USING THE NATIONAL HYDROGRAPHY DATASET PLUS TO IMPROVE FLOW MODELING ON THE CENTRAL COAST OF CALIFORNIA

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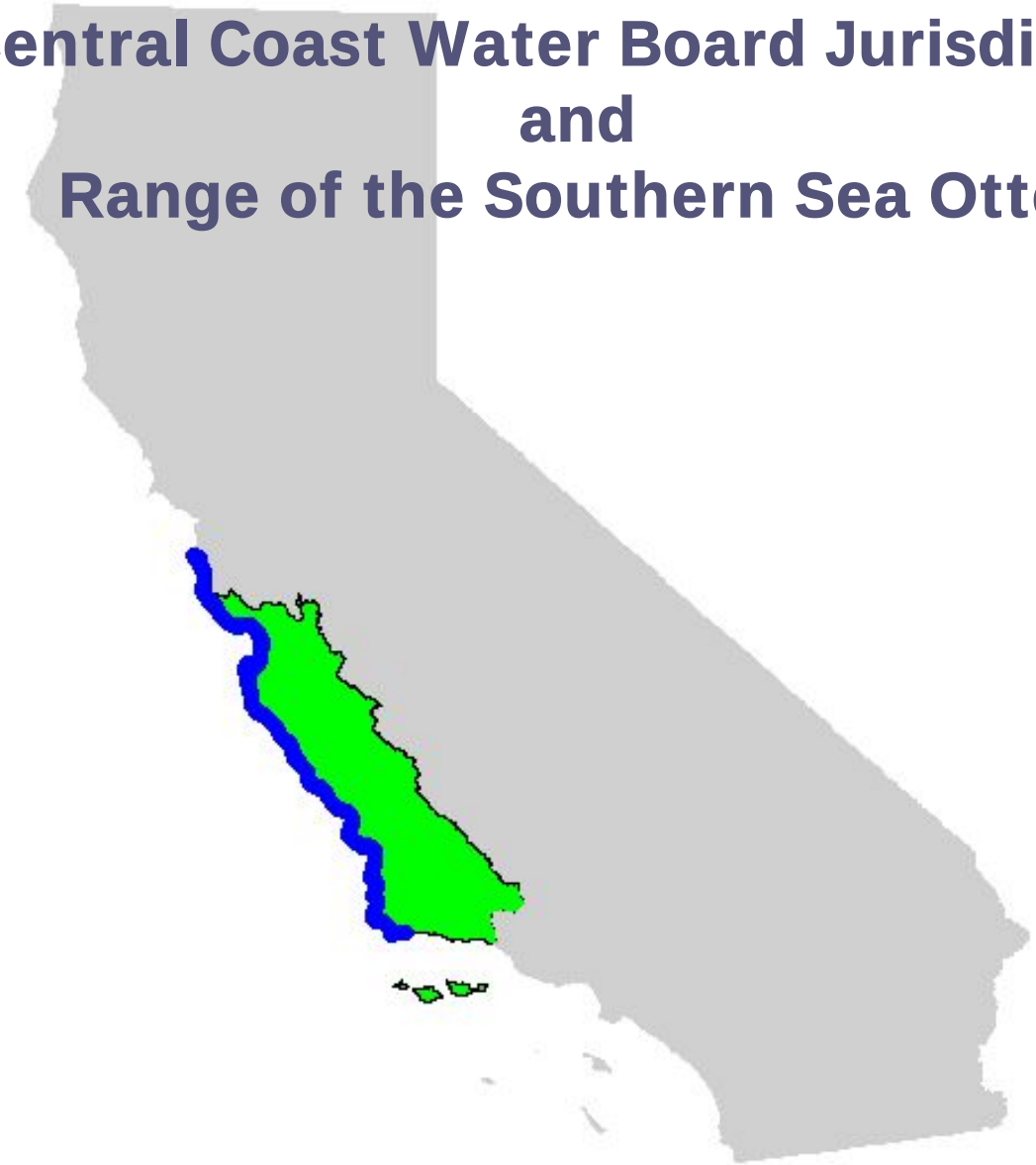
This work originated with attempts to explore possible relationships between Marine Mammal Disease and Coastal Runoff

The Southern Sea Otter

Central Coast Water Board Jurisdiction and Range of the Southern Sea Otter



The work is being expanded to support California Ocean Protection Council Strategies

- **Recognizing the interconnectedness of the land and the sea, supporting sustainable uses of the coast, and ensuring overall ecosystem health**

- **Improving the protection, conservation, restoration, and management of coastal and ocean ecosystems through enhanced scientific understanding, including monitoring and data gathering**


Monterey Bay
California Marine Protected Areas
and Coastal Confluence Monitoring
Marine Protected Areas
CCAMP Coastal Confluence Sites
Santa Barbara Channel

Typical pollutants found in surface runoff to the ocean

- Nutrients
- Pathogens
- Sediment
- Metals
- Pesticides and PCBs
- Petroleum hydrocarbons
- Other substances, such as phthalates, polybrominated diphenyl ethers (PBDEs)

Protozoal diseases

- Resistant to chlorination
- Can be concentrated in shellfish (otter food)

- Domestic and introduced species are sources
- *Toxoplasma*, *Cryptosporidium*, and *Giardia* associated with areas of high freshwater inflow

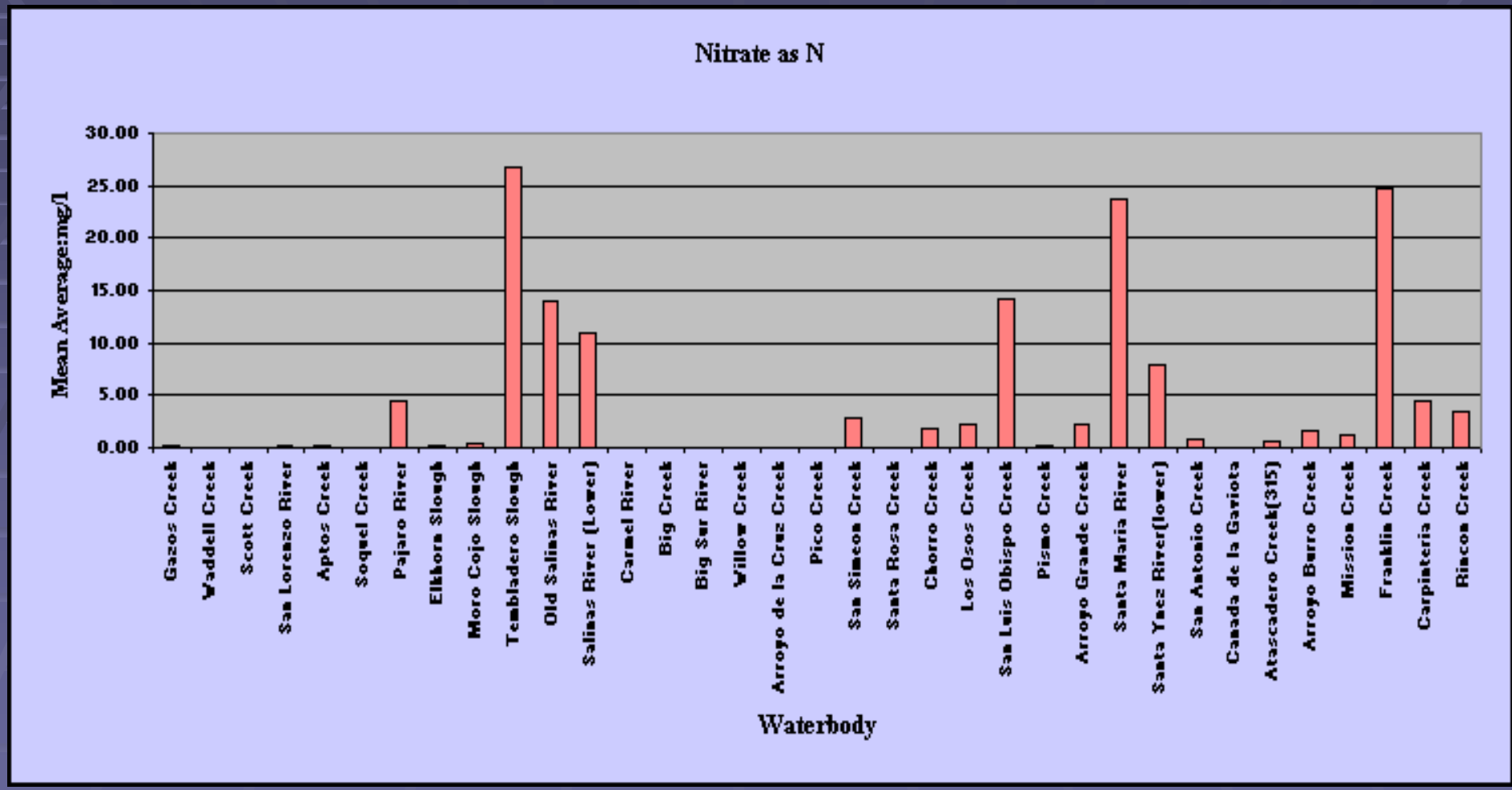
Bacterial Diseases

- *Salmonella*, *Vibrio*, *Campylobacter*, and others isolated in sea otters
- Several have been associated with physical symptoms and death
- Some strains are identical to human strains
- Risk factors for uptake by mussels include precipitation and sewage sources
- Risk factors include fresh water flow and increasing human population density

Harmful Algal Blooms
Domoic Acid Poisoning

- ***Pseudo-nitschia* has complex nutrient dynamics involving silica, iron, nitrate, urea and other nutrients**
- **Current research indicates anthropogenic nitrate and urea inputs exacerbate blooms and toxicity**

Nitrate Concentrations in Coastal Rivers and Streams



CCAMP Coastal Confluences Data

Apparent Land-Sea Interactions Exist

Where’s all this stuff coming from?

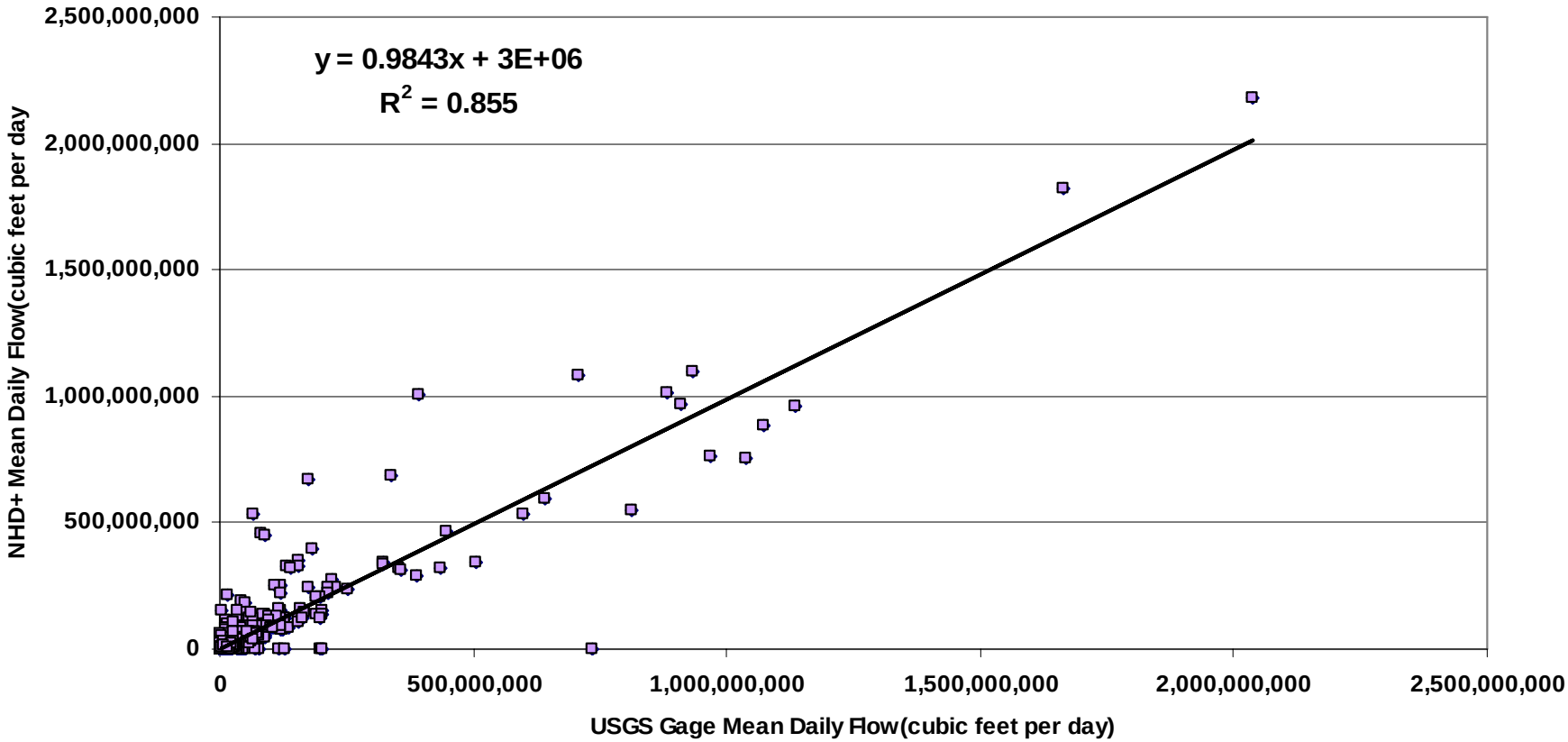
All models are wrong.

Some models are useful.

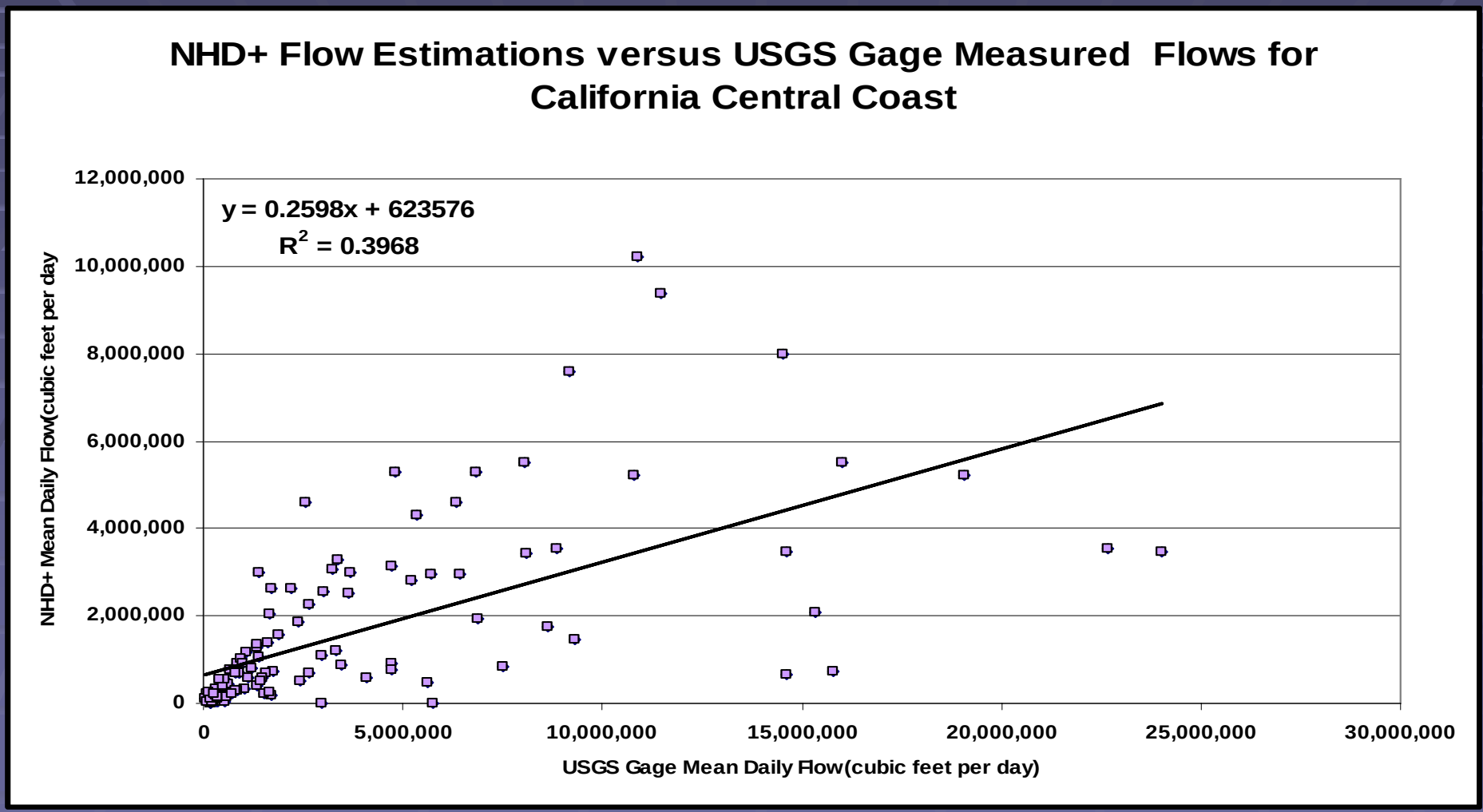
Initial Conceptual Model Efforts

- Our early coastal runoff estimations used only precipitation and watershed size
- Sixty year record of precipitation combined with watershed size indicated some strong relationships
- When NHD+ became available we felt estimations could be refined

NHD+ UROM Model looked good



NHD+ Model did not look as good for California's Central Coast



Un-gauged watershed issues?

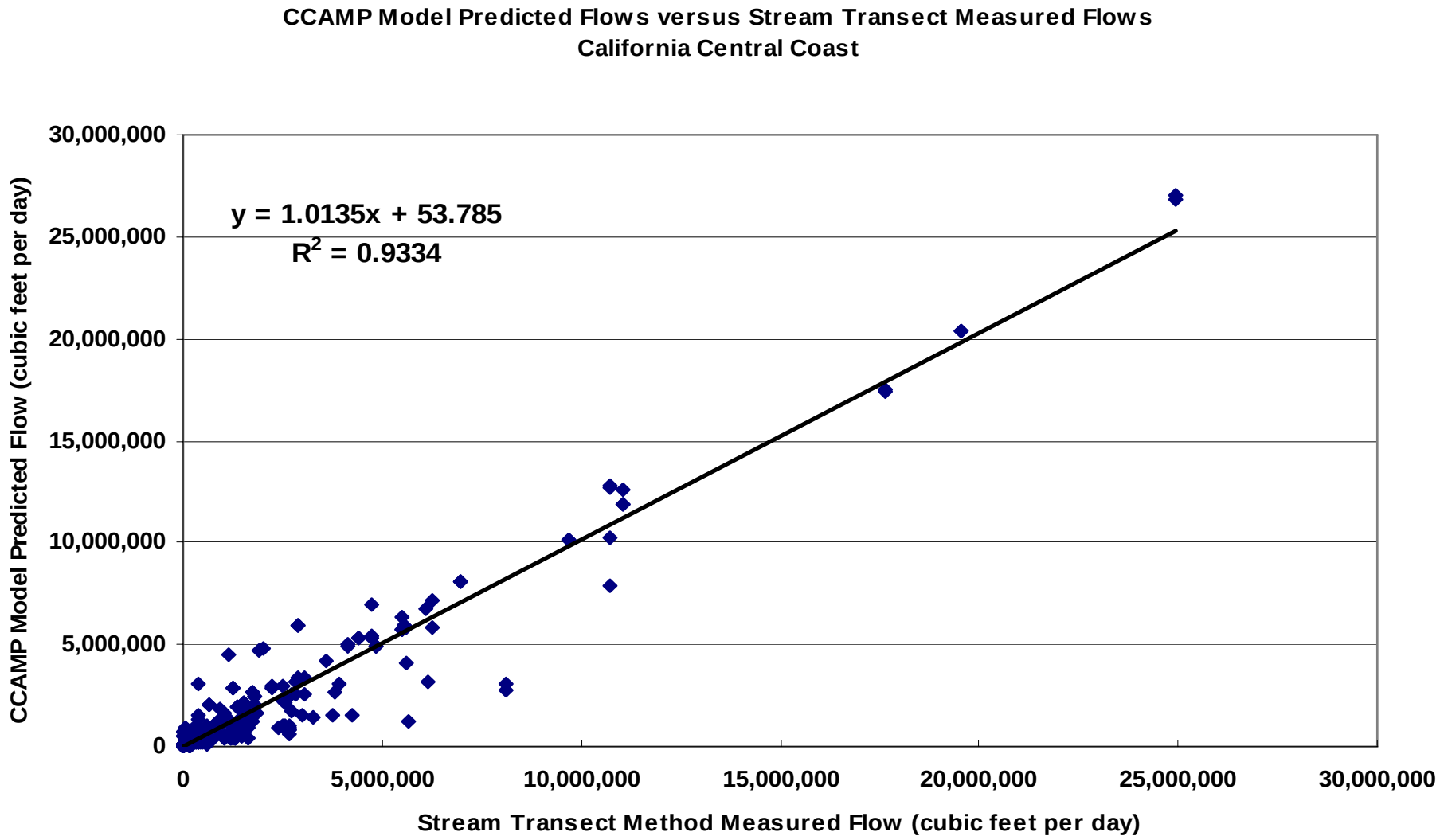
- Could flow estimates be improved?
- Could we use NHD+ to improve flow estimates?
- Could we predict flow on a given day
- Benchmark = Monthly stream transect measured flow

Empirical Modeling Approach

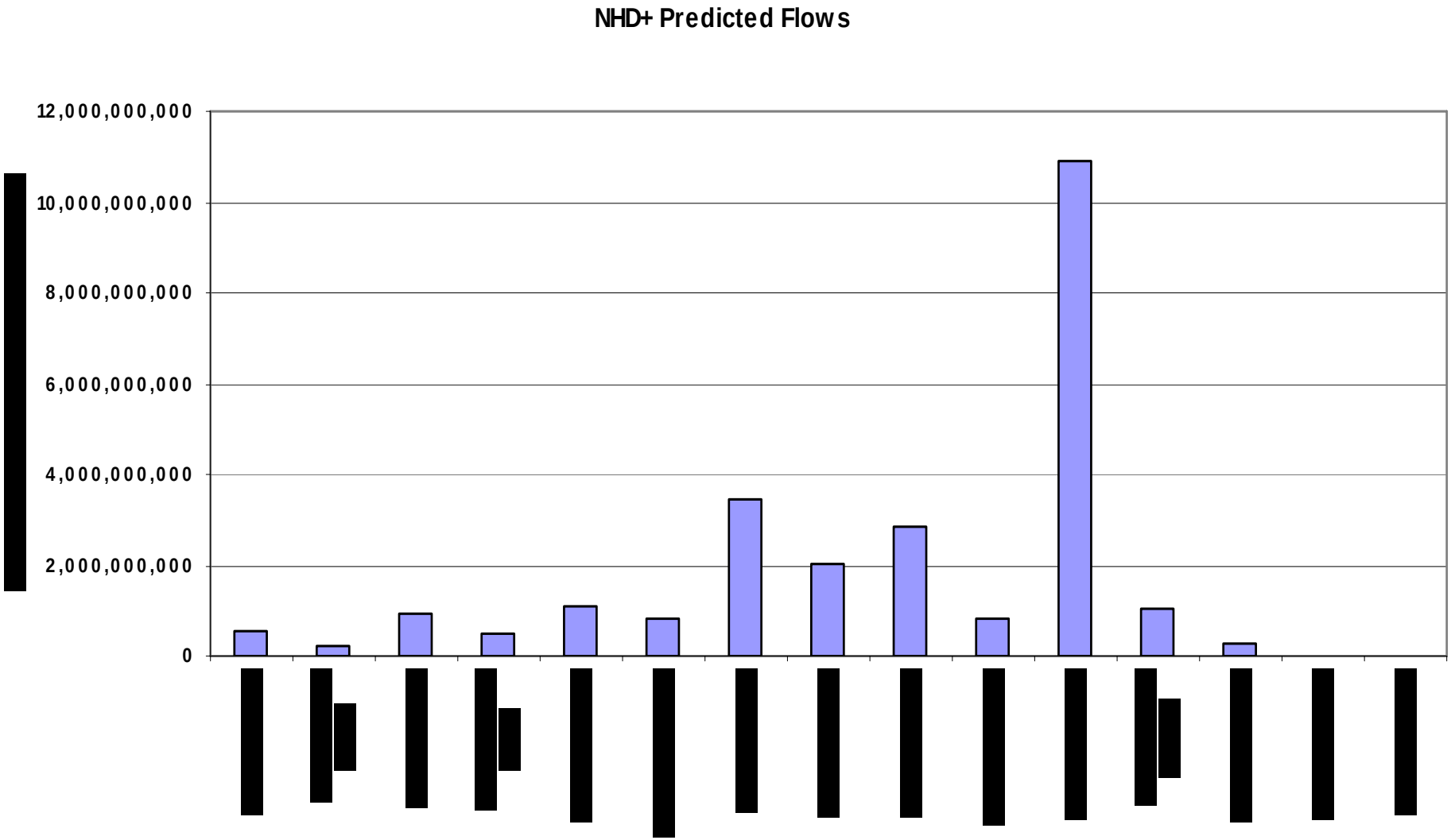
We selected a sub-set of 13 coastal confluences

- Devised a method of ‘tuning’ NHD+ UROM flow estimates
- Used local USGS gages in nearby watersheds for spatial, temporal, and anthropogenic influence ‘calibration’
- Benchmarked results using monthly stream transect measured flows

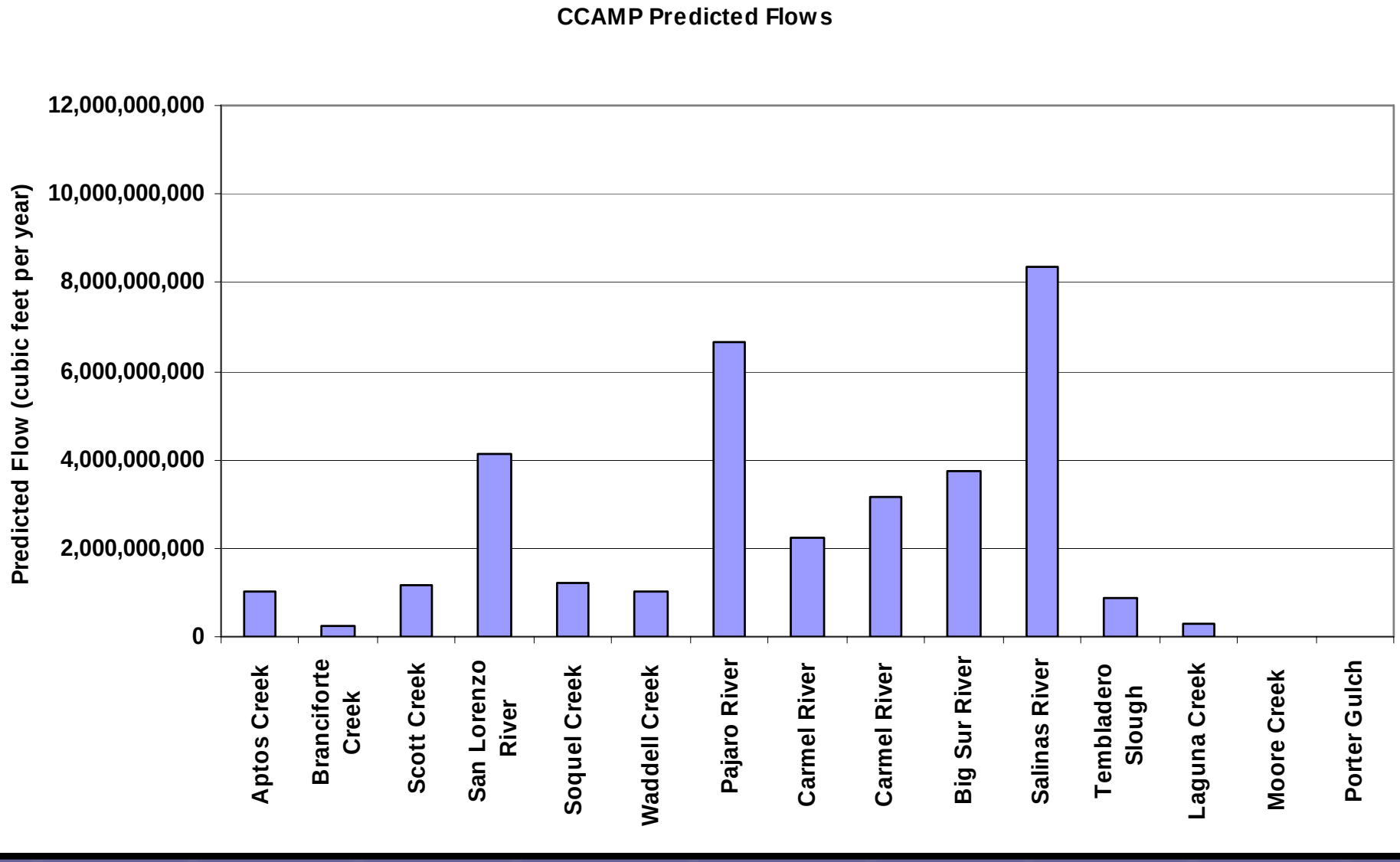
Initial Model Results (13 sites)



NHD UROM Predicted Flows



CCAMP Model Predicted Flows



The Notion Behind the Model

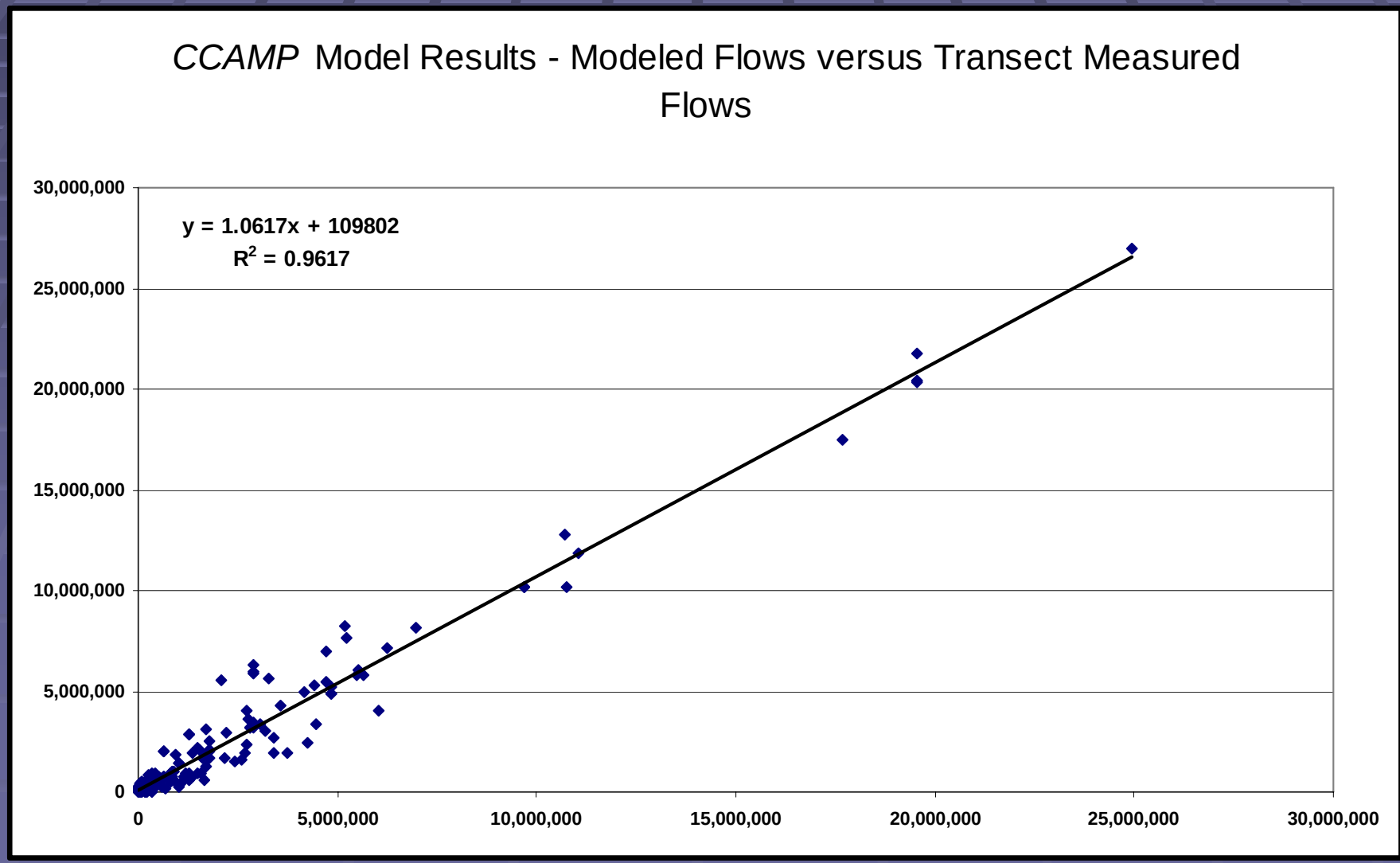
- Localize UROM using up to 3 local gages
- Select local gages via BPJ to represent local climate, weather, and anthropogenic influences
- Use exploratory data analysis to identify model failures and provide alternative methods of estimating flows for sites subject to model failures

Model Algorithm

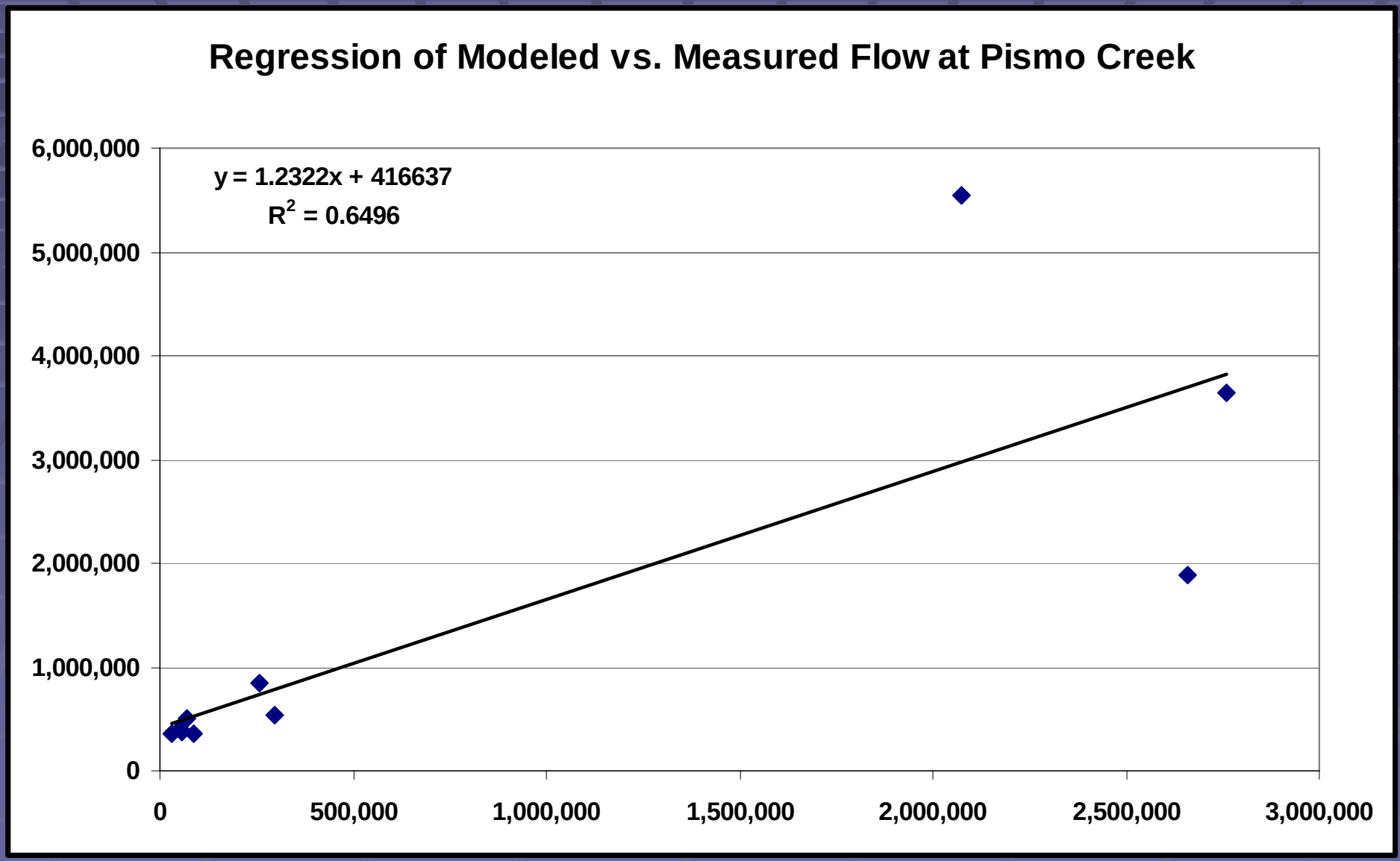
- **Used for flows => 5 cfs**
- flow_ratio[1] = gage_flow[1] / NHD_reach_mean_daily_flow[1]
- flow_ratio[2] = gage_flow[2] / NHD_reach_mean_daily_flow[2]
- flow_ratio[3] = gage_flow[3] / NHD_reach_mean_daily_flow[3]
- mean_flow_ratio=(flow_ratio[1]+ flow_ratio[2]+ flow_ratio[3]) / reach_count
- flow_estimate[instant_reach]= mean_flow_ratio * reach_mean_daily_flow[instant_reach]

- **Used for mean daily flows under 5 cfs**
- flow_ratio[1] = gage_flow[1] / NHD_reach_cumulative_drainage_area[1]
- flow_ratio[2] = gage_flow[2] / NHD_ reach_cumulative_drainage_area[2]
- flow_ratio[3] = gage_flow[3] / NHD_reach_cumulative_drainage_area[3]
- mean_flow_ratio = (flow_ratio[1] + flow_ratio[2] + flow_ratio[3]) / reach_count
- flow_estimate[instant_reach]= mean_flow_ratio * reach_cumulative_drainage_area [instant_reach]

Flow Estimates at 25 sites slope=1.06 correlation=0.96

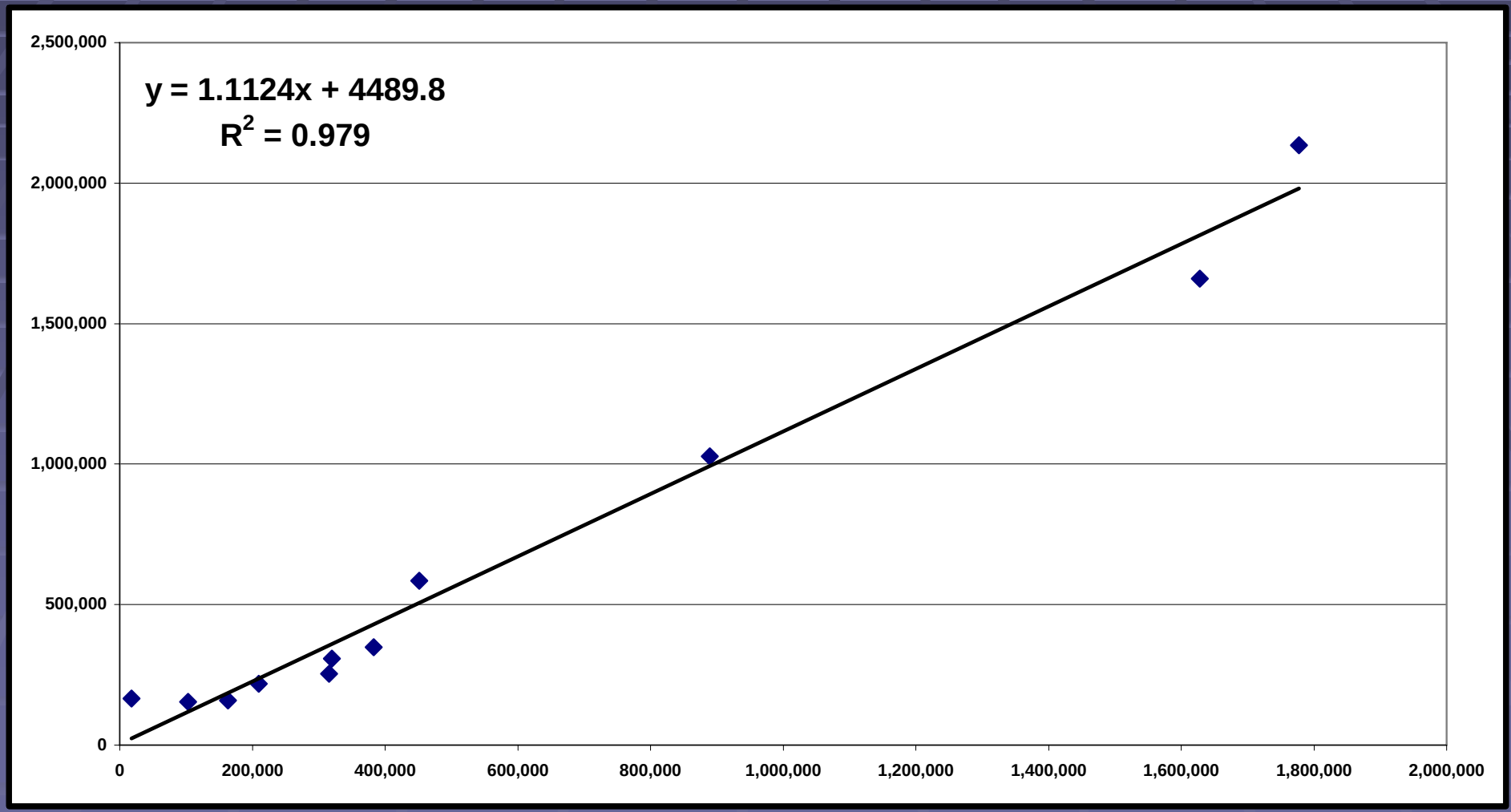


Poor Model Performance at some sites



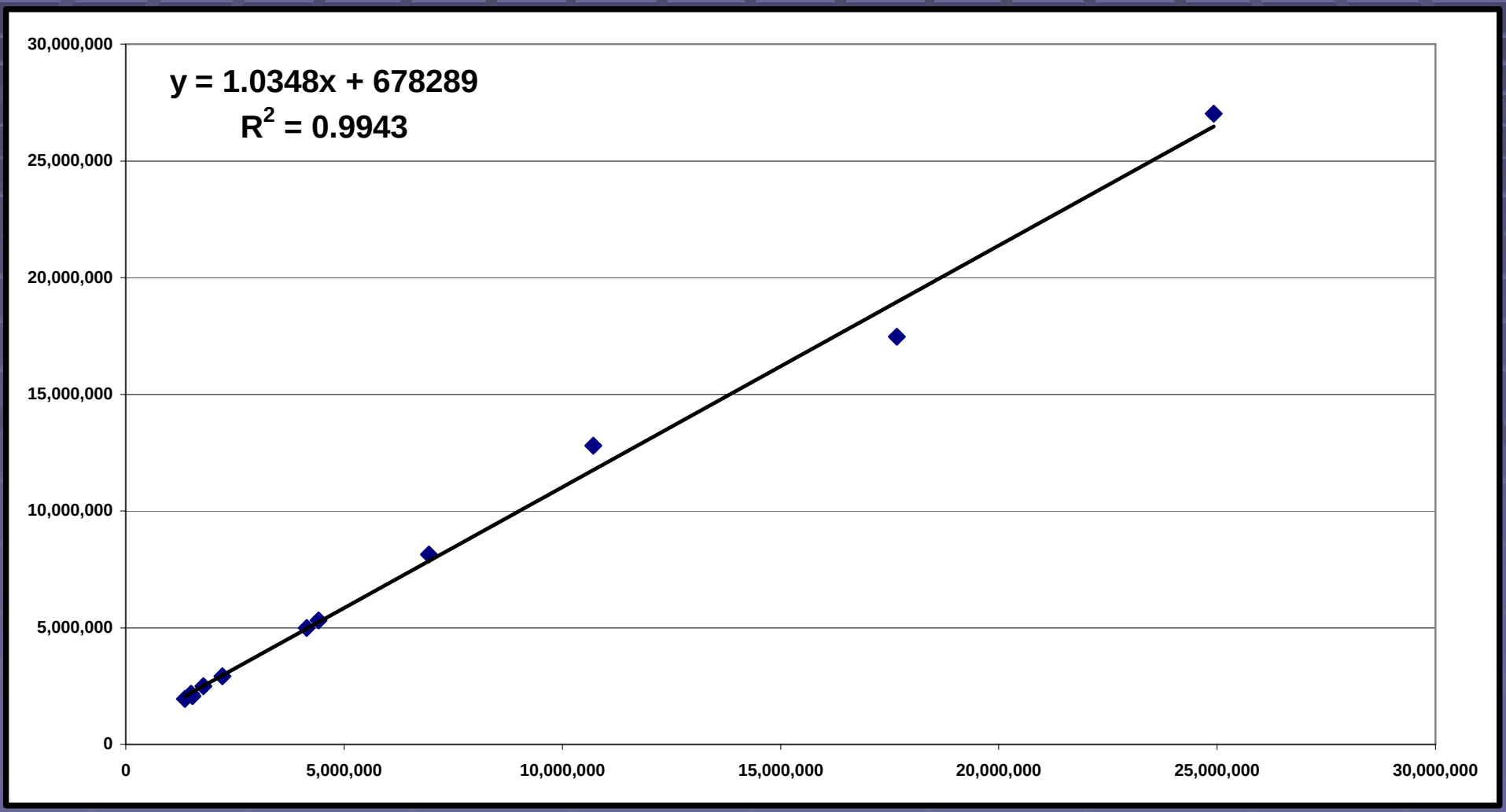
Unexpected High Model Performance at many sites

Example: Arroyo Grande Creek

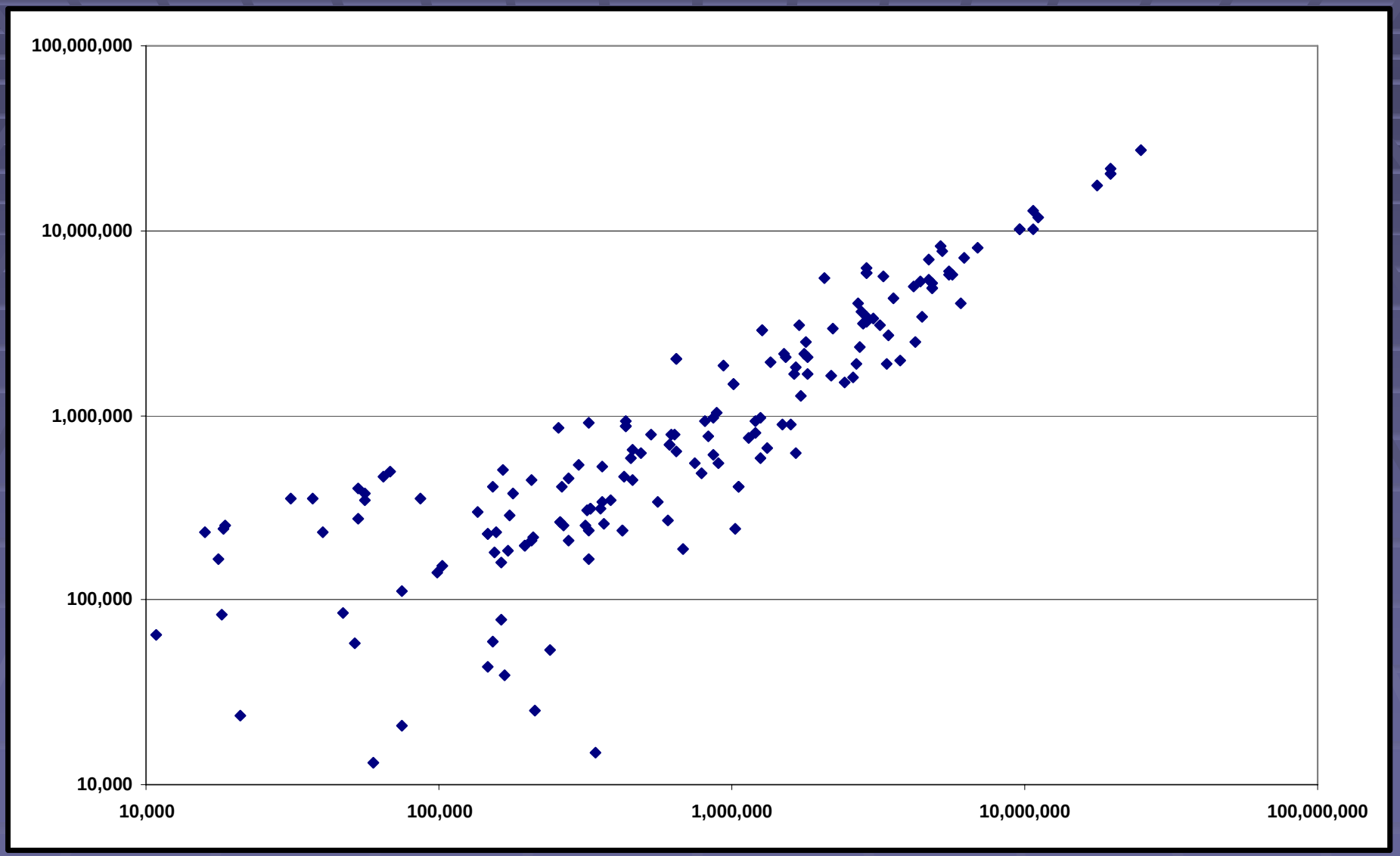


Unexpected High Model Performance at many sites

Example: Big Sur River



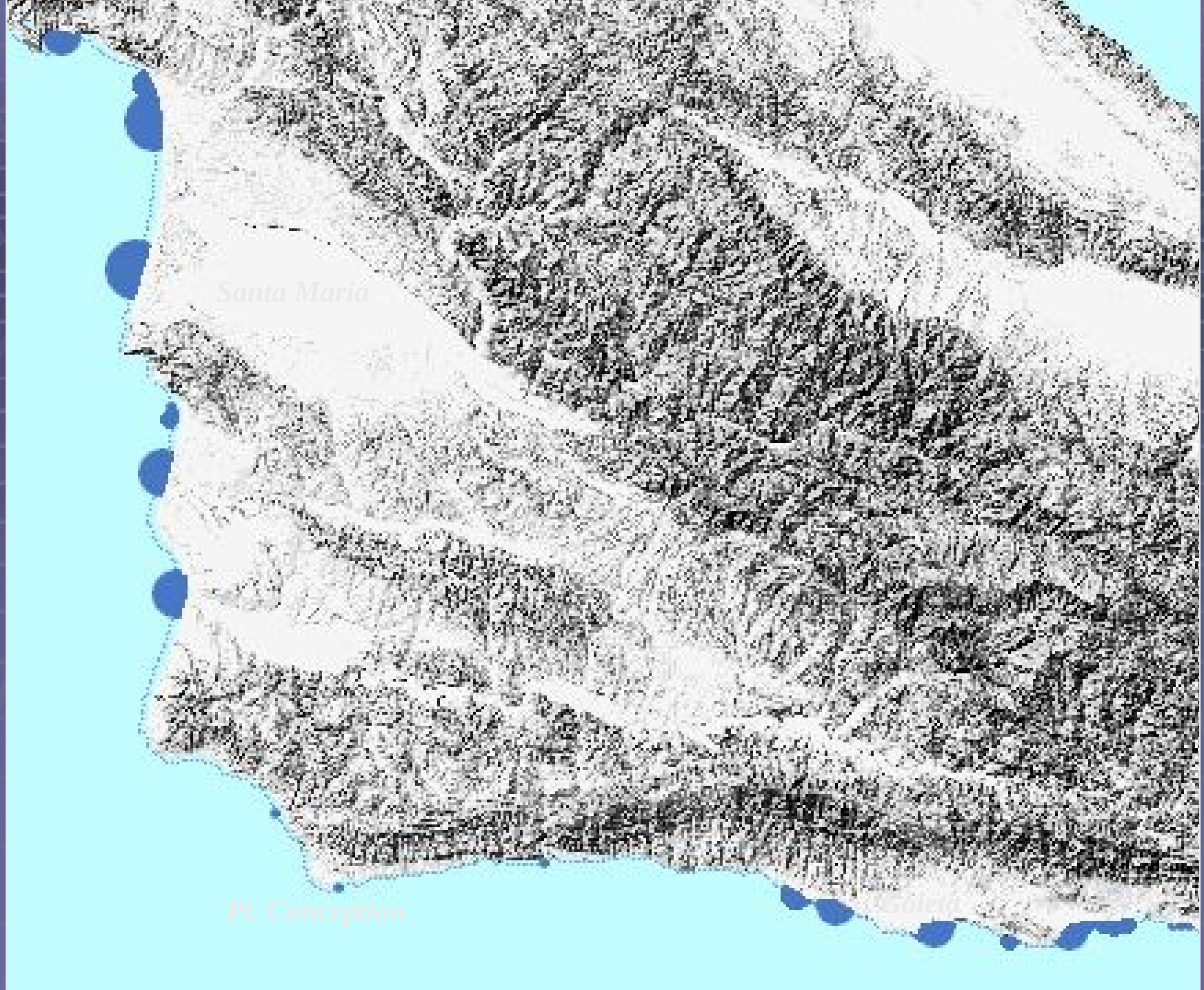
Model Error Pattern

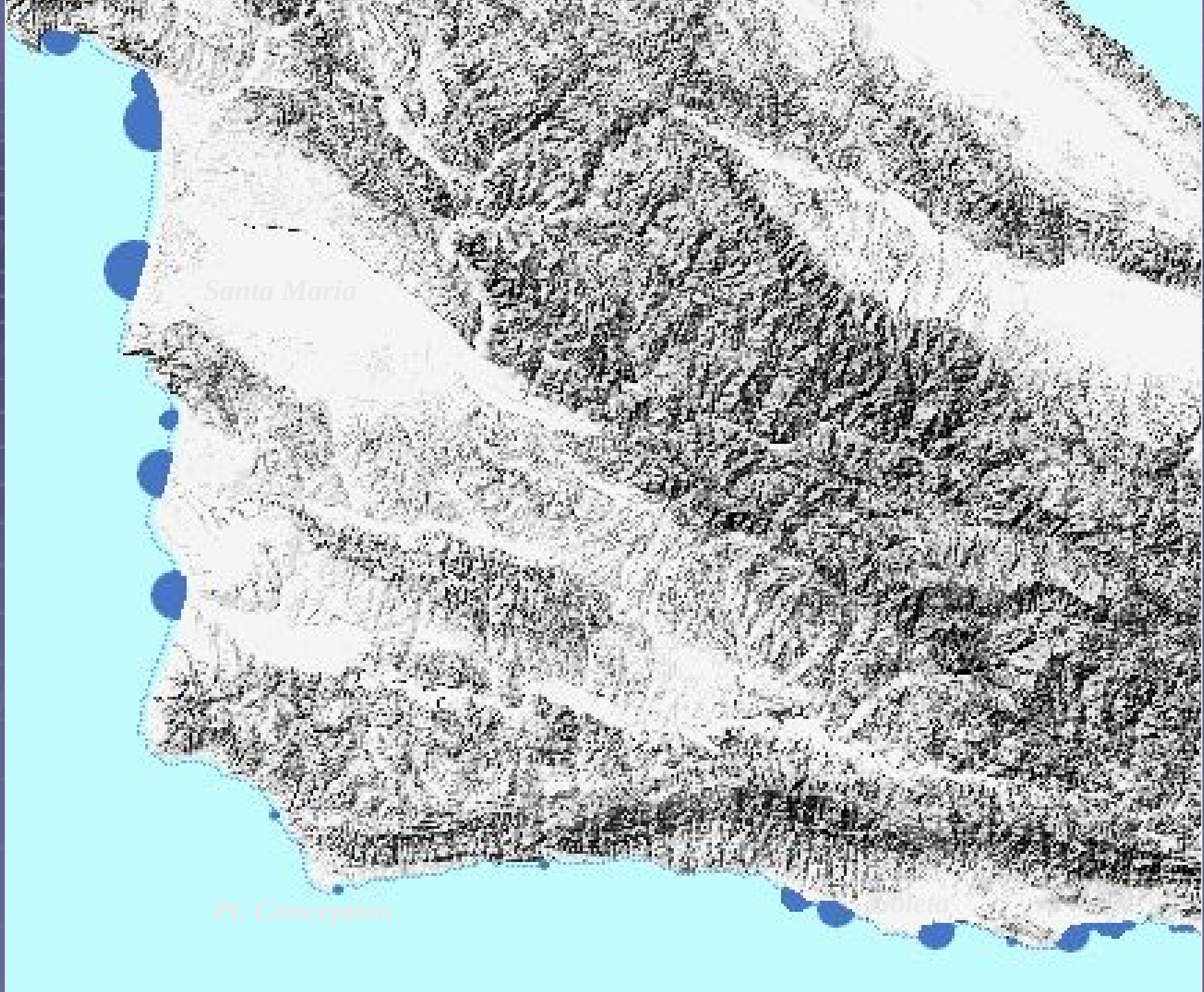


Land Sea Interface

- Transfered model results to 0.5 kilometer coastal grid

- Used simple exponential dilution and mixing with adjacent grid cells to predict near shore concentrations


Santa Maria
Pt. Conception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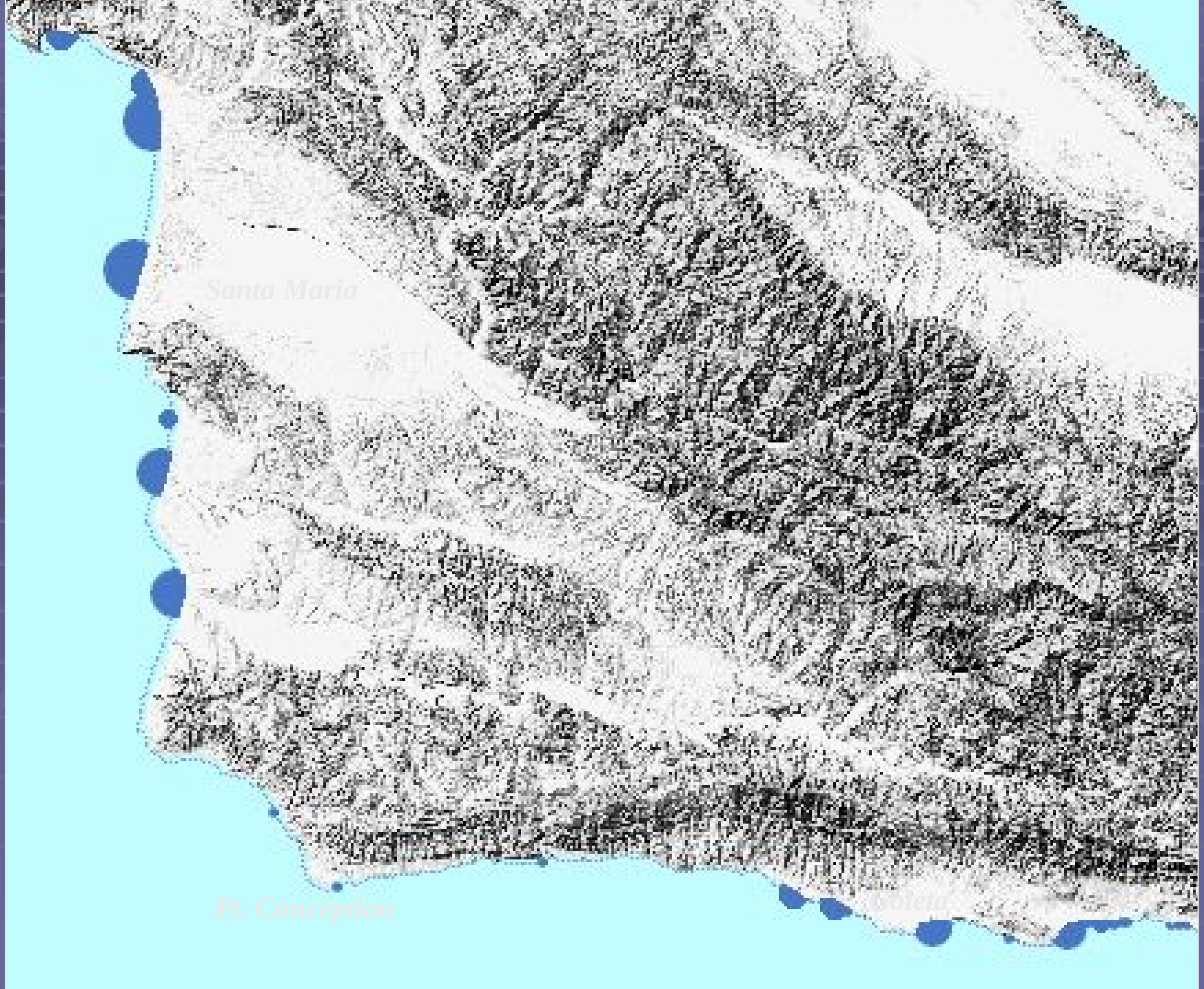
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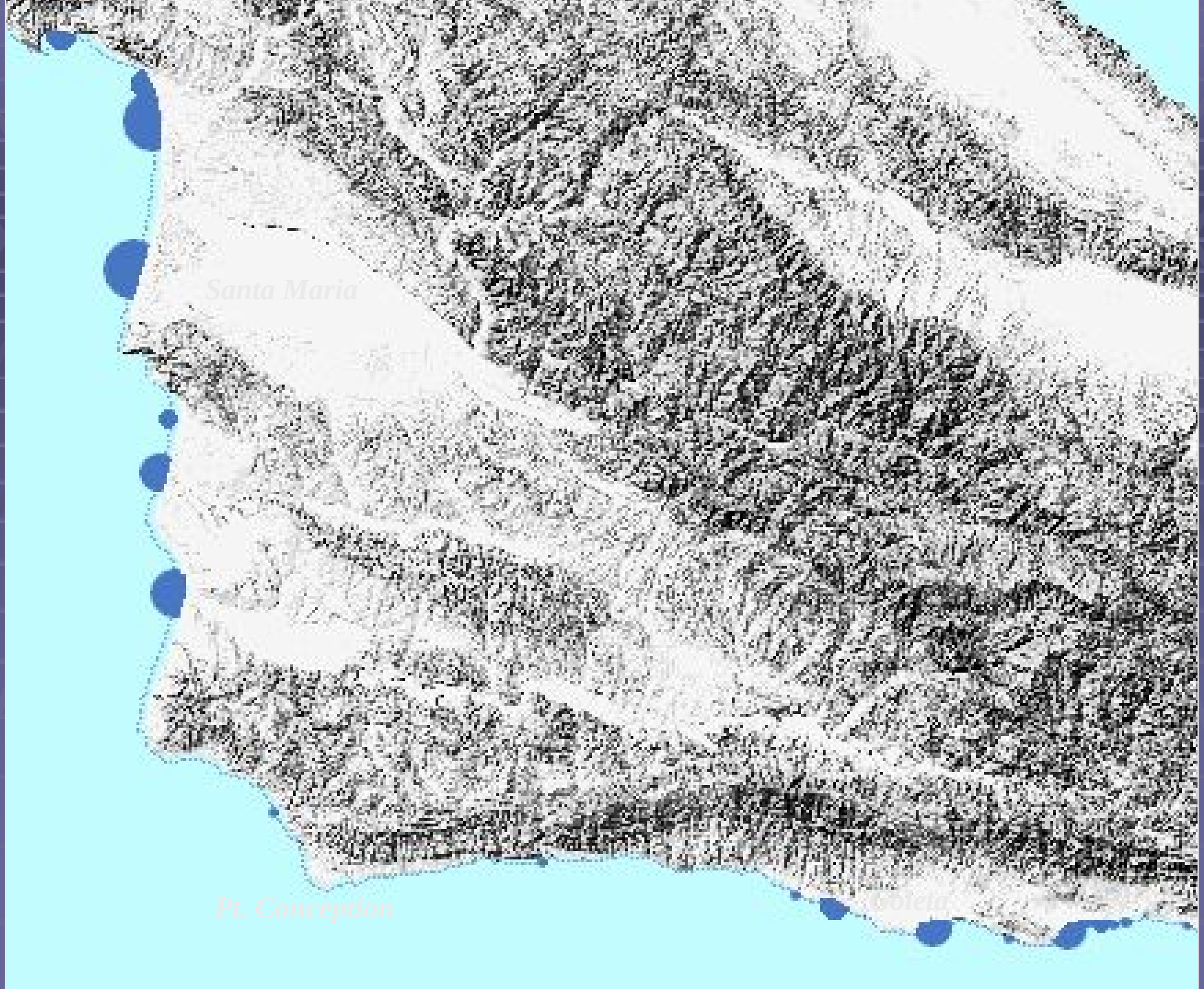
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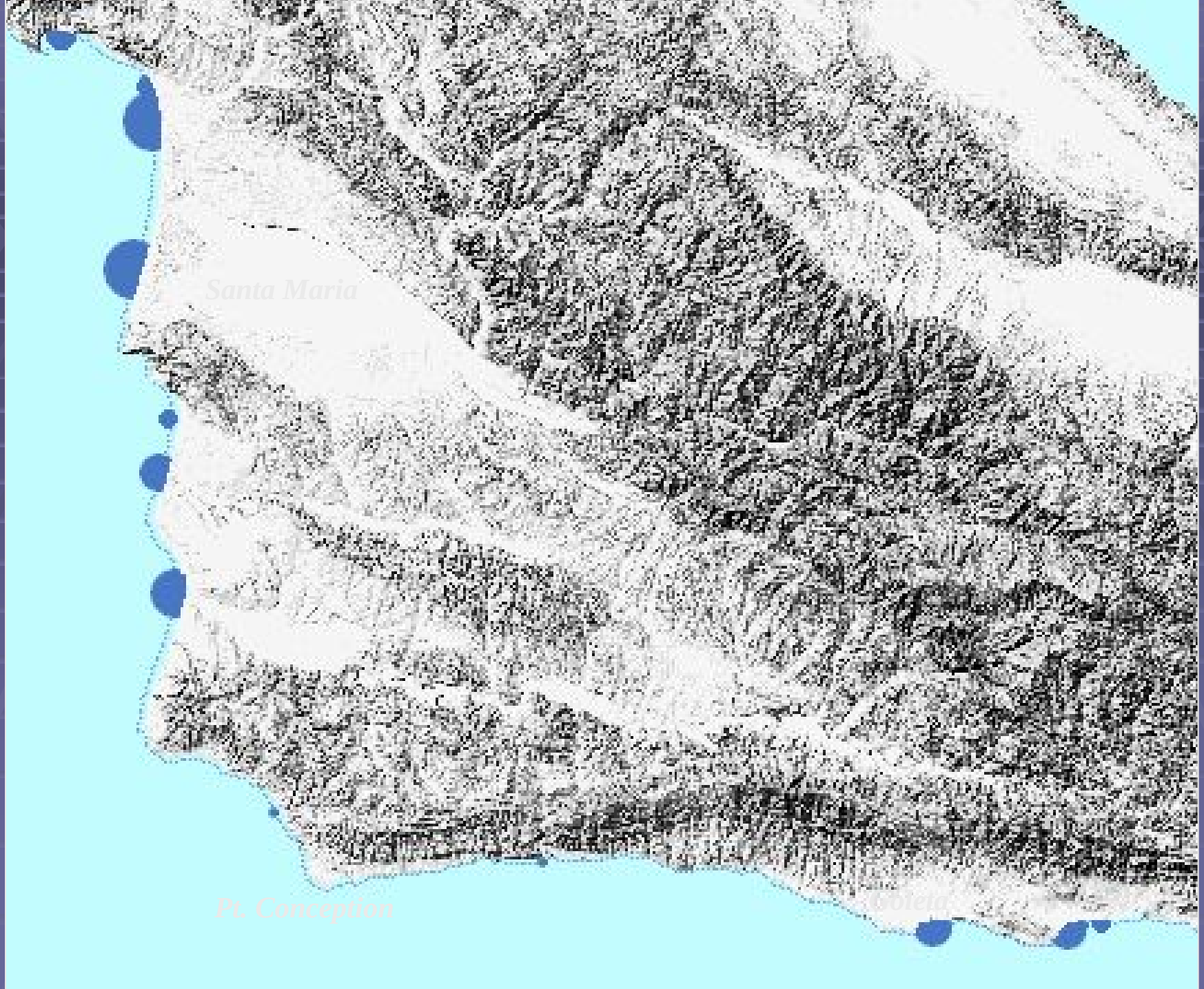
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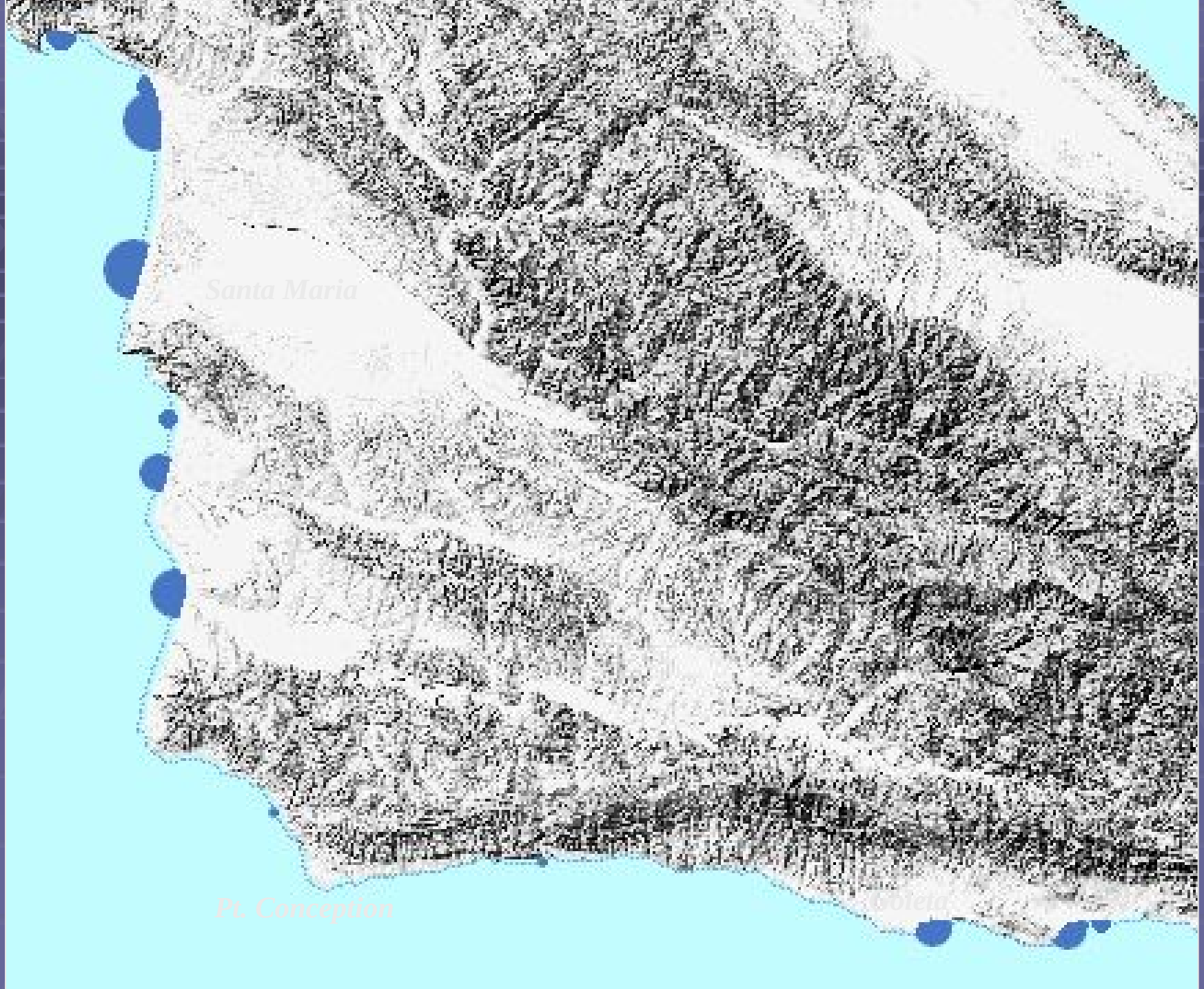
Goleta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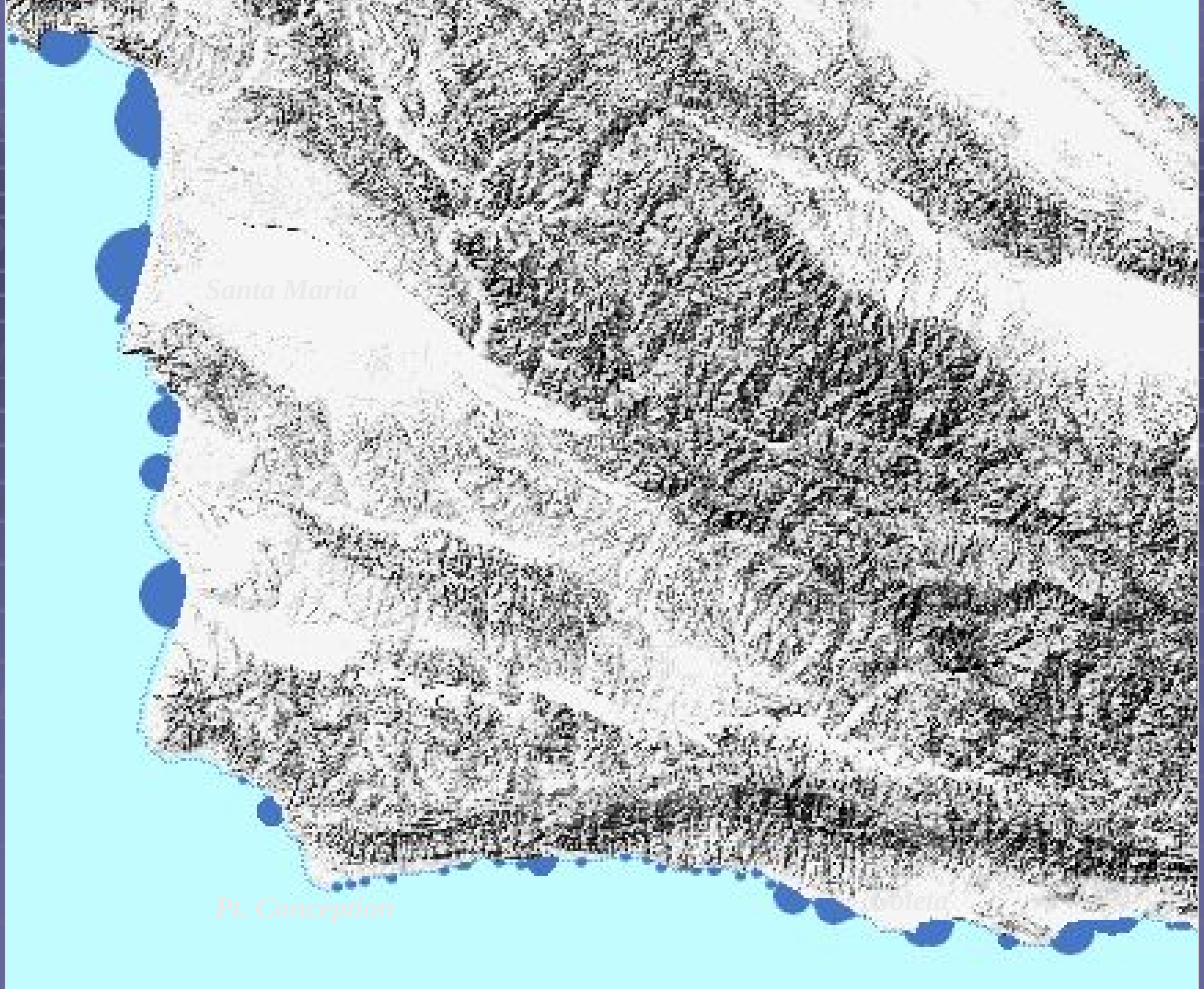
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Next Steps for Development

- Expand model coverage to 110 sites
- Add more calibration gauges
- Improve nearshore mixing model

Questions?

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