

Natural Background Water Quality Estimates in California

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Question

What are the natural background levels in California and the Santa Ana region regarding inorganic analytes? These analytes include but not limited to calcium, chloride, hardness, magnesium, sodium, specific conductivity, sulfate and total dissolved solids.

Background

Water quality affects both human health and the survival of native aquatic species, plant life, and other terrestrial organisms that play an integral part of the local food web. Since water flows downstream, any unbalance can lead to degradation of the environment and pose a severe threat to aquatic ecosystems downstream of pollution sources housing vital habitat for native species.

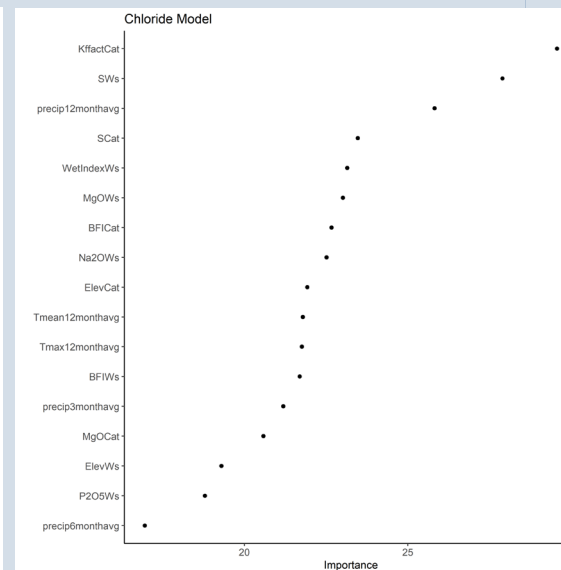
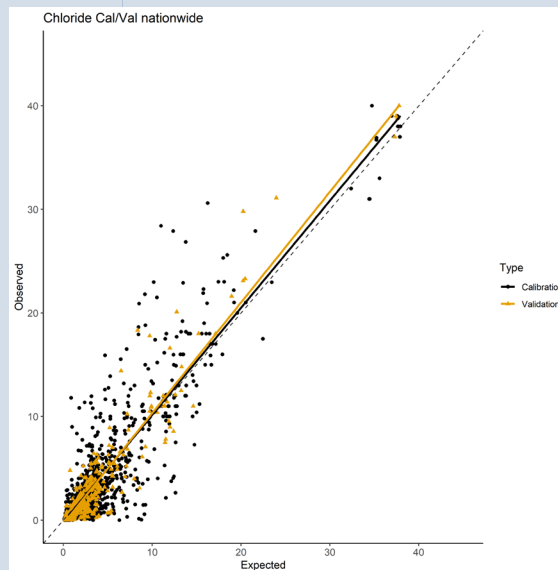
Method

1. Nationwide analytic data were consolidated (NRSA, CEDEN, SMC, and published data from Olson and Cormier 2019).
2. Reference sites were screened using the Ode et al. method adjusted to the StreamCat database. If any outliers made it through the screening they were analyzed in Google Earth, noted, and removed.
3. Nationwide random forest models were built for each analyte.
4. Variable selection for these models was done using the "kitchen sink" method, described in Fox et al.
5. The best model of each analyte was used with the nationwide validation data. The California COMIDs will be used to validate the models' performance in the state.

Nationwide and Santa Ana model performance

Parameter	Set	Scale	N Ref	OE r2	OE slope	OE slope SE	OE intercept	OE intercept SE
Ionic								
Chloride	Cal	Nationwide	1787	0.865	0.84	0.0081	0.58	0.051
	Val	Nationwide	445	0.855	1	0.02	-0.266	0.11
	Both	Santa Ana	16	0.62	0.76	0.158	-0.77	0.784

Current Chloride Model Results



Results

- Soil erodibility (Kfactor), Sulfur in the Watershed (SWs), and the average precipitation in a 12-month time period are the most important factors when predicting Chloride levels
- Nationwide validation ($r^2 = 0.85$) showed that the model had good predictive power Nationwide. The Santa Ana ($r^2 = 0.62$) showed that the model couldn't predict as well in Santa Ana, but it was still acceptable

Conclusion

- VSURF and RFE required too much computing power and running time due to the large dataset. A step-wise variable selection method was used for variable selection, as described in Fox et al (2017)
- The current Chloride model has good predictability Nationwide and acceptable predictability within the Santa Ana watershed.
- Partial Dependence Plots (PDP) will be created to analyze how the most important factors are correlated with Chloride levels
- Further analysis of variable correlation to analyte levels will be completed, along with analysis of top predictors across models.

References/Acknowledgments

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- Cals State University Monterey Bay and SCCWRP, among others