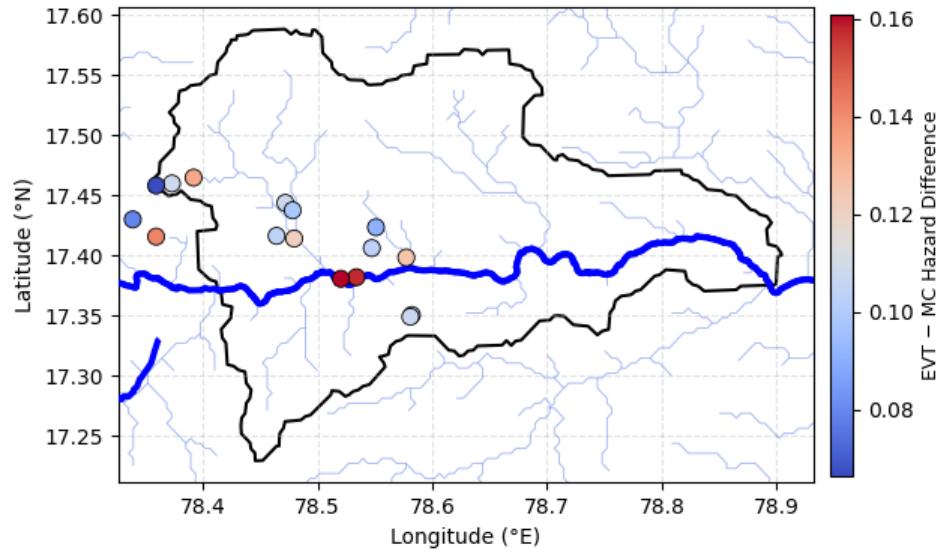
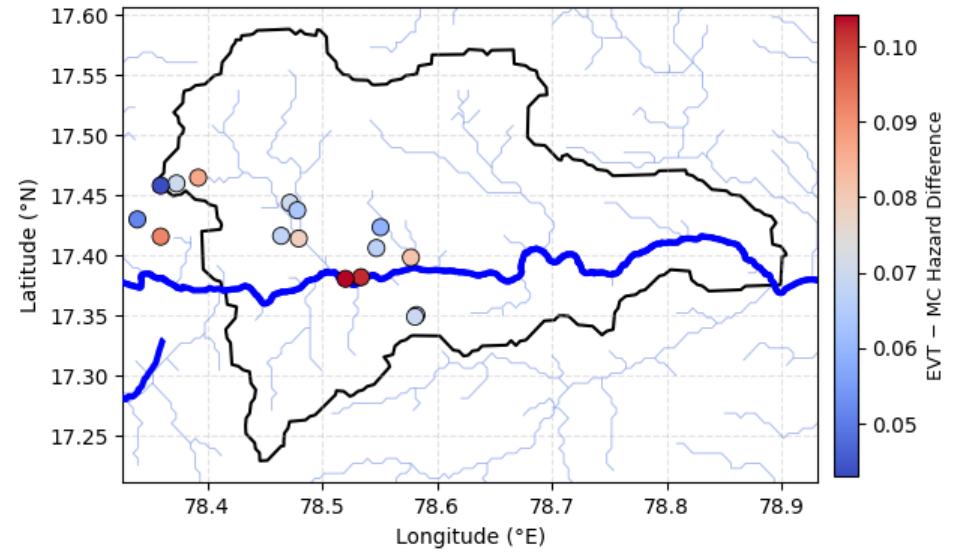
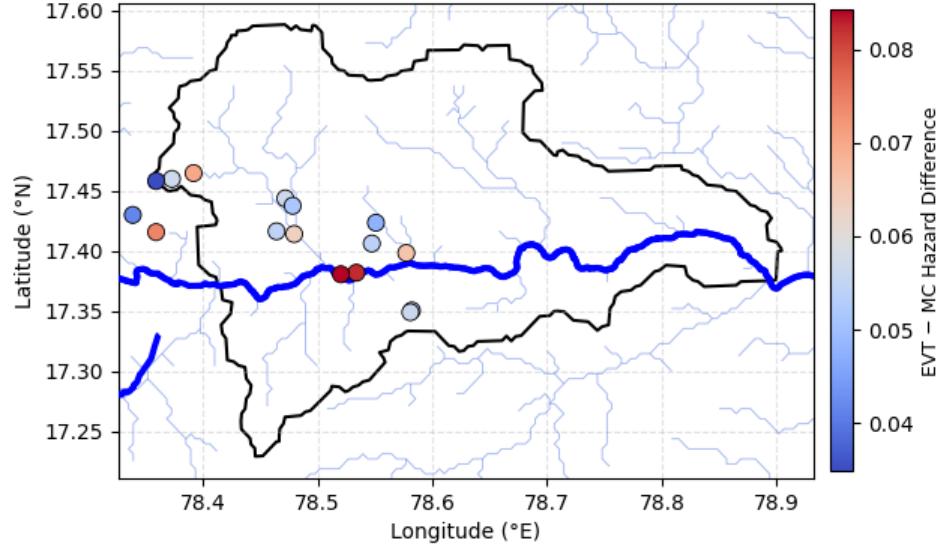
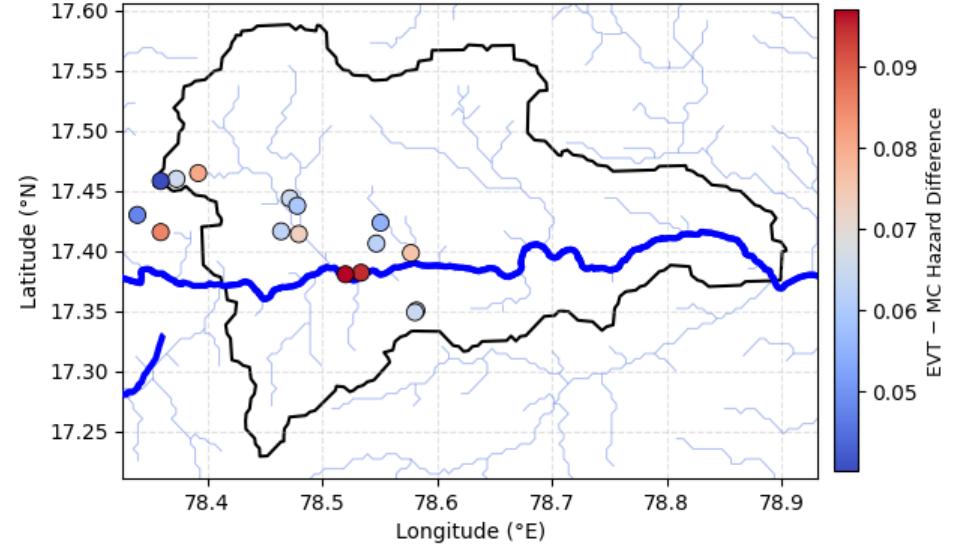
EVT vs Monte Carlo EP Curves - Musi Basin

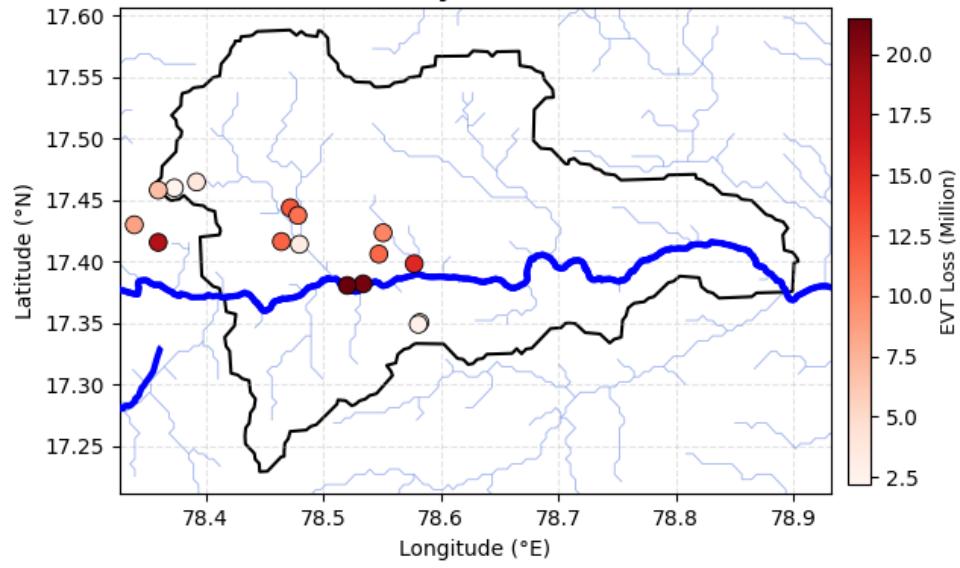
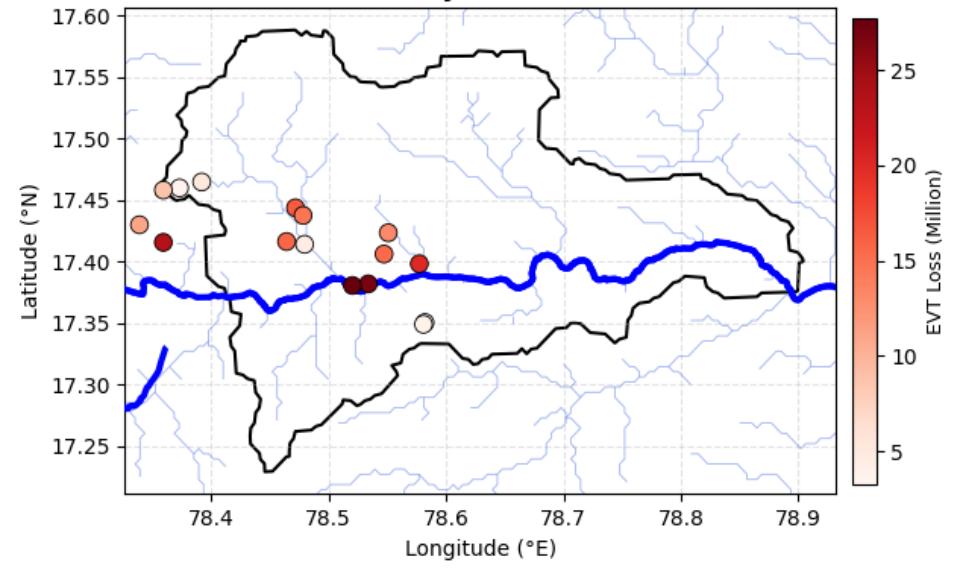
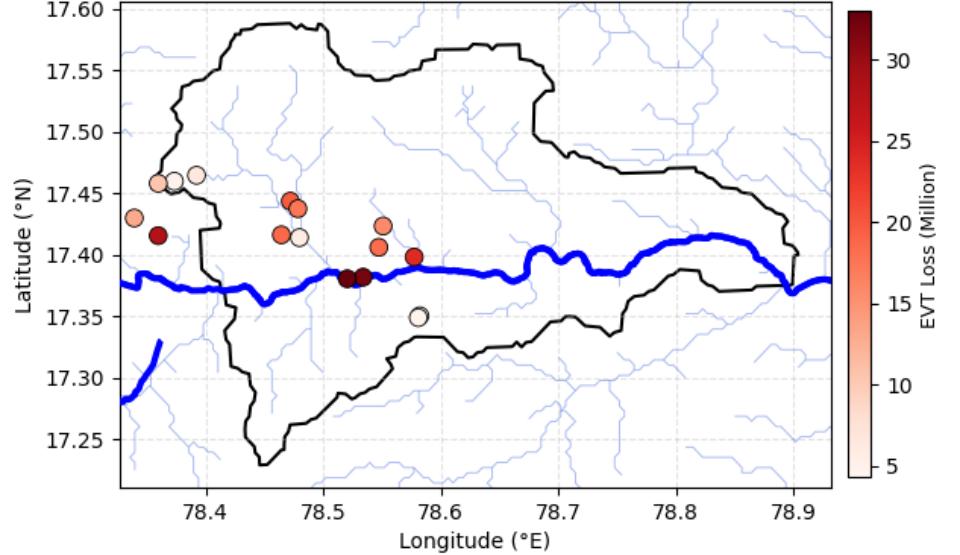
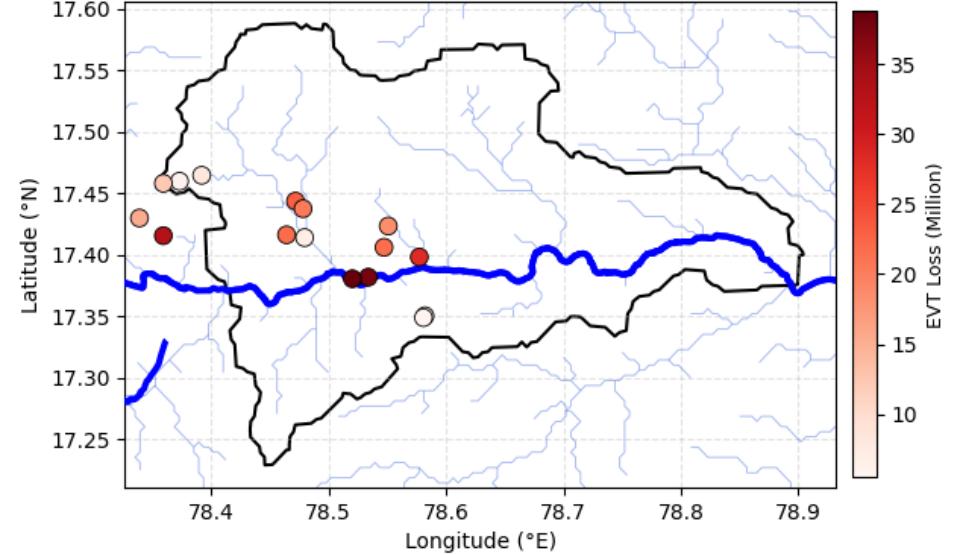


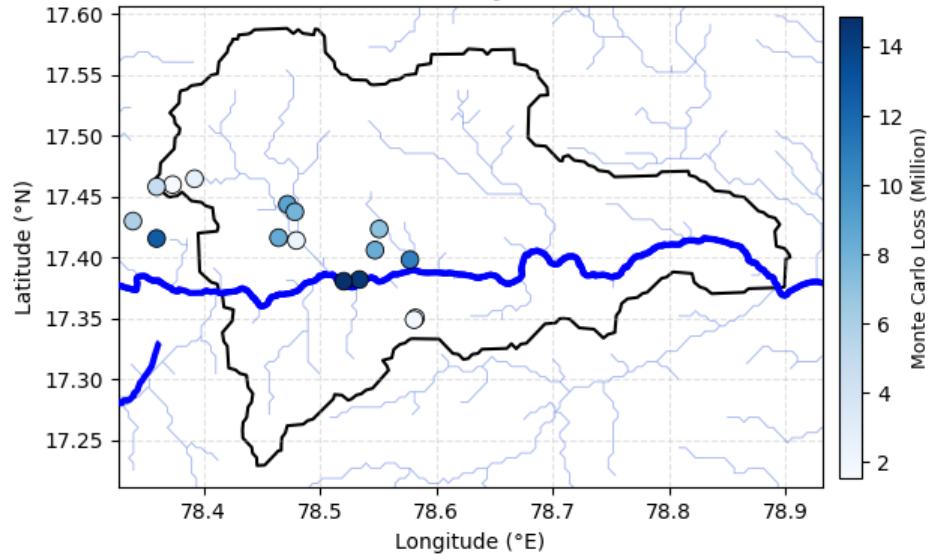
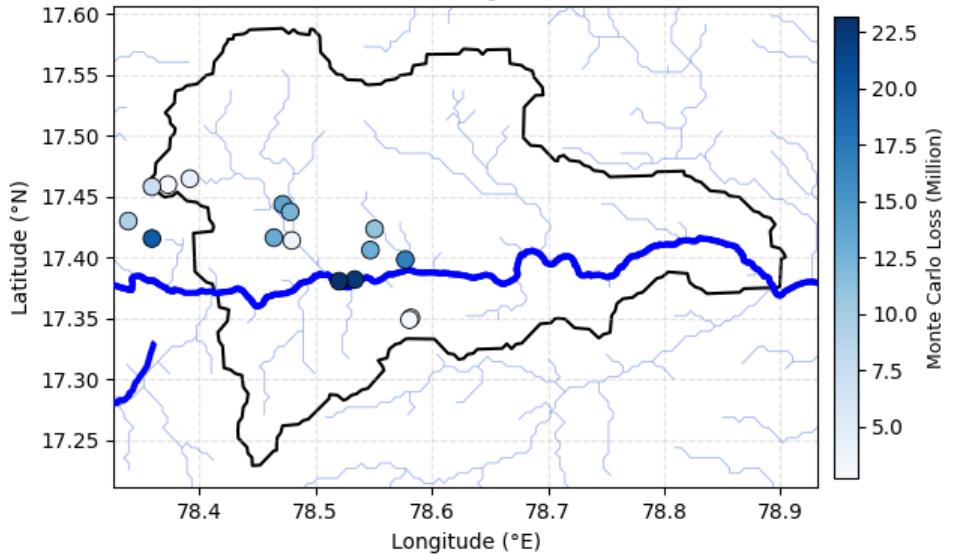
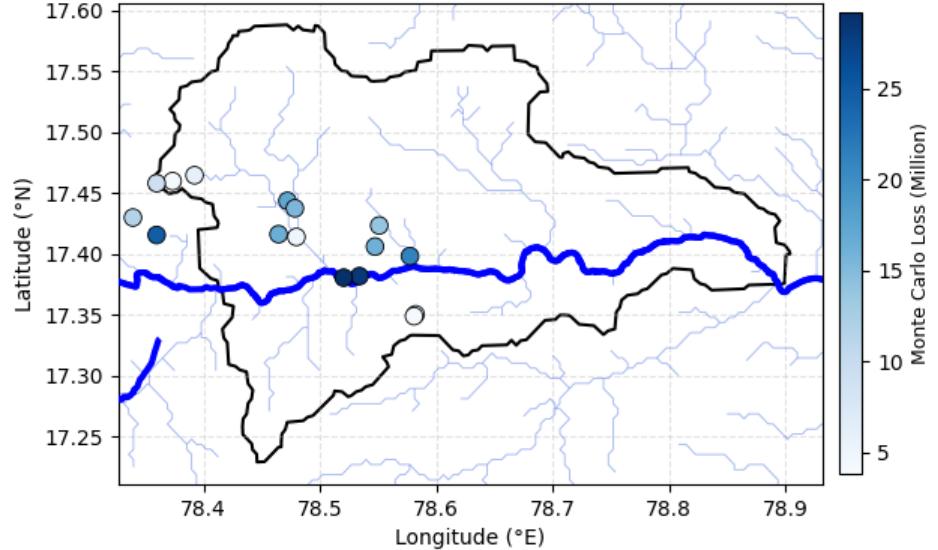
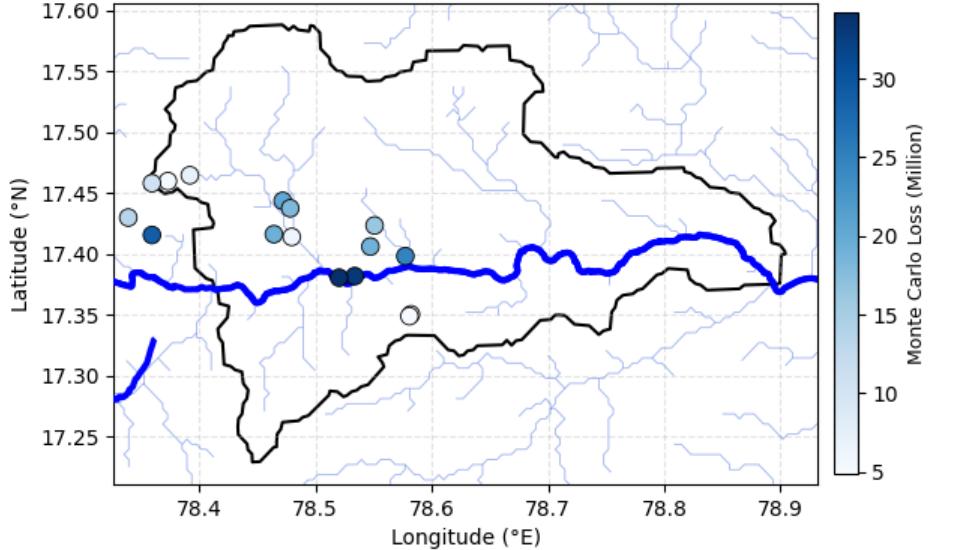
EVT Flood Hazard - 10-Year**EVT Flood Hazard - 25-Year****EVT Flood Hazard - 50-Year****EVT Flood Hazard - 100-Year**

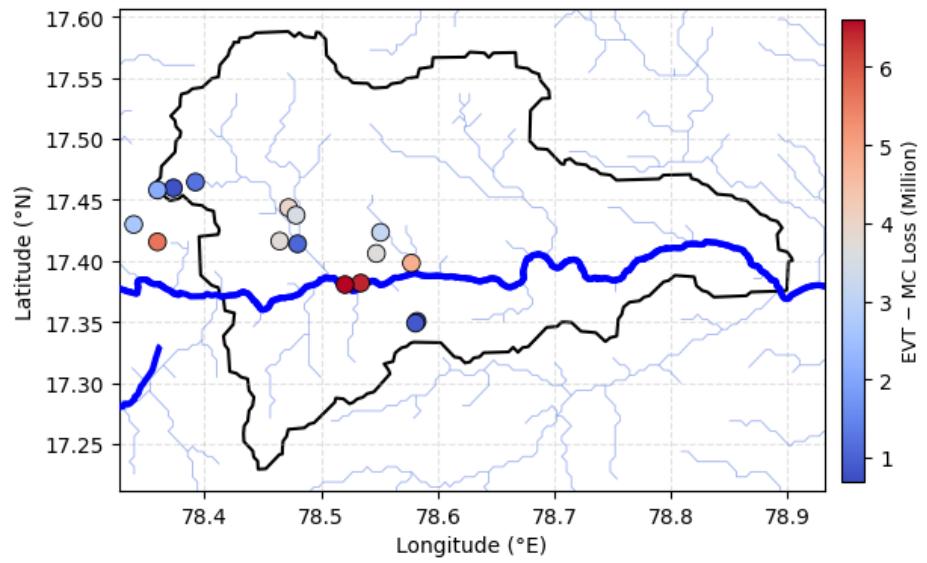
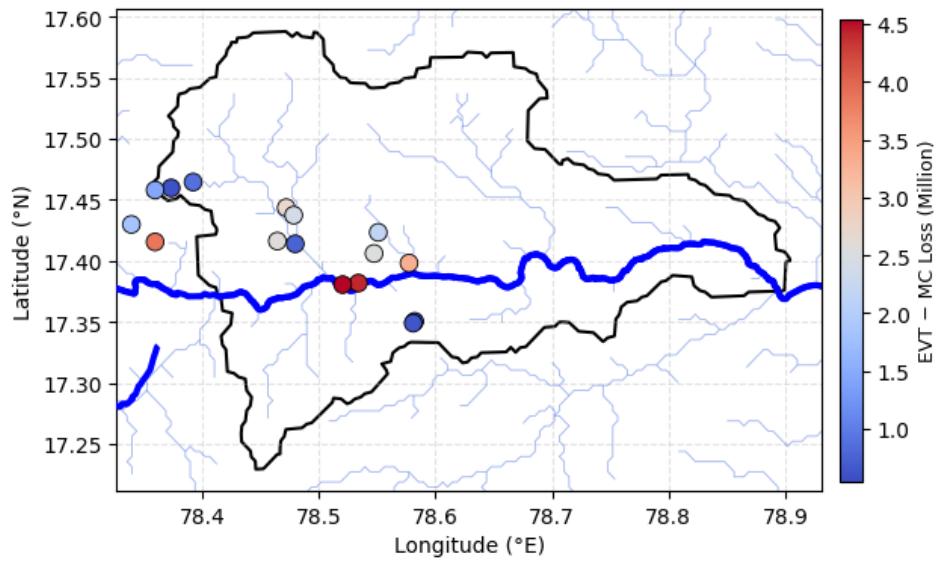
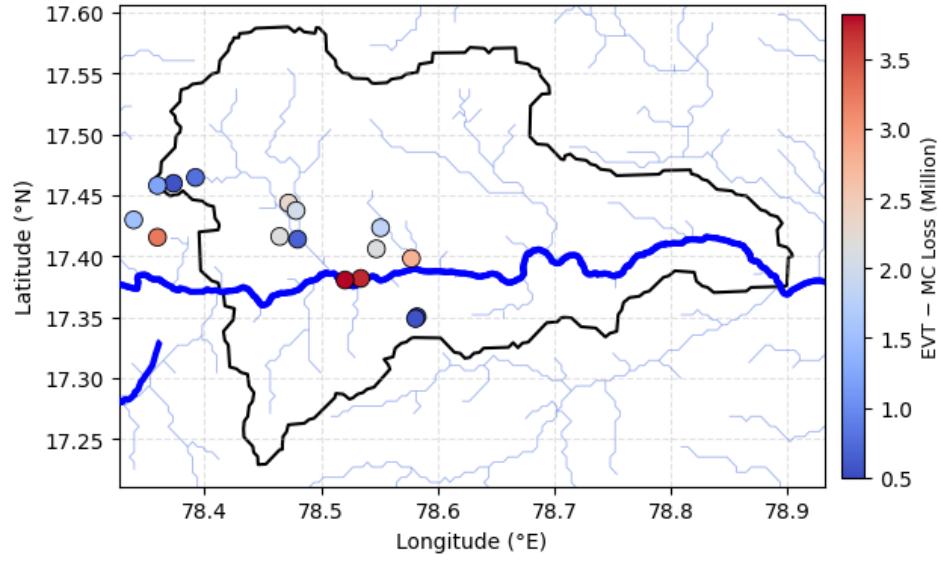
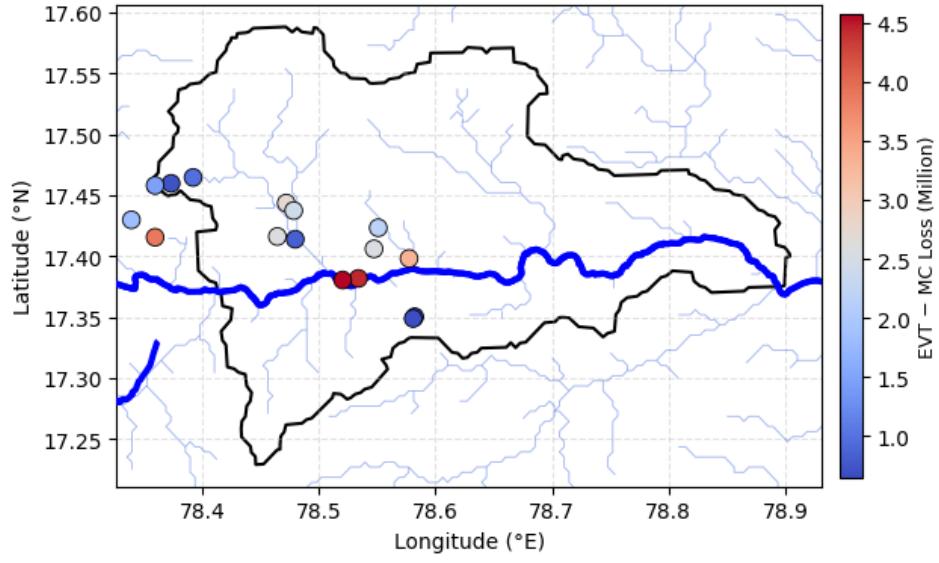
EVT Damage Ratio - 10-Year**EVT Damage Ratio - 25-Year****EVT Damage Ratio - 50-Year****EVT Damage Ratio - 100-Year**

Monte Carlo Flood Hazard - 10-Year**Monte Carlo Flood Hazard - 25-Year****Monte Carlo Flood Hazard - 50-Year****Monte Carlo Flood Hazard - 100-Year**

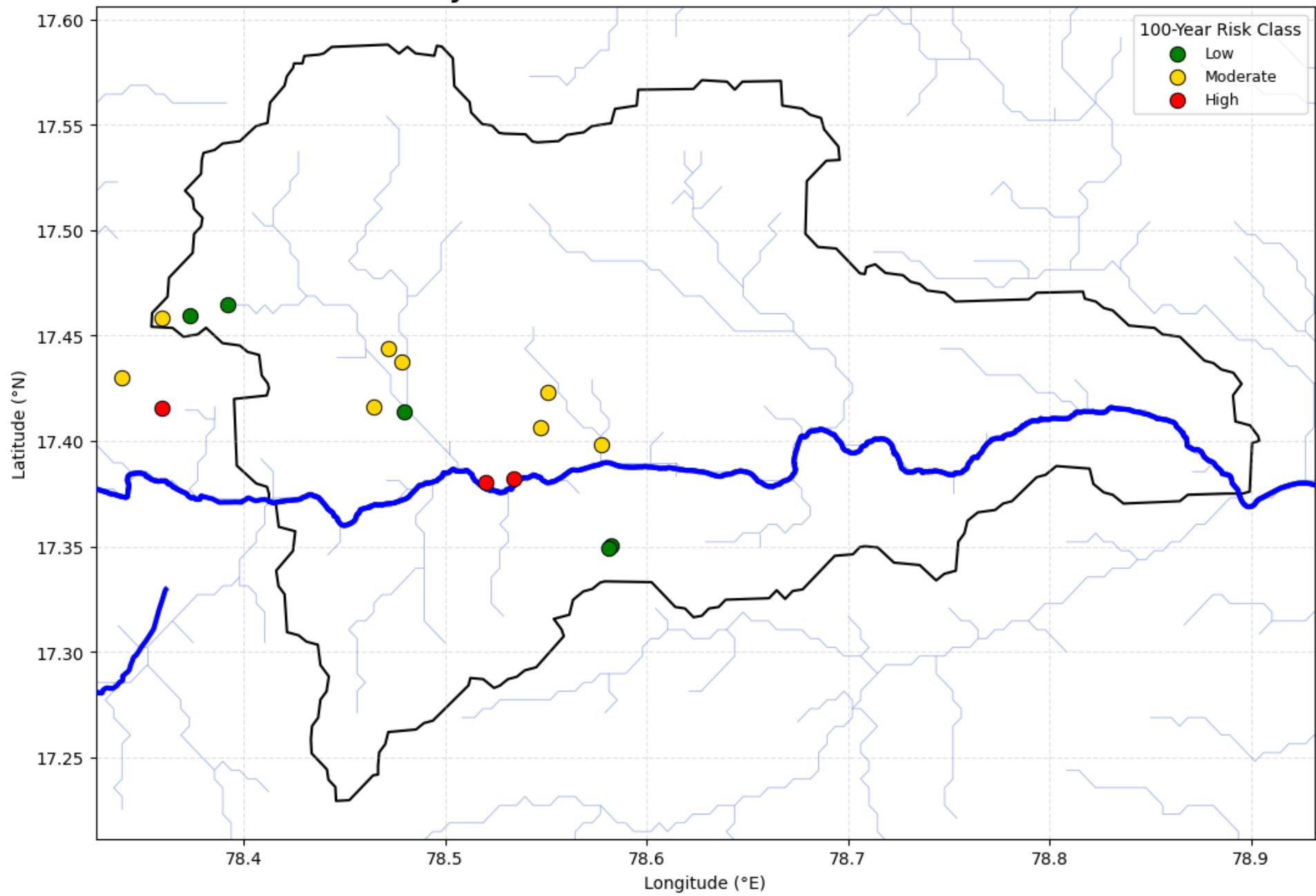
Hazard Difference - 10-Year**Hazard Difference - 25-Year****Hazard Difference - 50-Year****Hazard Difference - 100-Year**

EVT Facility Loss - 10-Year**EVT Facility Loss - 25-Year****EVT Facility Loss - 50-Year****EVT Facility Loss - 100-Year**

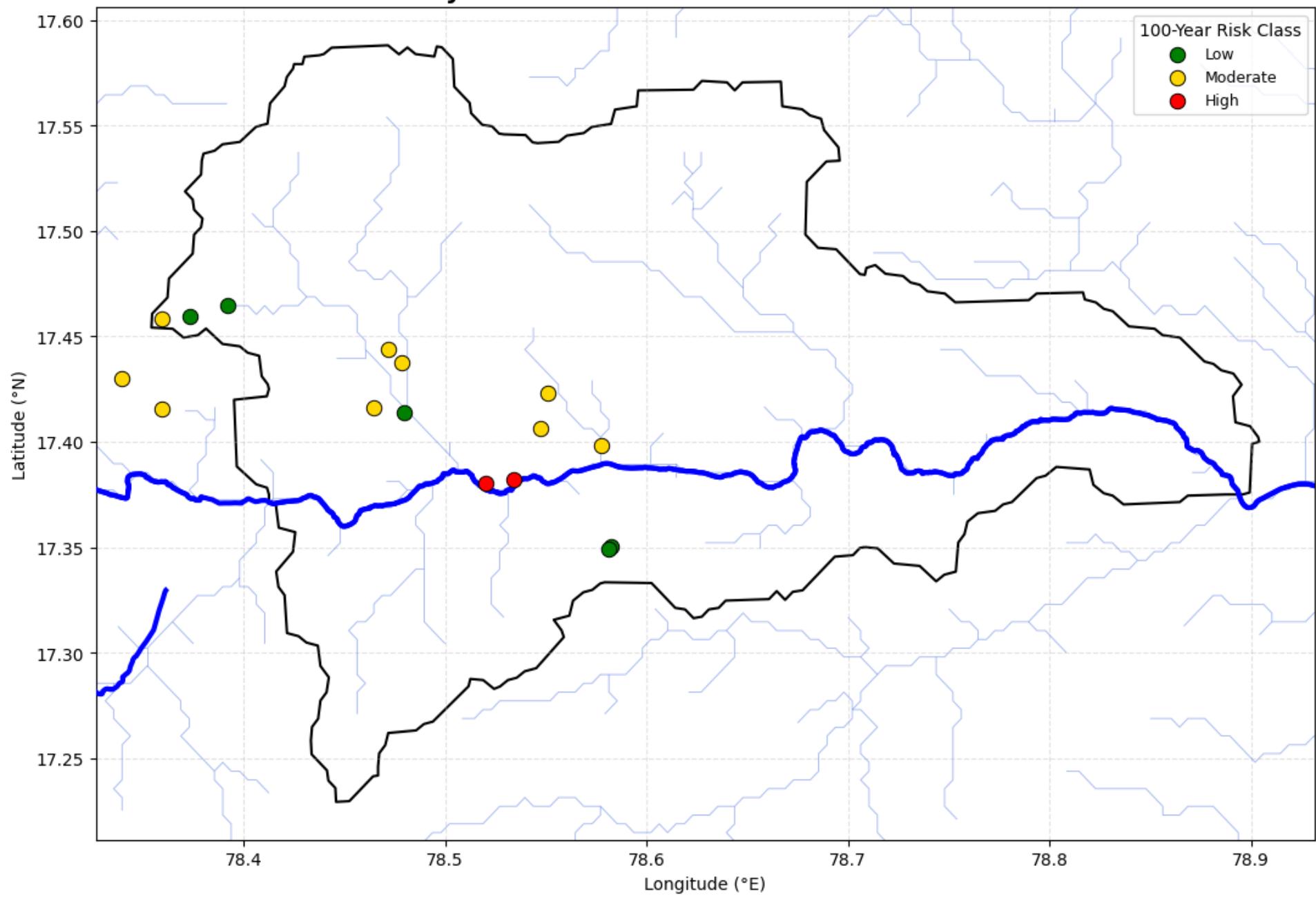
Monte Carlo Facility Loss - 10-Year**Monte Carlo Facility Loss - 25-Year****Monte Carlo Facility Loss - 50-Year****Monte Carlo Facility Loss - 100-Year**

Loss Difference - 10-Year**Loss Difference - 25-Year****Loss Difference - 50-Year****Loss Difference - 100-Year**

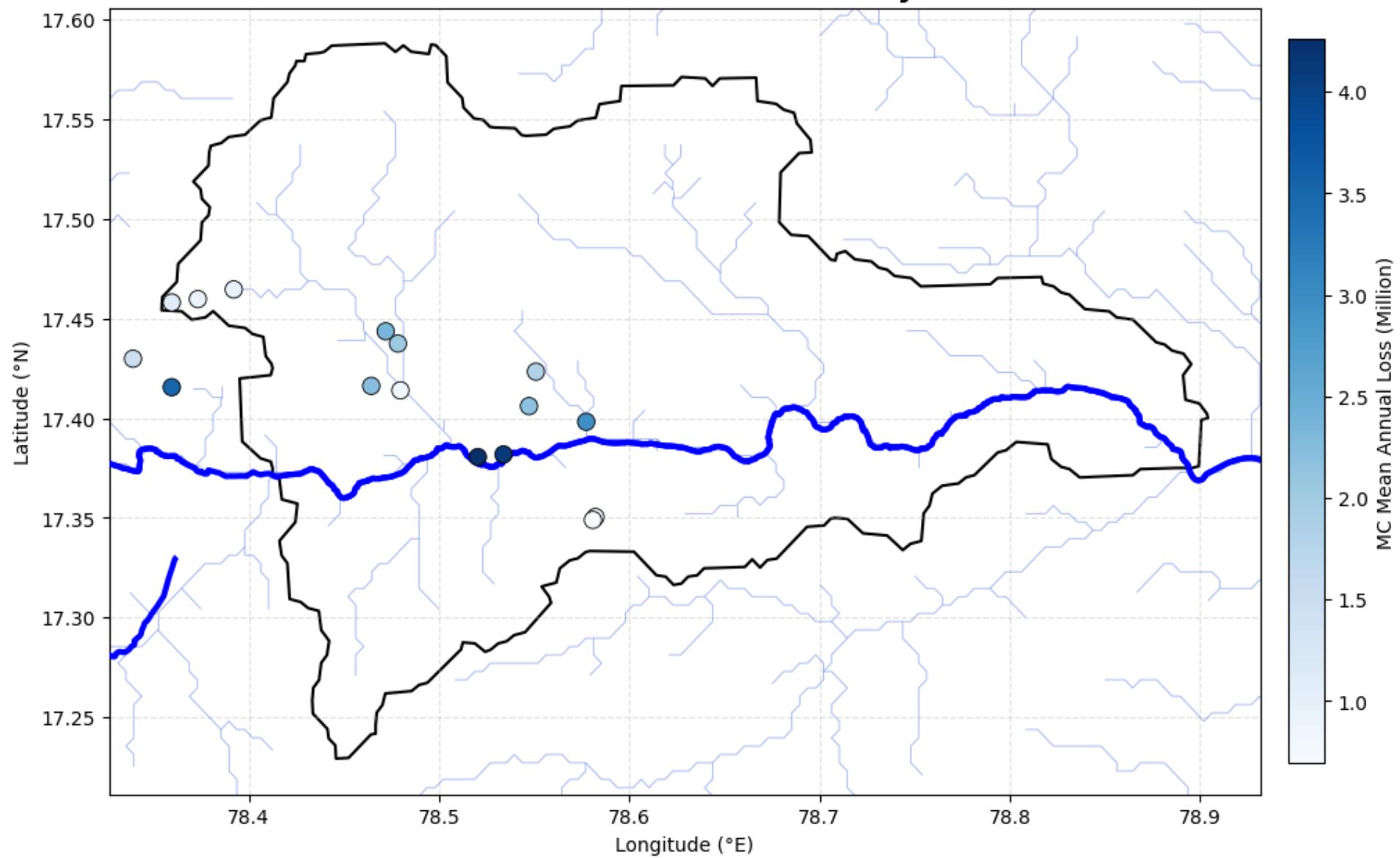
EVT-Facility Risk Classification - 100-Year Flood Scenario



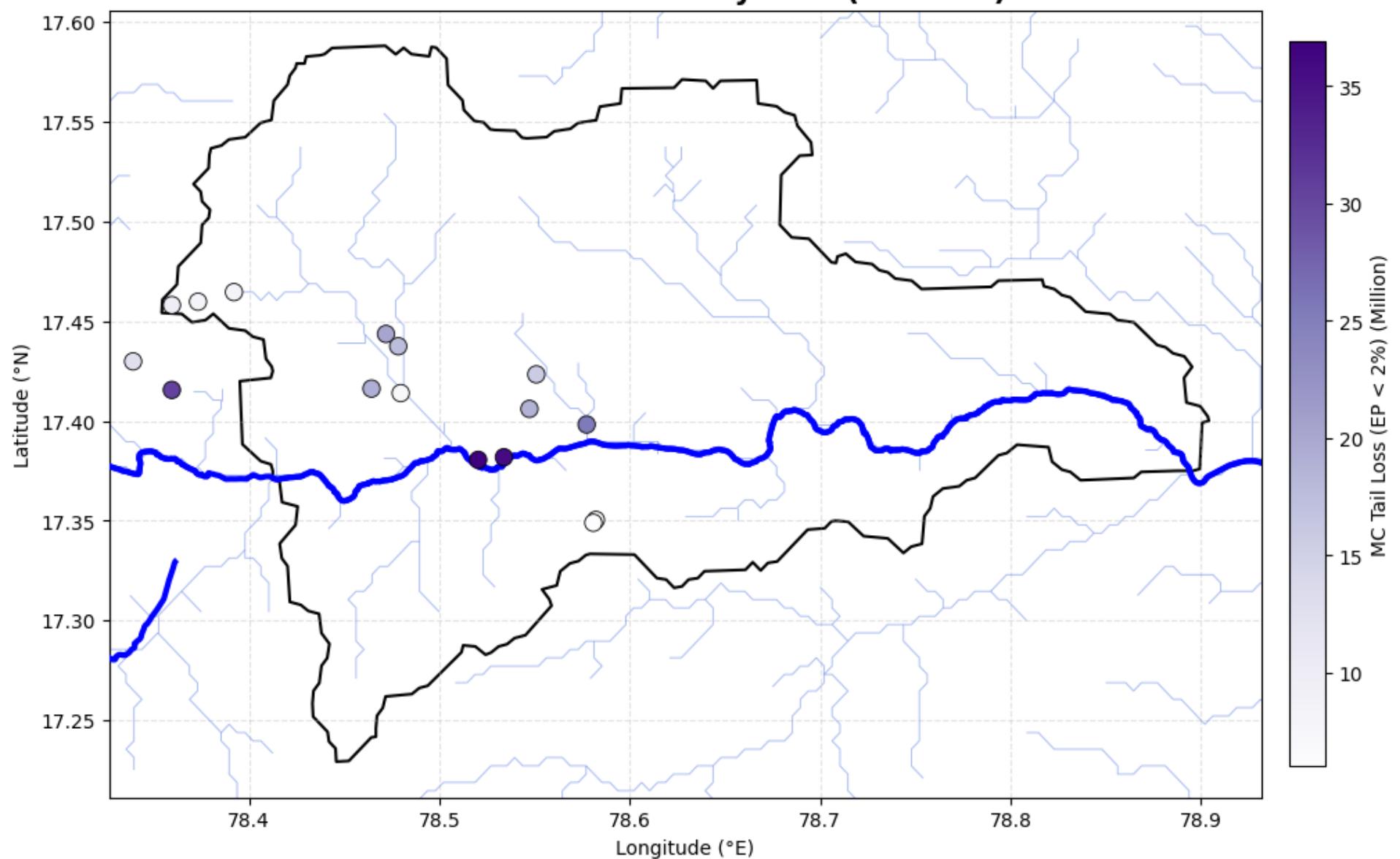
MC-Facility Risk Classification - 100-Year Flood Scenario



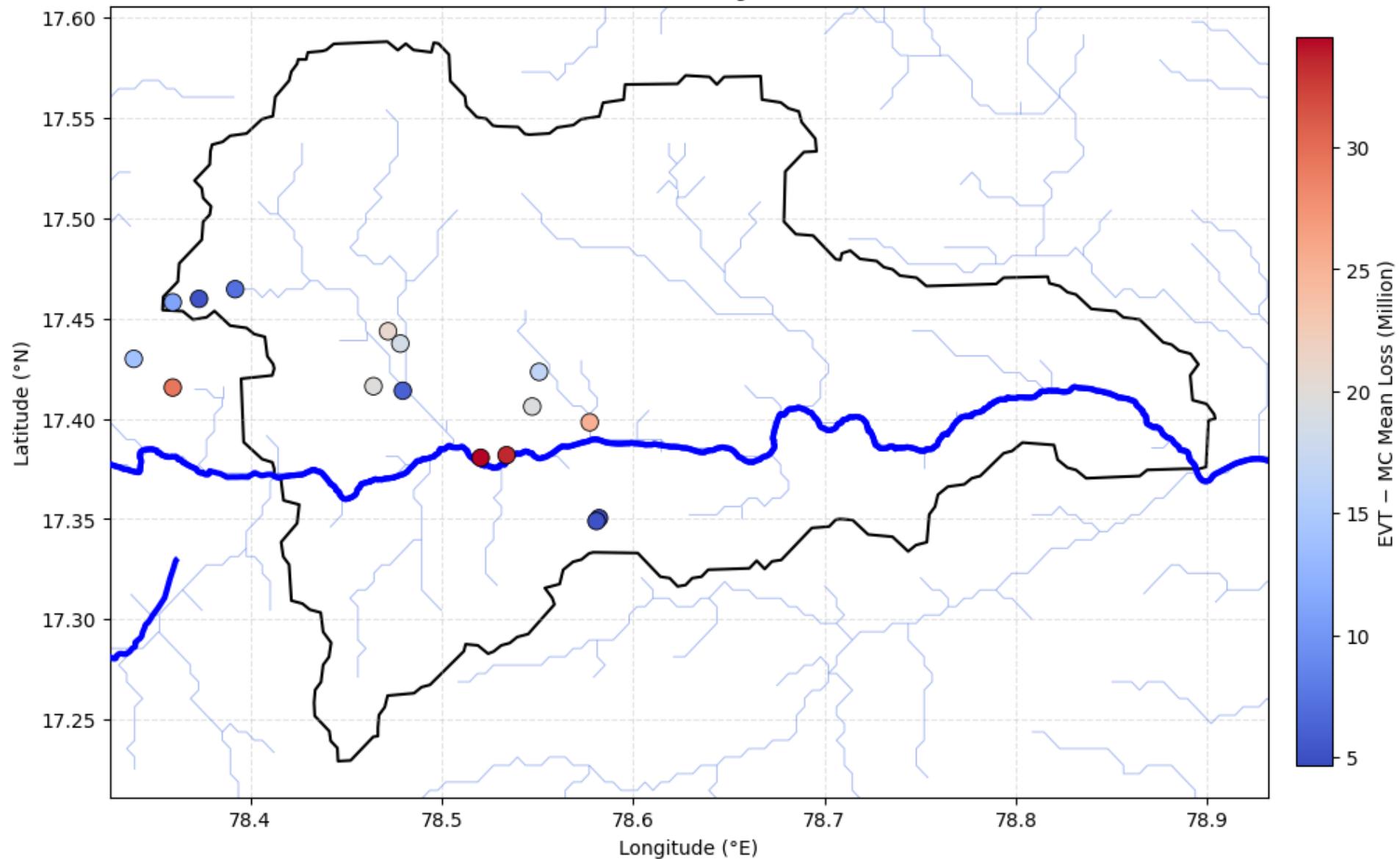
Monte Carlo Mean Annual Facility Loss



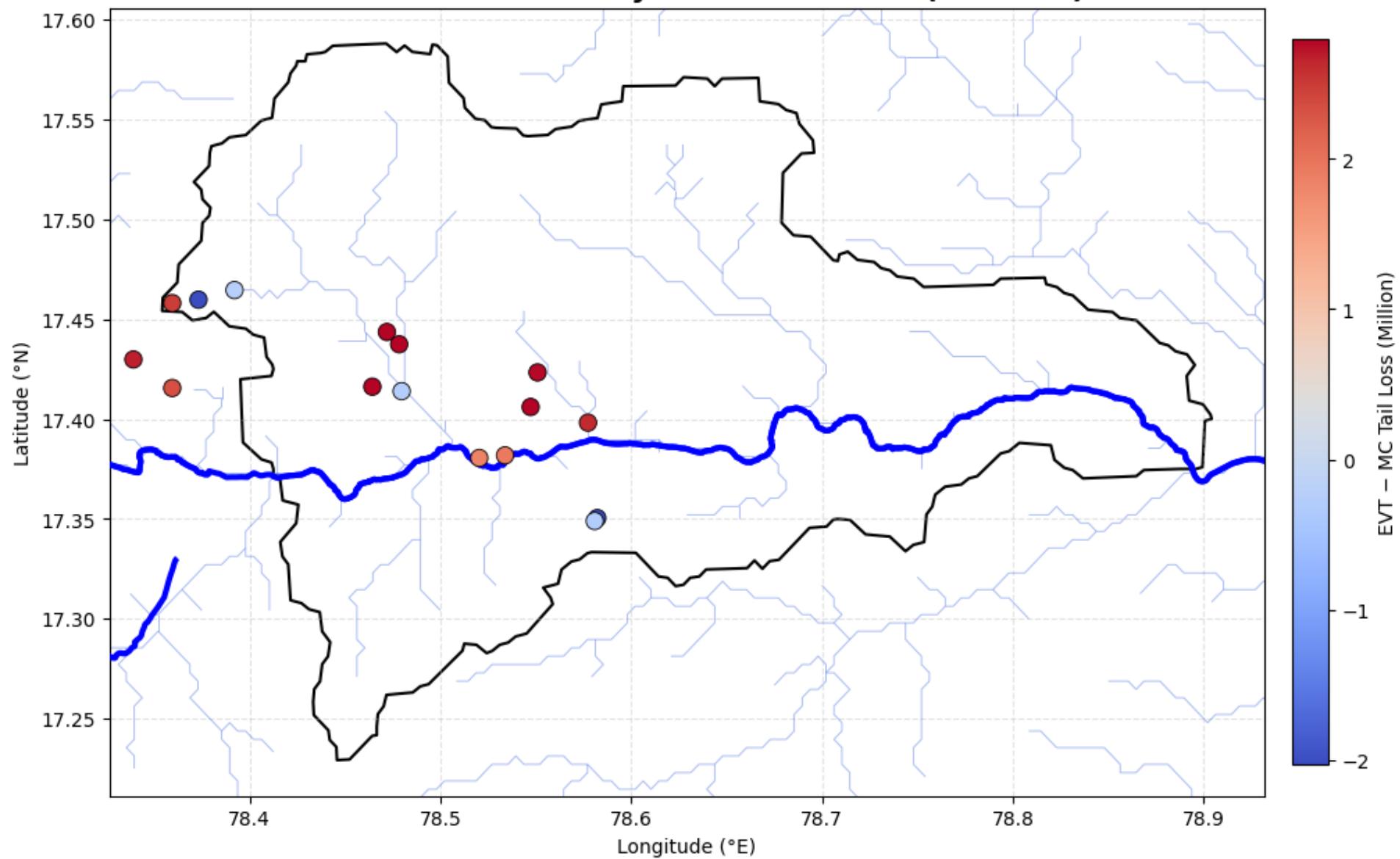
Monte Carlo Tail Facility Loss (EP < 2%)



EVT vs MC Mean Facility Loss Difference

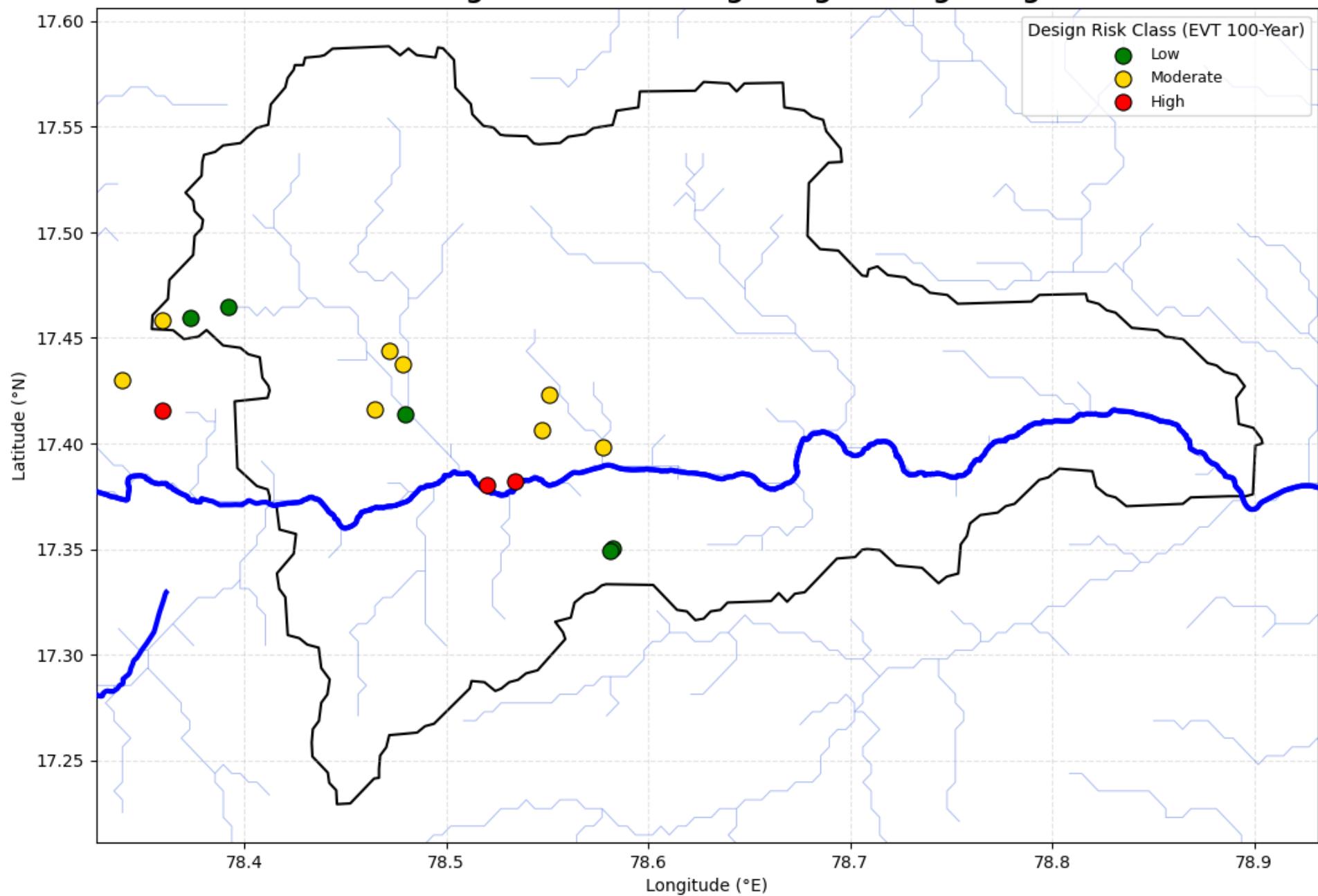


EVT vs MC Tail Facility Loss Difference (EP < 2%)



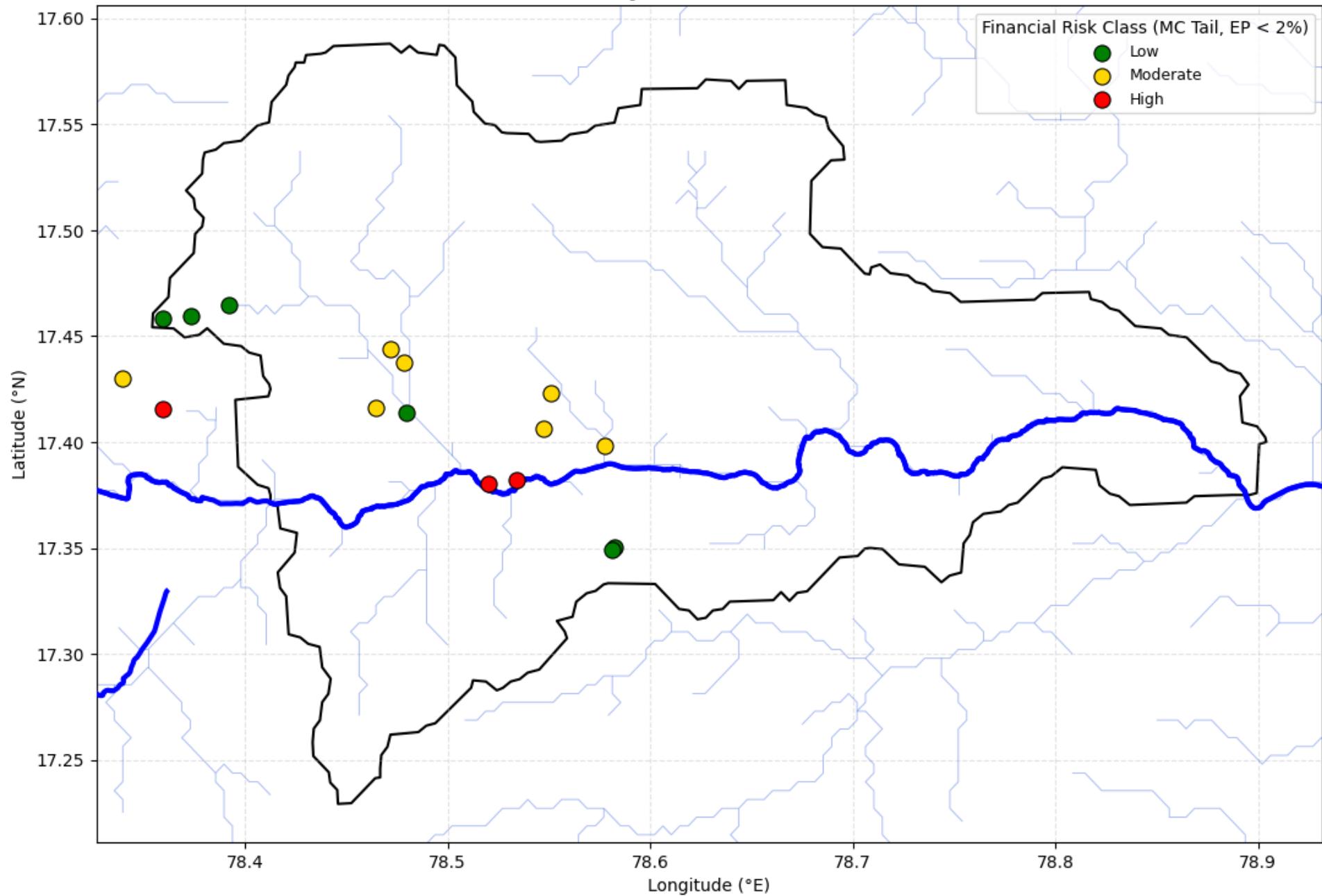
Facility Design Risk Classification - EVT 100-Year Flood Scenario

Use: Regulation • Planning • Engineering Design



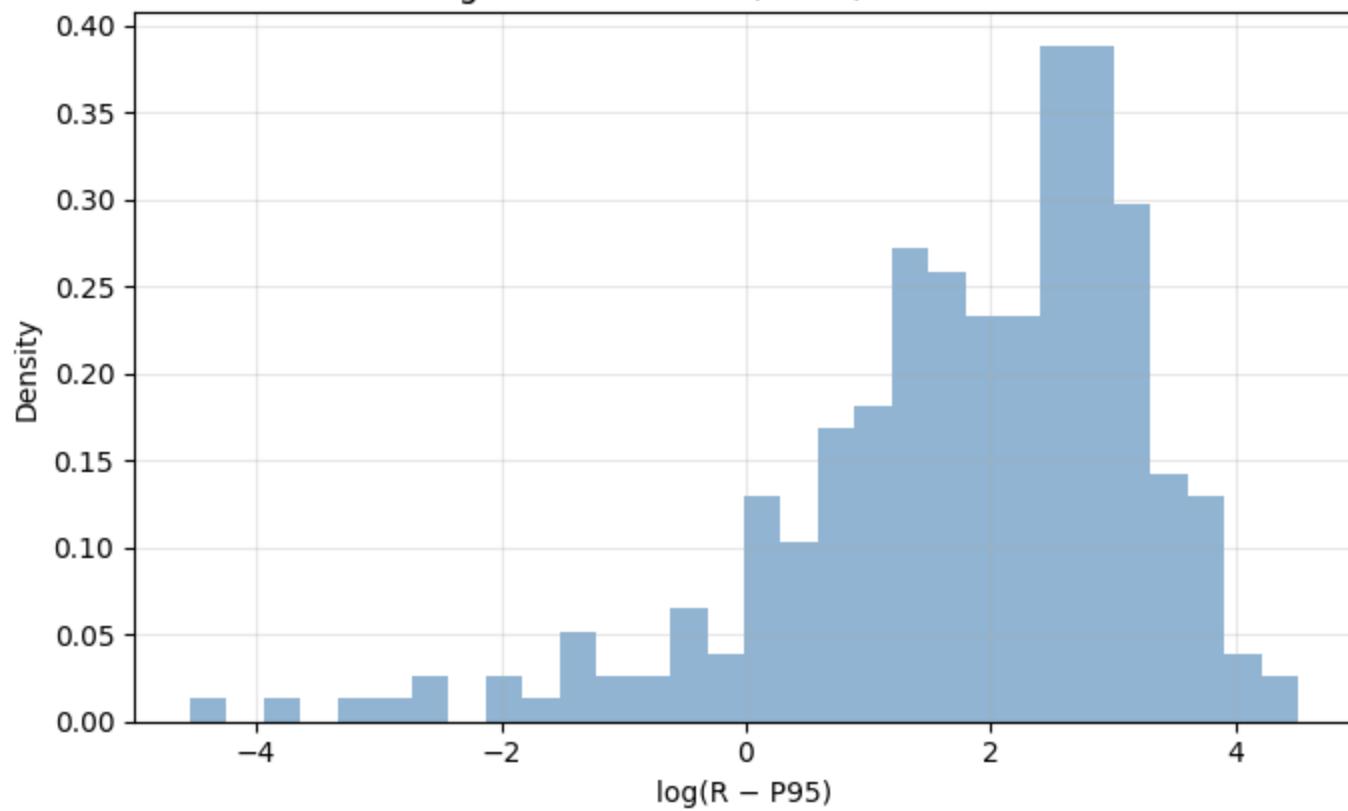
Facility Financial Risk Classification - Monte Carlo Tail Flood Loss

Use: Insurance • Capital Allocation • Portfolio Risk

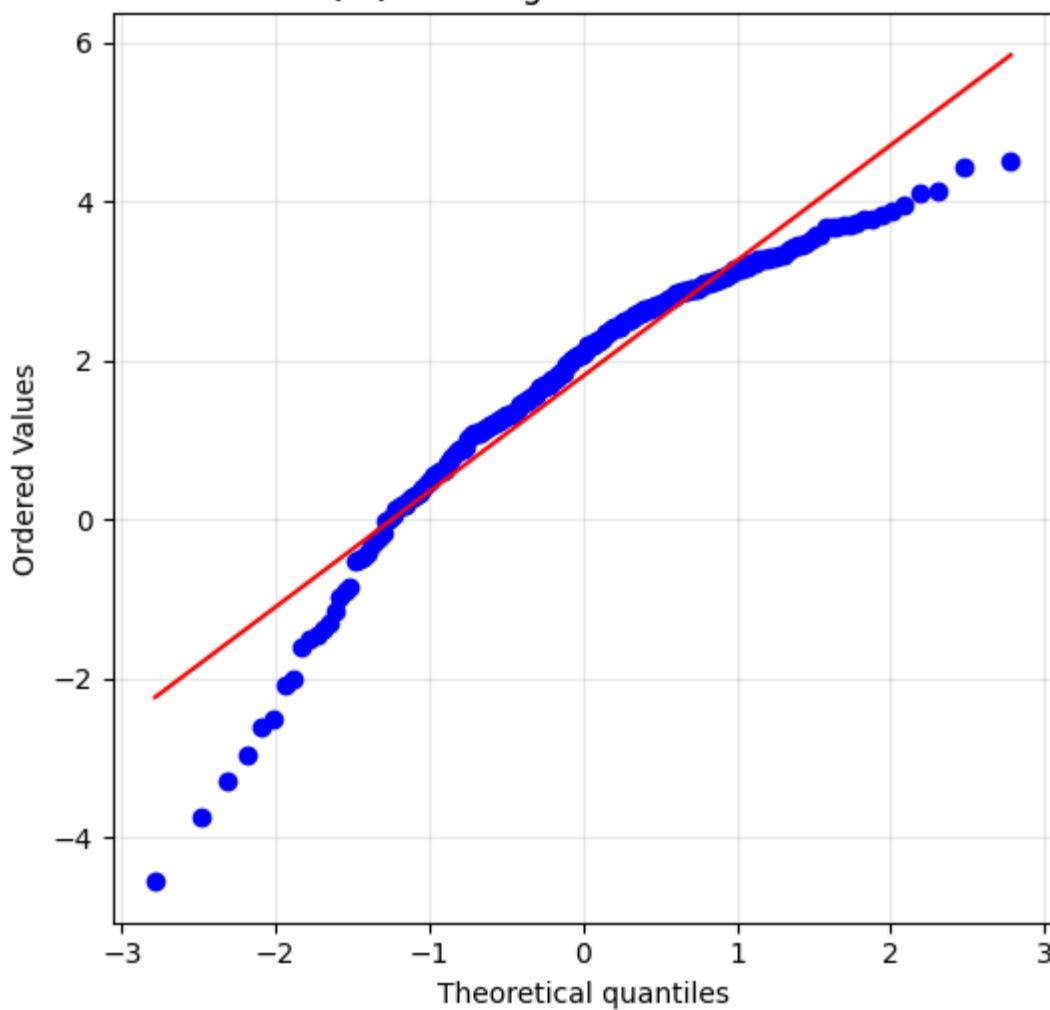


DGM-VAE

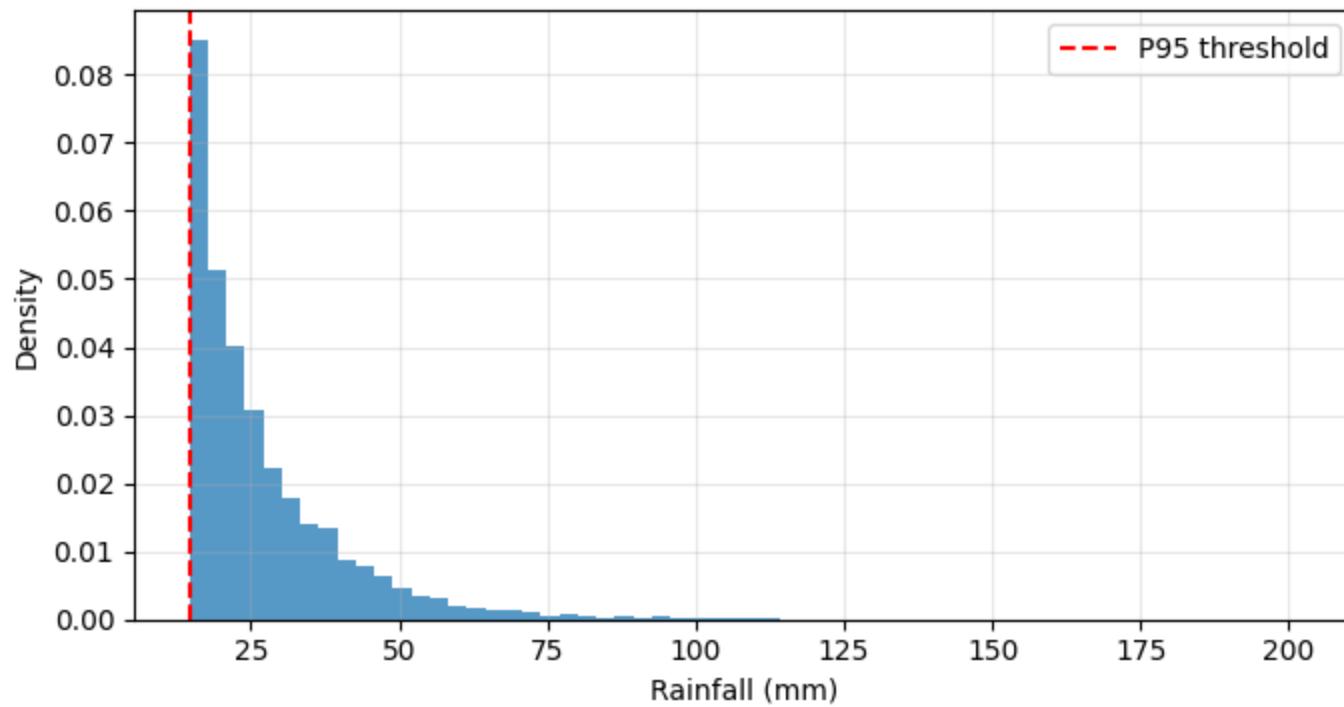
Log-Excess Rainfall (P95+) Distribution



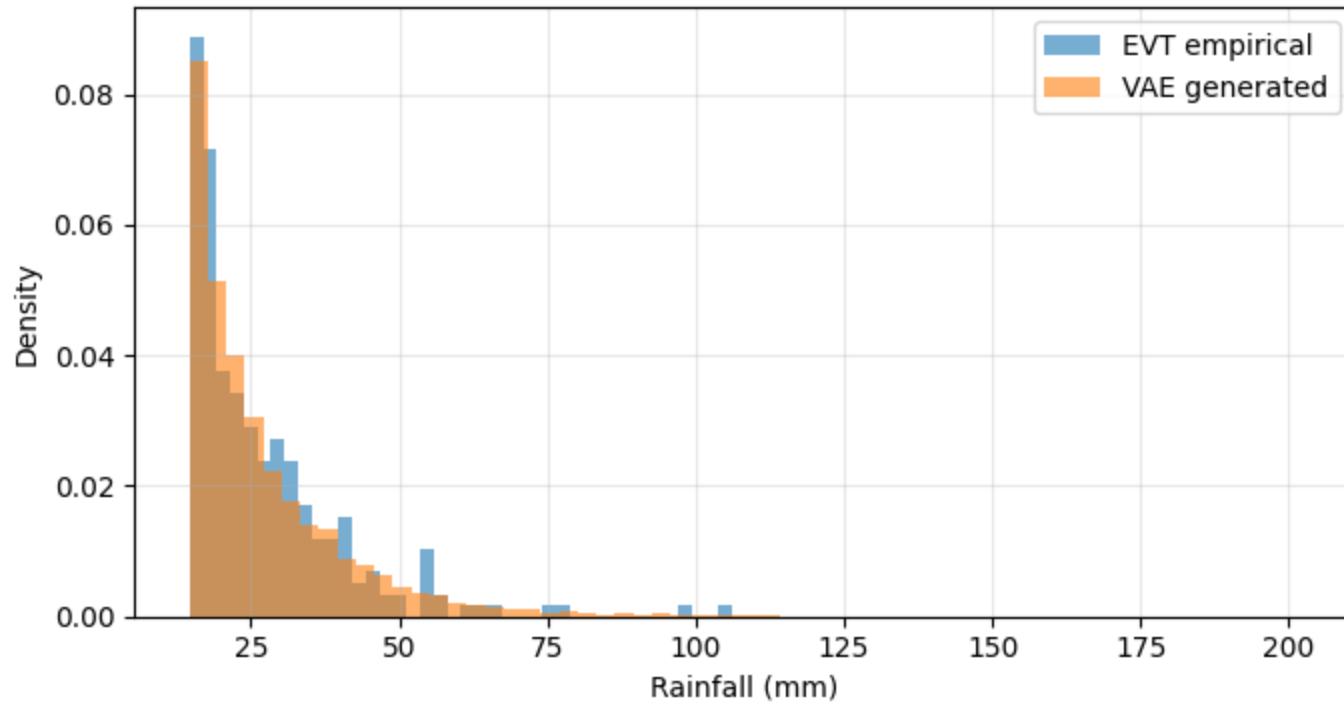
Q-Q Plot: Log-Excess vs Normal



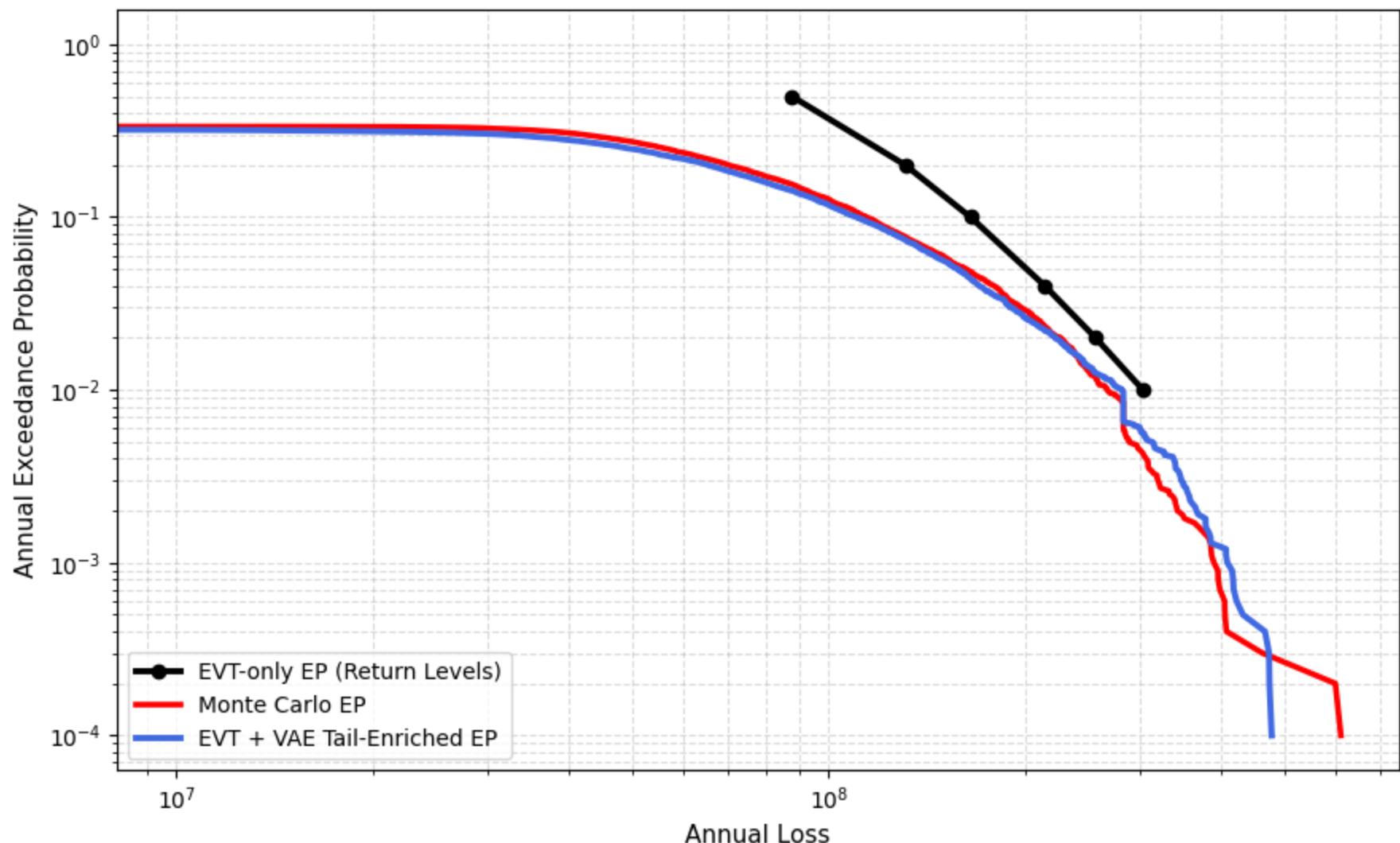
VAE-Generated Tail Rainfall Distribution



EVT vs VAE Tail Rainfall

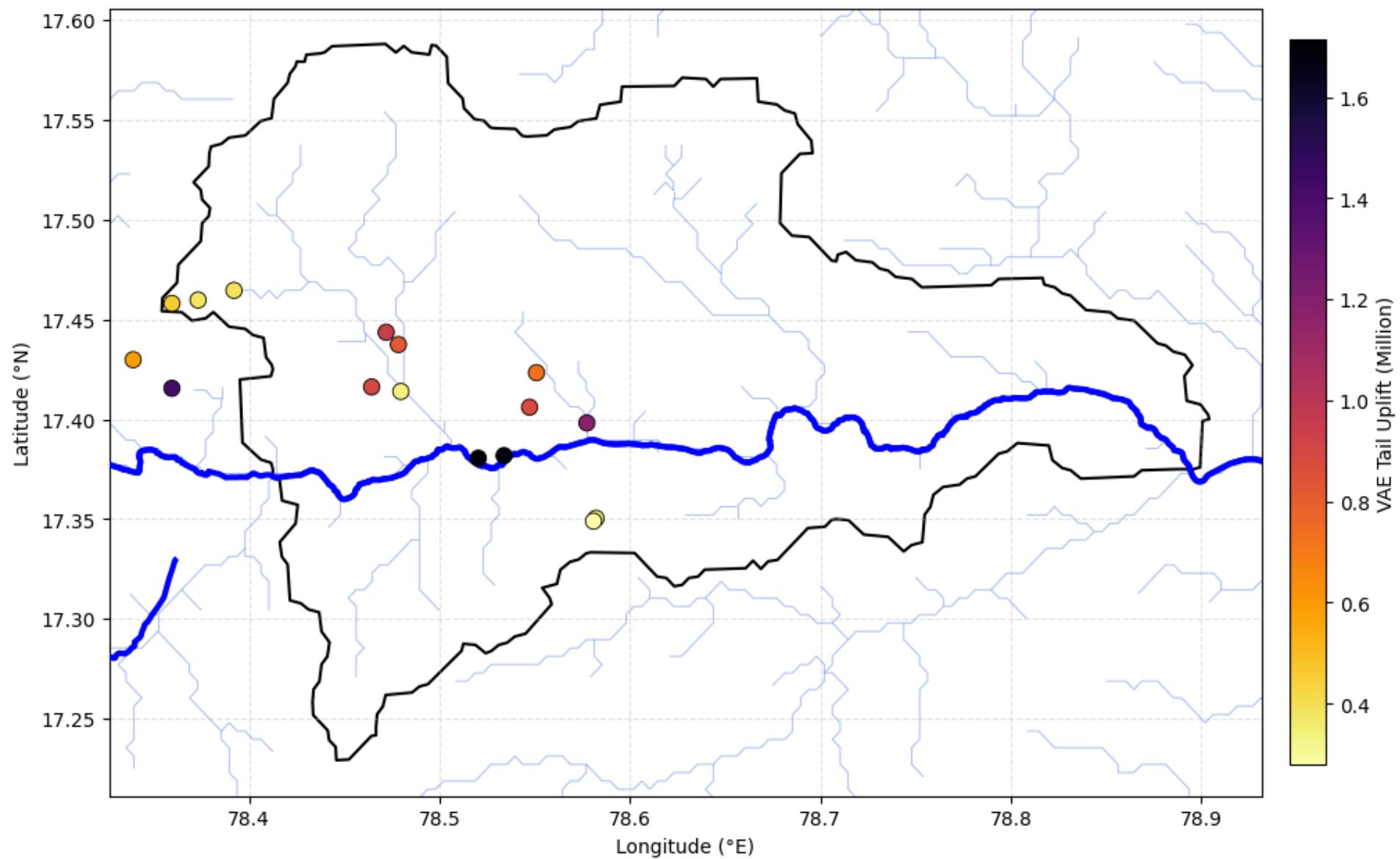


3-Way Flood Loss EP Curve Comparison - Musi Basin EVT vs Monte Carlo vs EVT + VAE Tail Enrichment

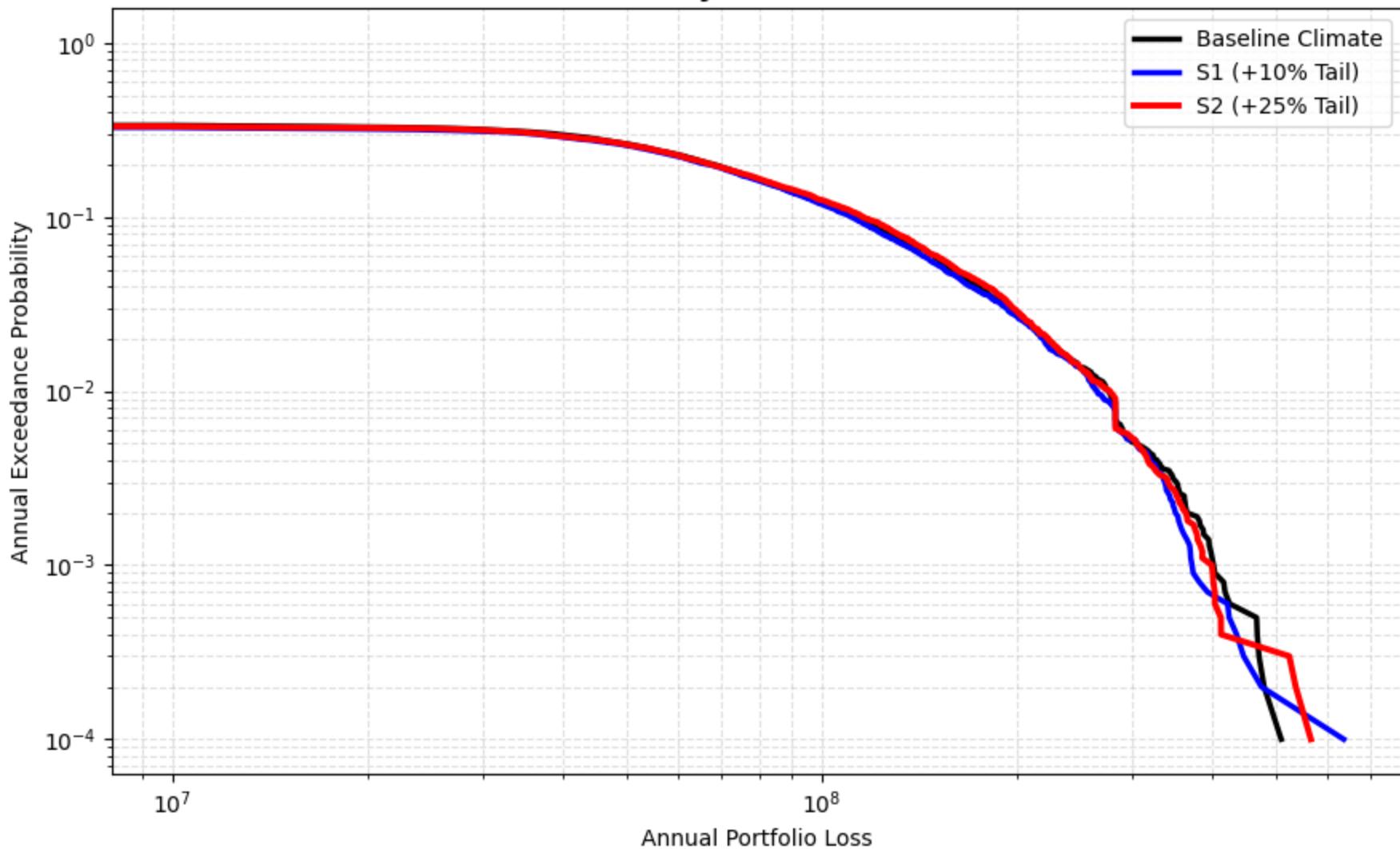


Facility-Level VAE Tail Risk Attribution

Color = Incremental Tail Loss from DGM

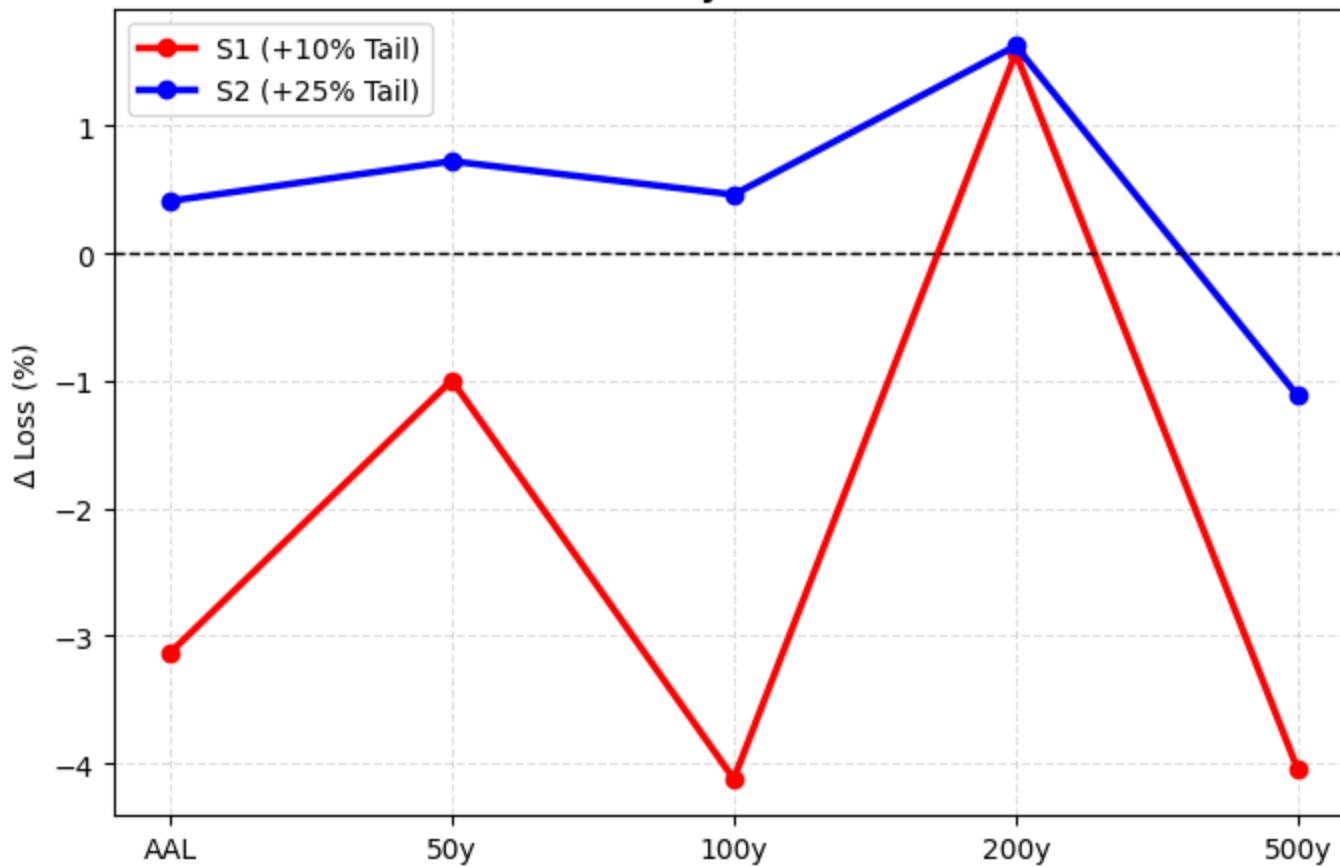


Climate-Conditioned Flood Loss EP Curves Non-Stationary VAE Tail Stress Test

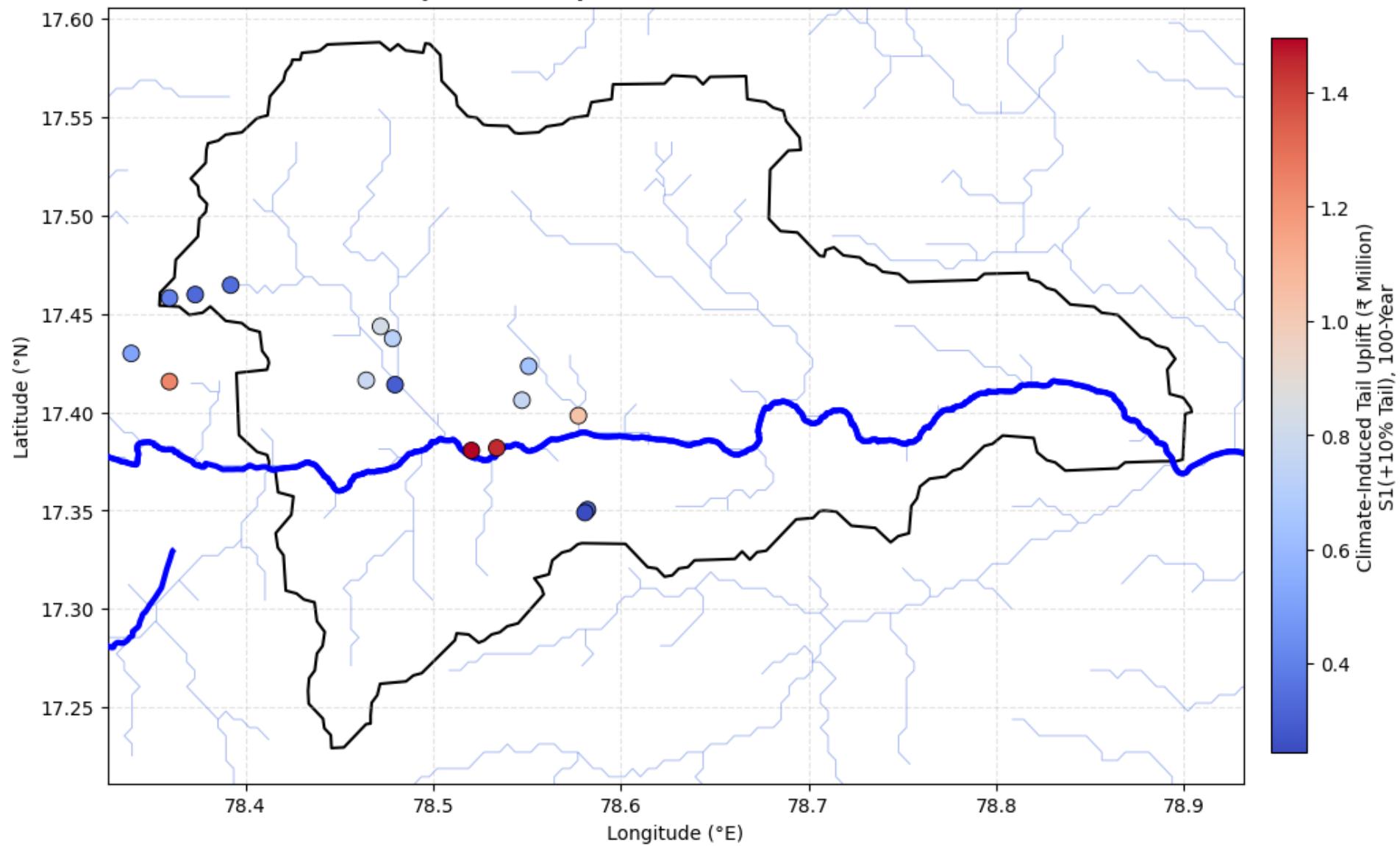


Climate-Conditioned Tail Impact on Portfolio Metrics

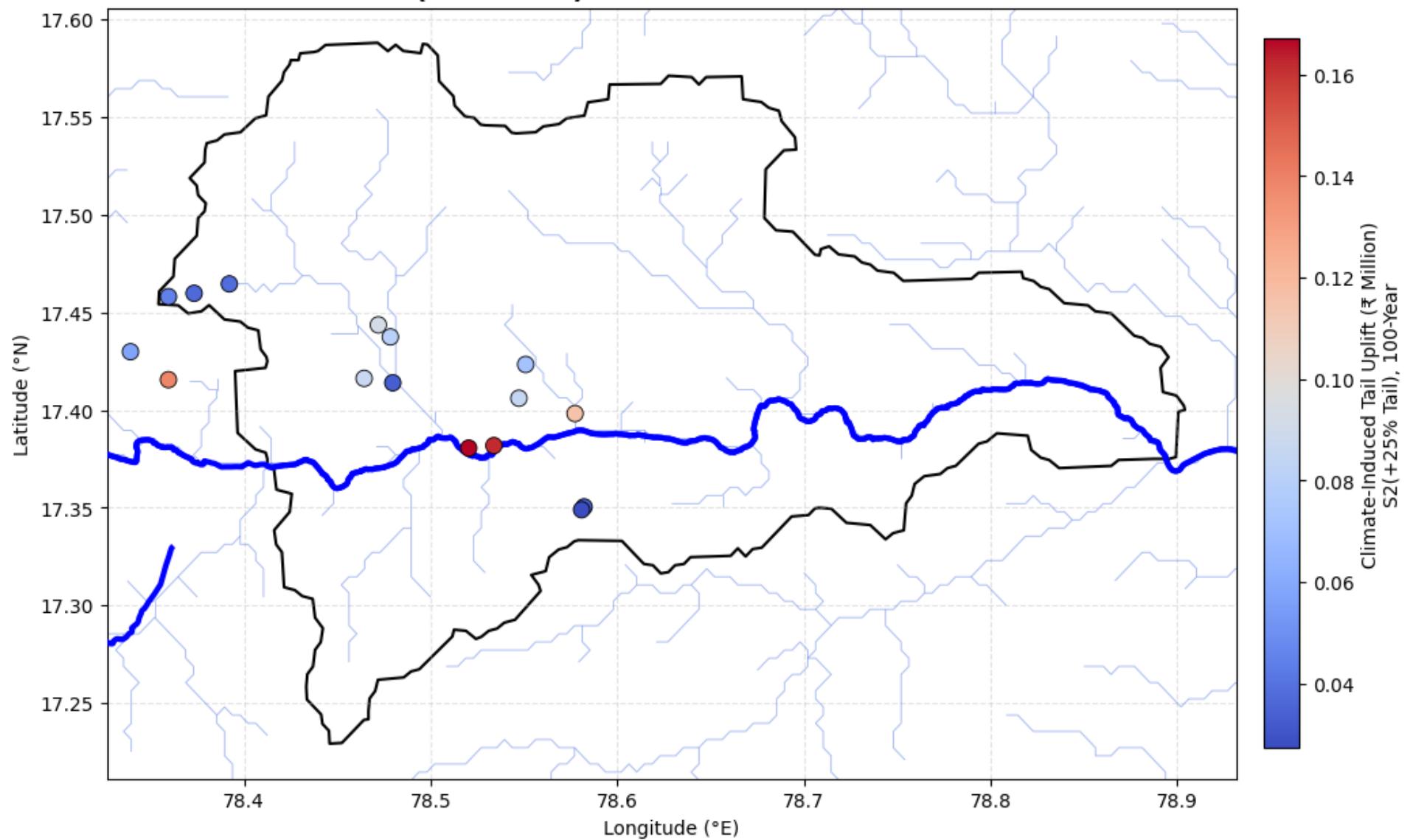
Non-stationary VAE Stress Test



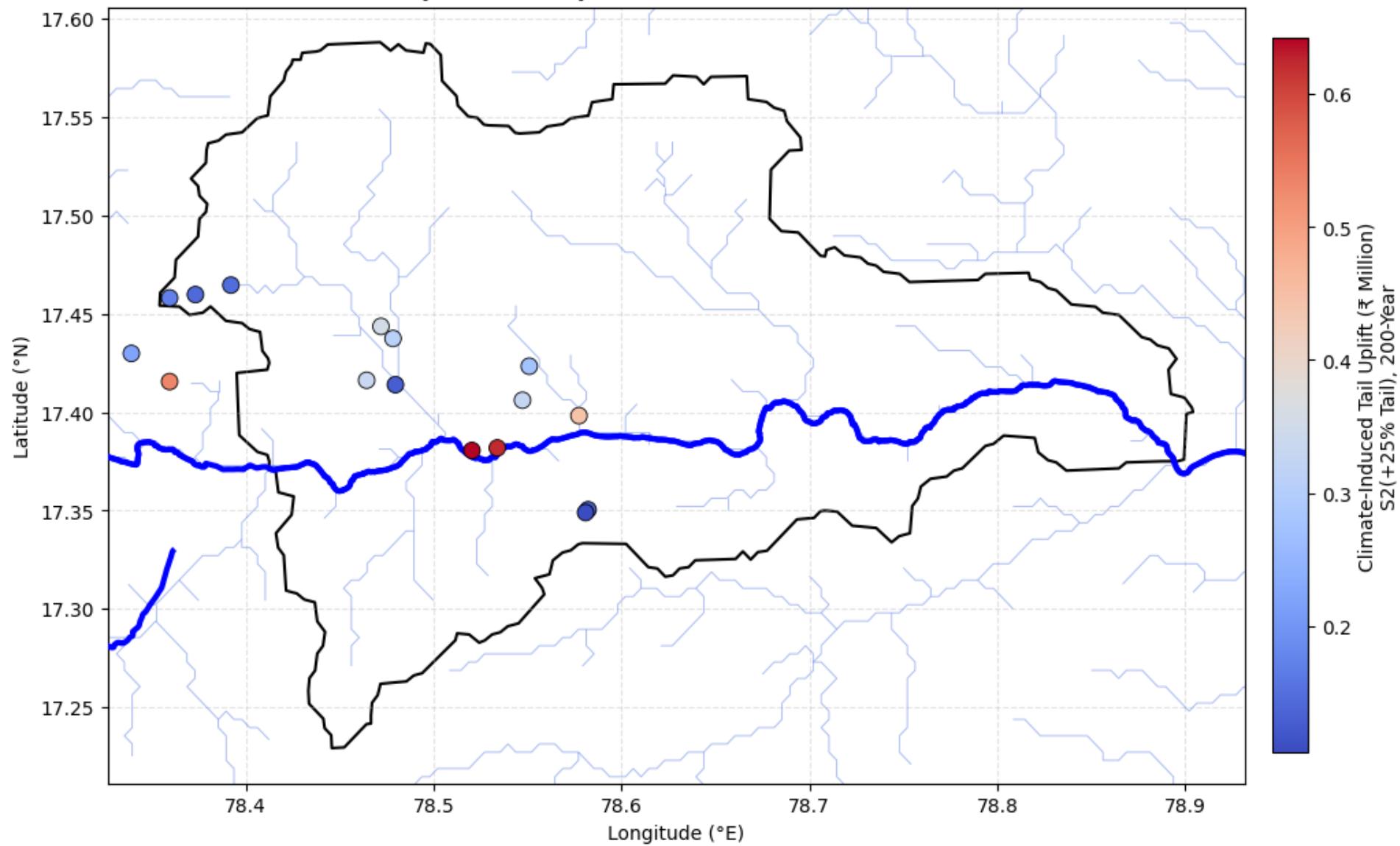
Facility-Level Climate-Conditioned Tail Risk S1 (+10% Tail) - 100-Year Flood Scenario



Facility-Level Climate-Conditioned Tail Risk S2 (+25% Tail) - 100-Year Flood Scenario



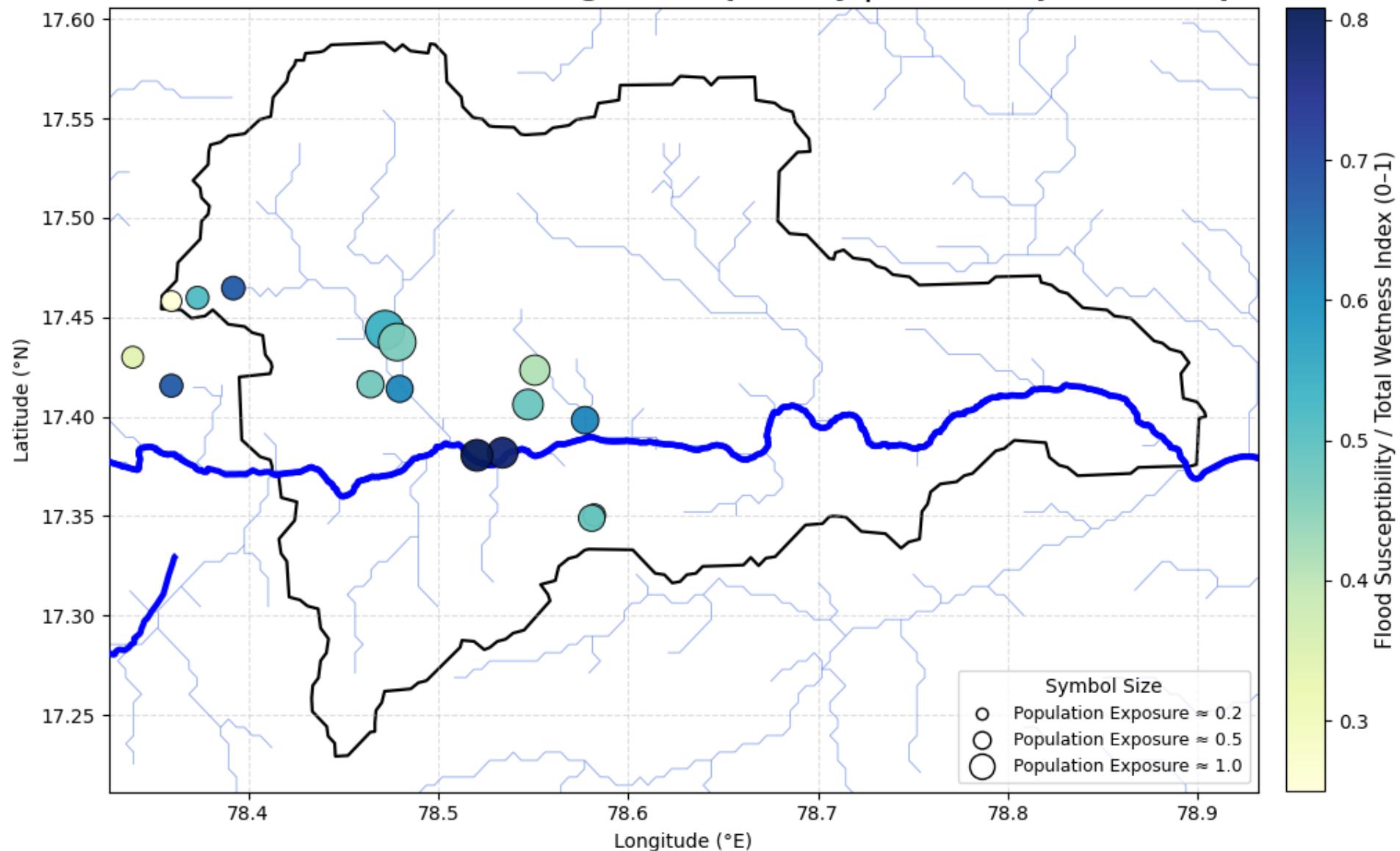
Facility-Level Climate-Conditioned Tail Risk S2 (+25% Tail) - 200-Year Flood Scenario



indices

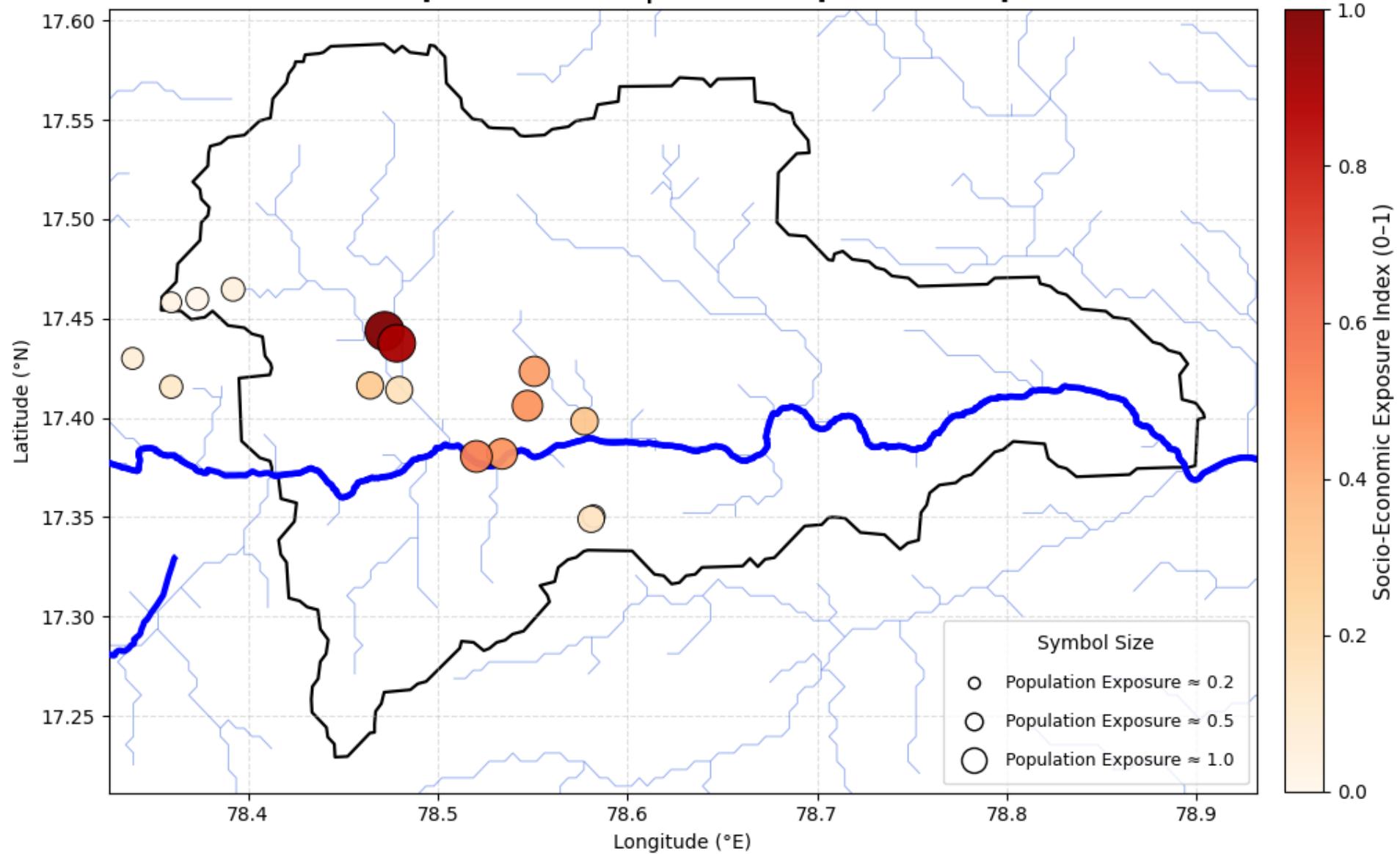
Musi Sub-Basin — Bio-Physical Flood Susceptibility Index

Color = Terrain Wetness & Drainage Susceptibility | Size = Population Exposure



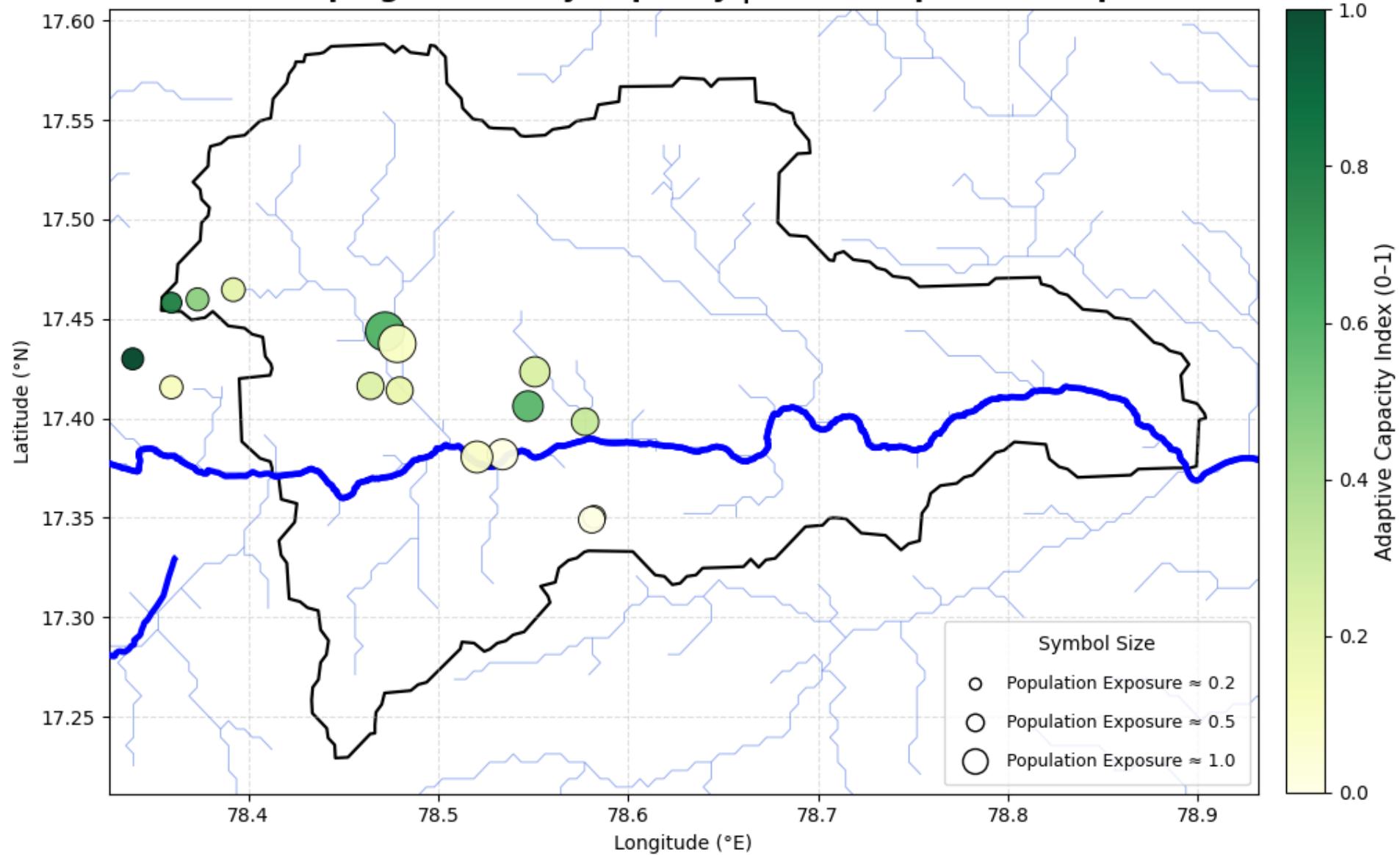
Musi Sub-Basin – Socio-Economic Exposure of Wastewater Infrastructure

Color = Exposure Index | Size = Population Exposure



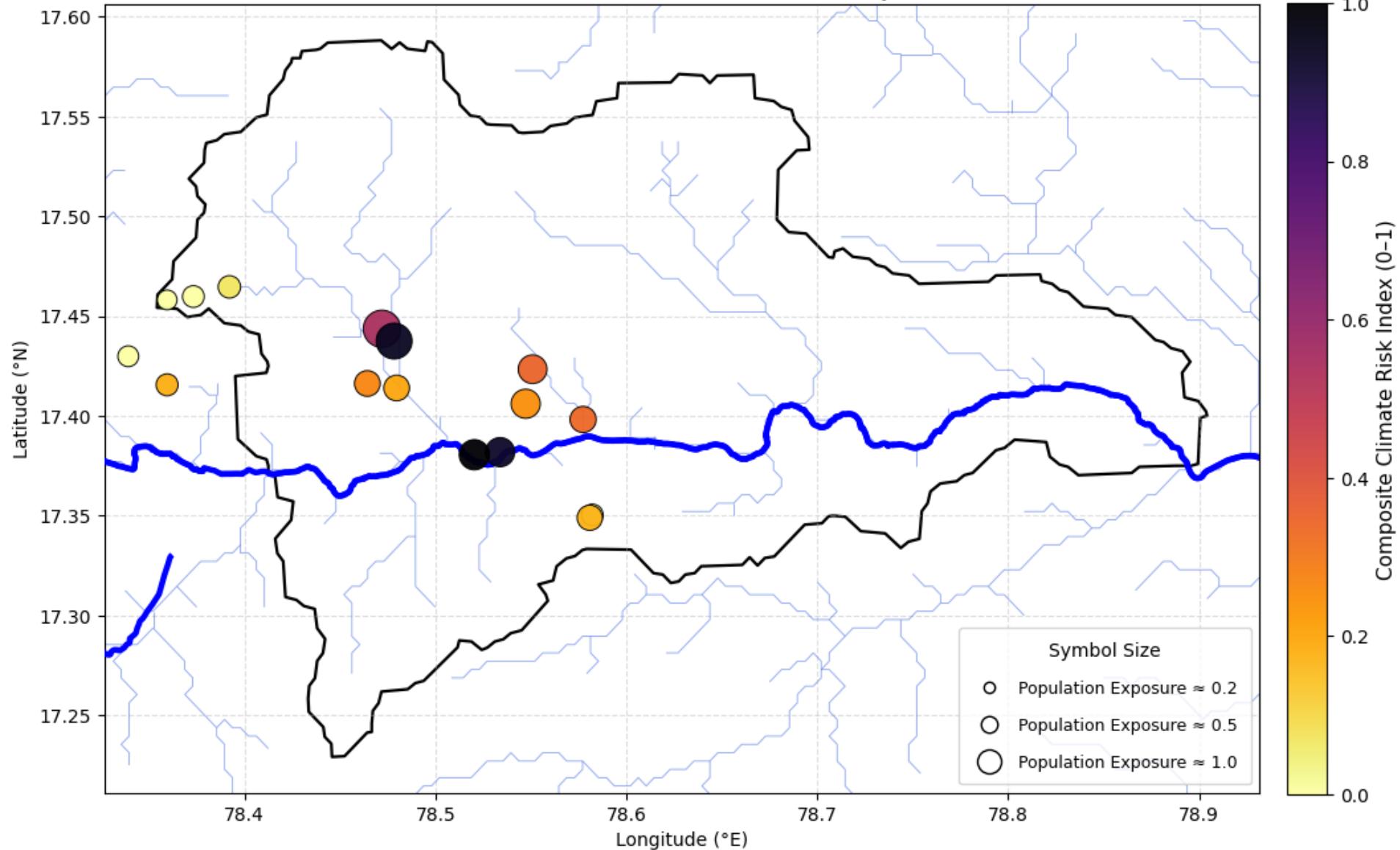
Musi Basin - Adaptive Capacity of Wastewater Facilities

Color = Coping / Recovery Capacity | Size = Population Exposure



Musi Sub-Basin — Composite Climate Risk of Wastewater Infrastructure

Color = Hazard \times Exposure \times (1 – Adaptive Capacity) | Size = Population Exposure



Musi Sub-Basin — Flood Tail Risk vs Composite Climate Risk

