

Hydrology Group Update

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Outline

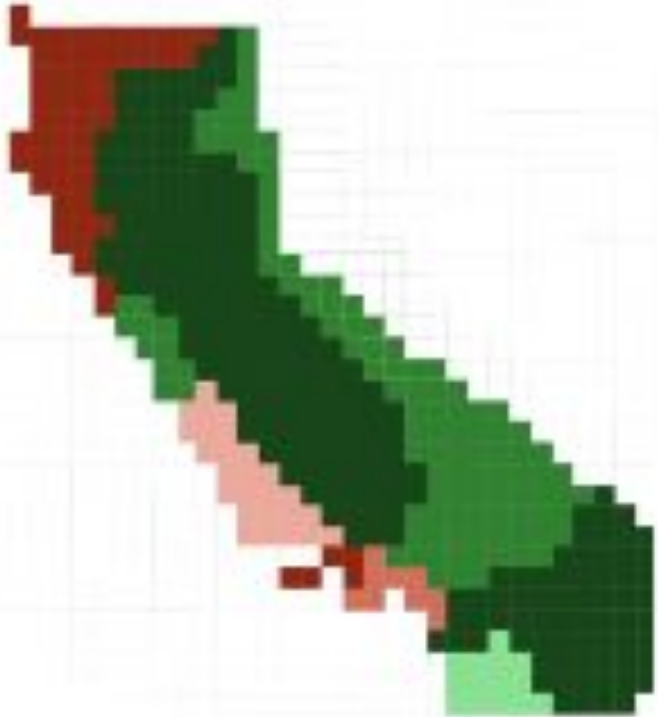
1. Project Goals
2. Multiple Datasets
3. Modeling with the Data
4. Status and Next Steps

Project Goals

1. Predict Water Table Levels
 - a. At 6-month Intervals
 - b. Point predictions and Ranges (mean, min, max)
2. Hydrologic Region Information
 - a. Offer region-specific predictions

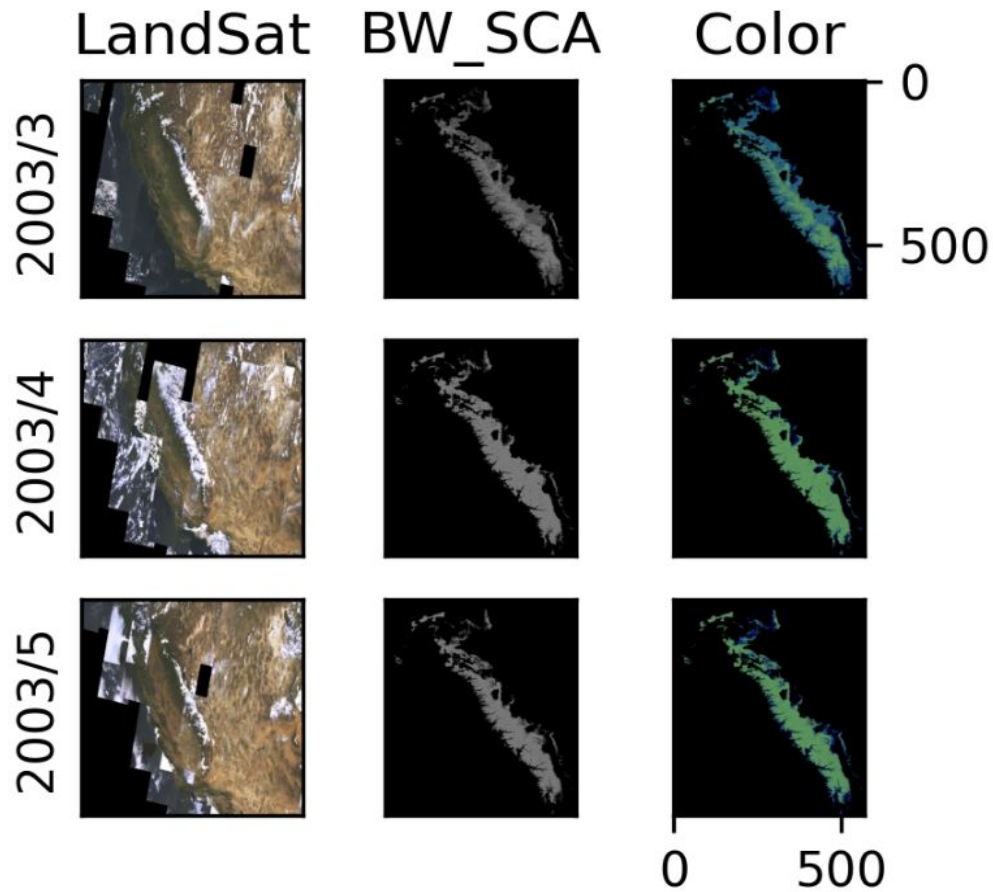
Hand-Me-Down Data : GRACE Satellite Data

Gravity Recovery and Climate Experiment



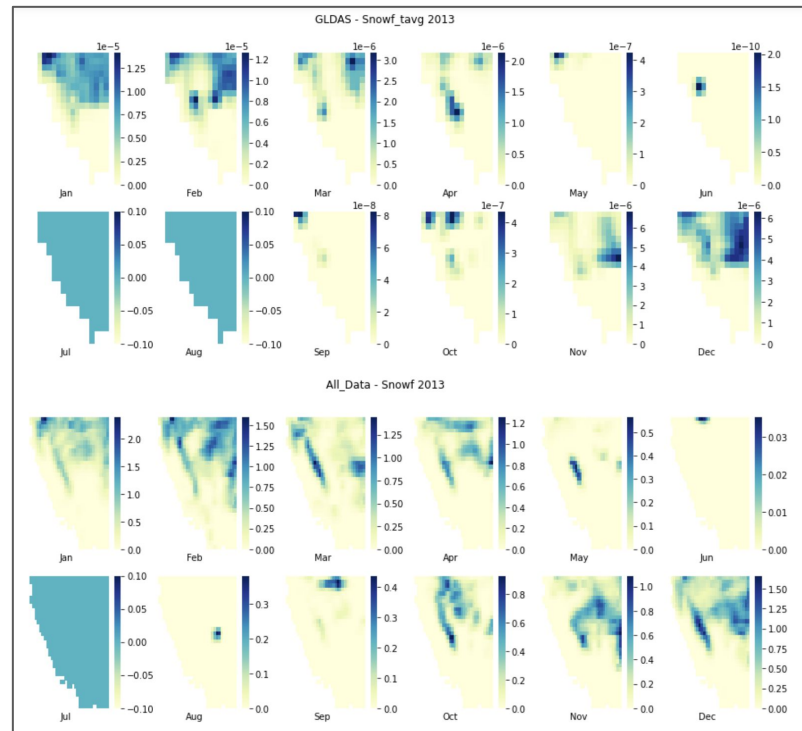
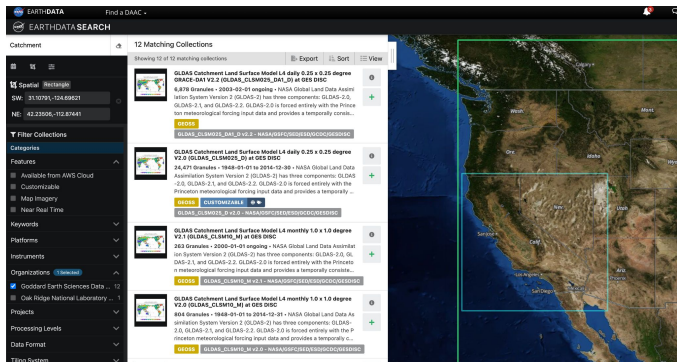
1. 33x37 rows/columns of 858 non-empty time-series
 - a. 168 months
 - b. $168 \text{ months} * 858 \text{ non-empty} = 140\text{k+ data points}$
 - c. California grid-points a subset of this 33x37 grid
2. From the Previous Group
3. Example Features
 - a. Near-ground moisture level
 - b. Depth to water table (“catdef”)
 - c. Rain
 - d. Temperature
4. *Data Augmentation*
 - a. A new feature of “water district” added!

Snow Pack Data

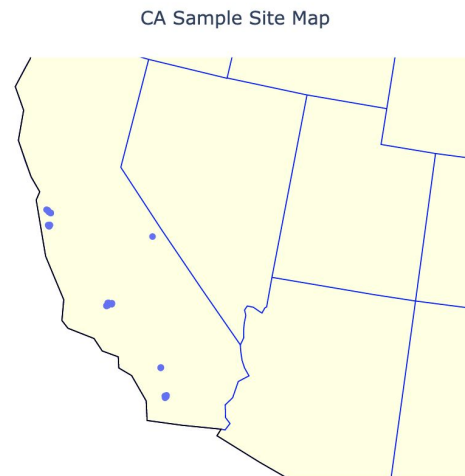
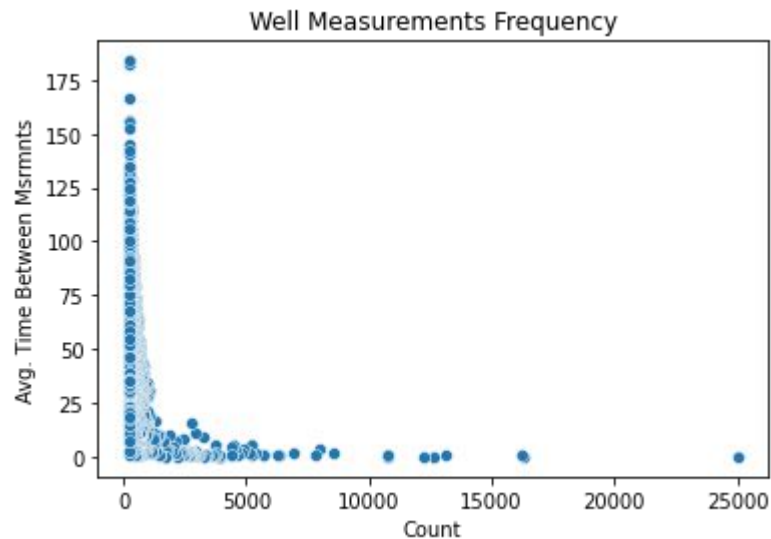


Data Provenance: Corroborating Source

- NASA GES DISC:
 - GLDAS Catchment Land Surface Model L4 (clear definitions, granular data)
 - Most variable names and measurements line up with what we see in inherited dataset
 - Data and lat/long resolution conflicts (unable to directly line up geospatial and interpolation grid to match 33x37, no catdef in measurements)



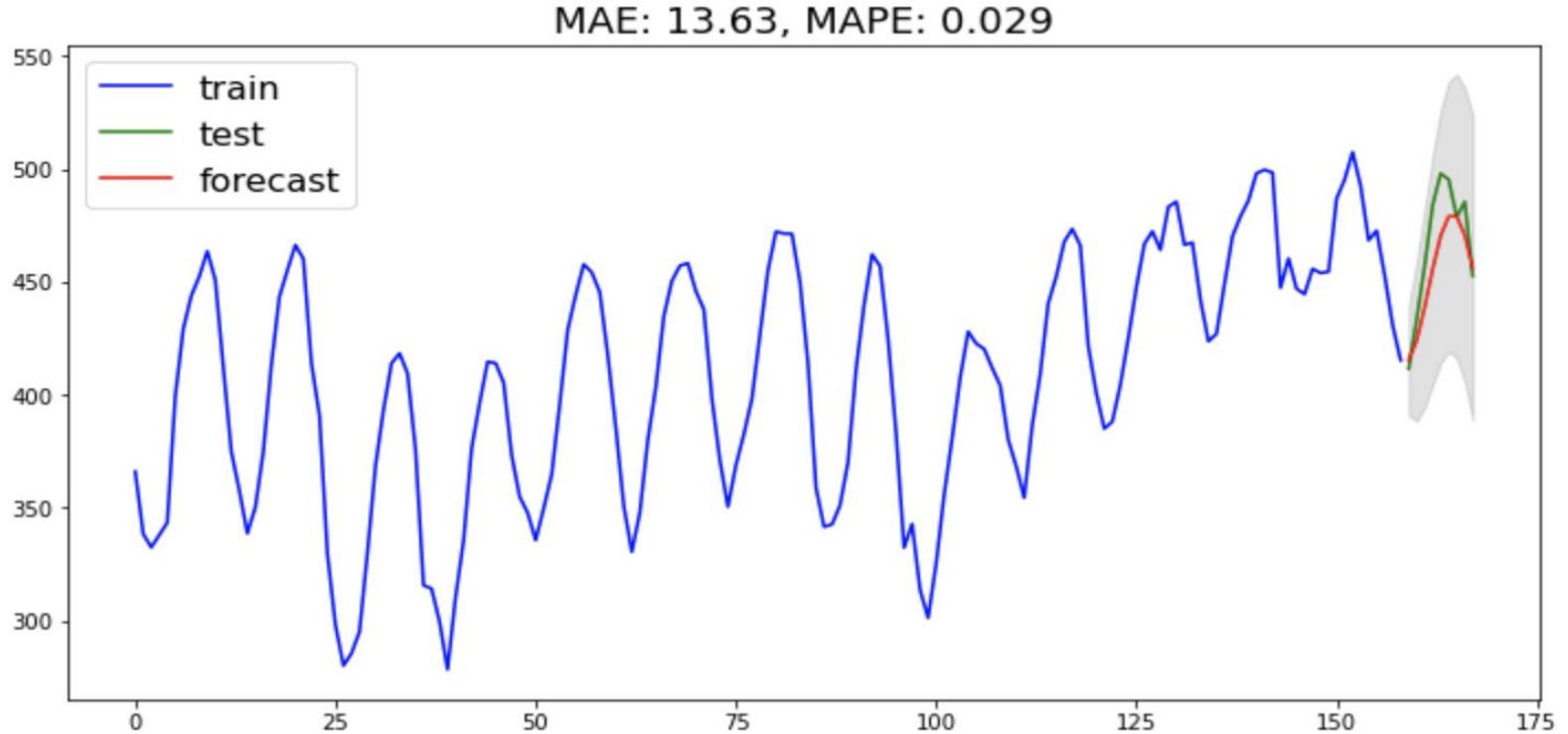
Data From the CA Natural Resources Agency



Project Goals (ReCap)

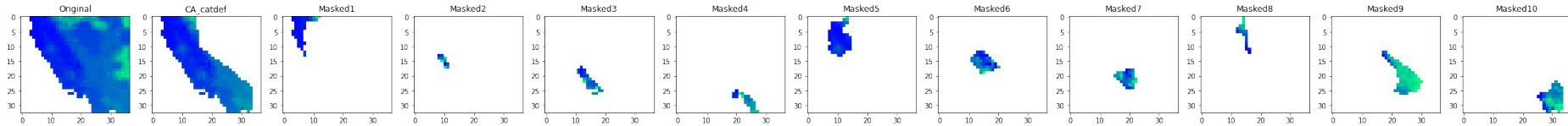
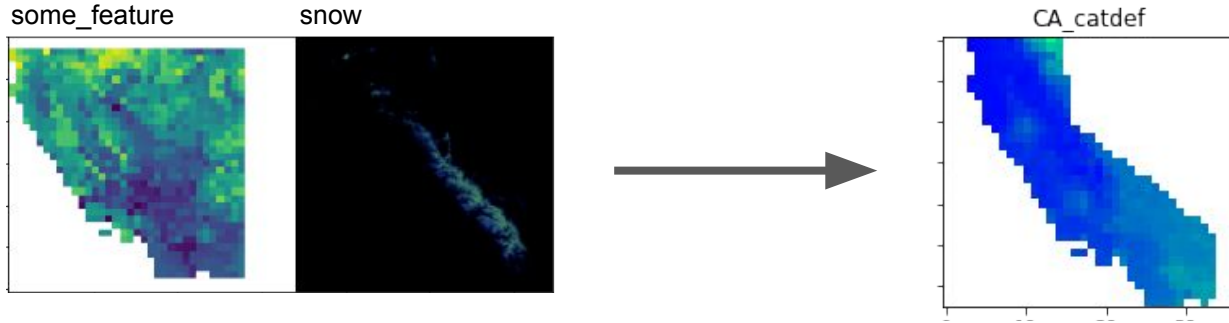
1. Predict Water Table Levels
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Modeling Projects Underway : ARIMA



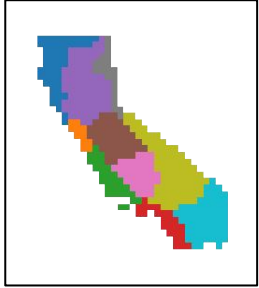
Modeling Projects Underway : Snowpack Re-Analysis

ConvLSTM

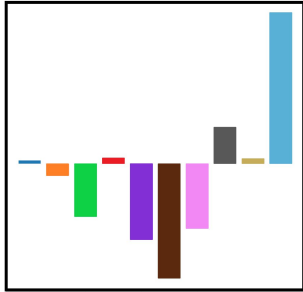


Modeling Projects Underway : Snowpack Re-Analysis

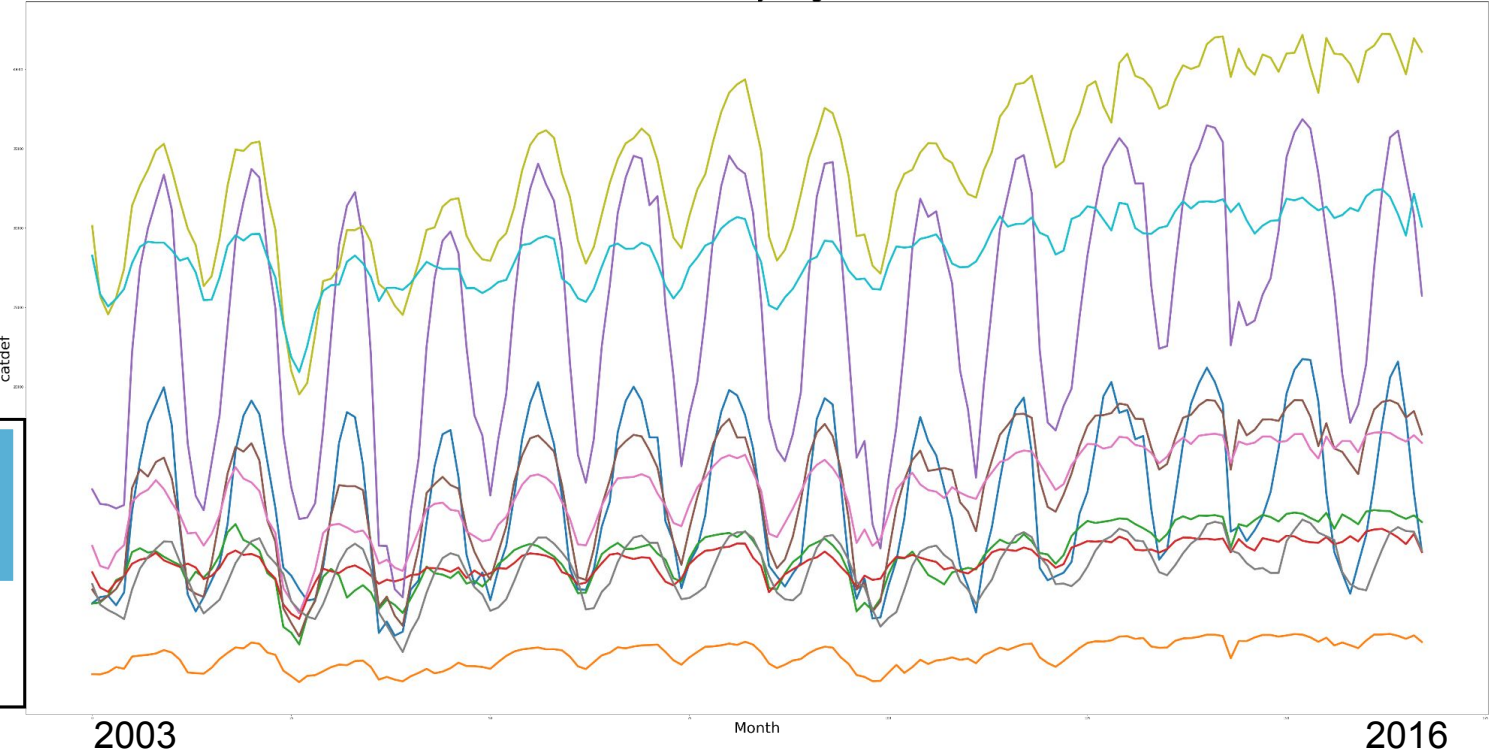
Region map



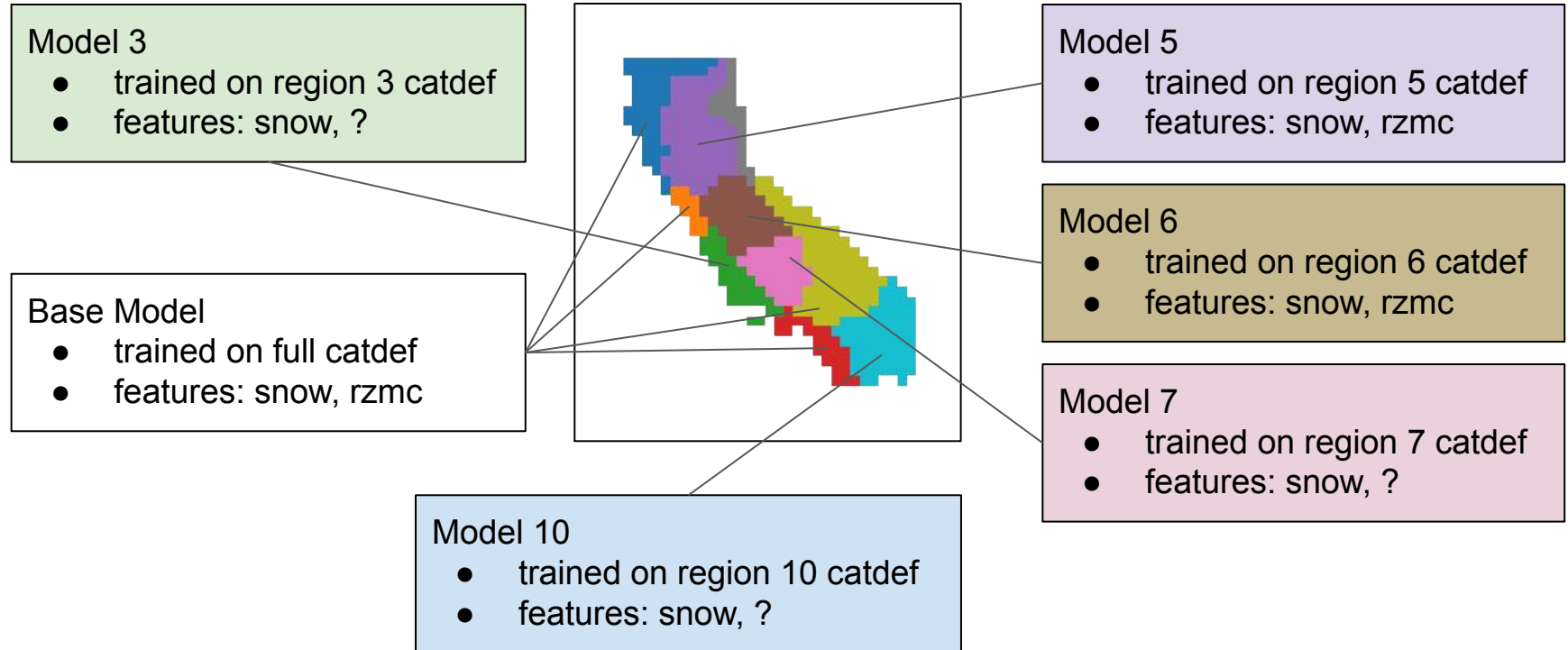
Feature importance



Catdef by Region

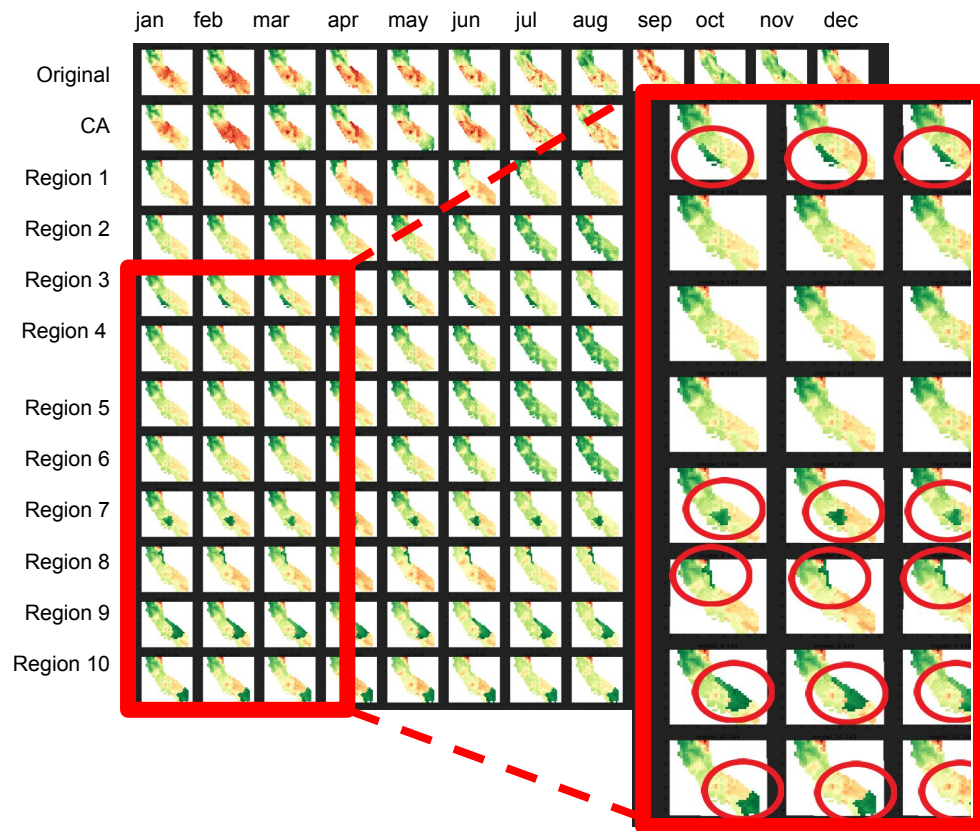
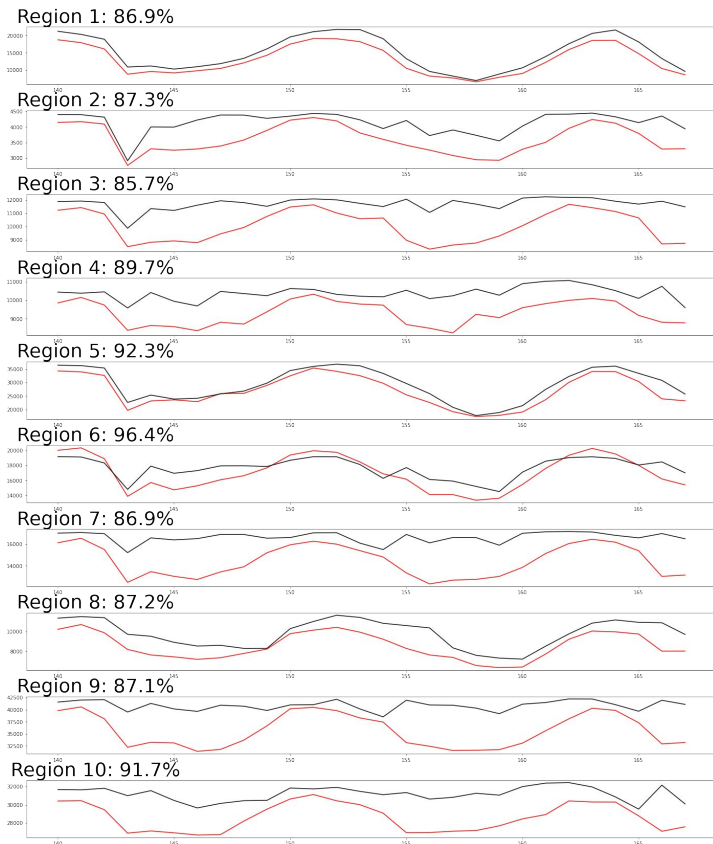


Modeling Projects Underway : Snowpack Re-Analysis

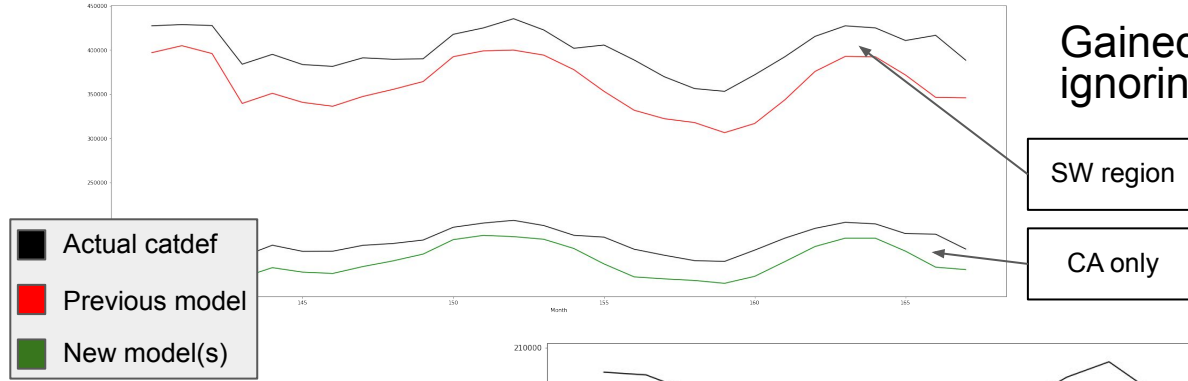


Modeling Projects Underway : Snowpack Re-Analysis

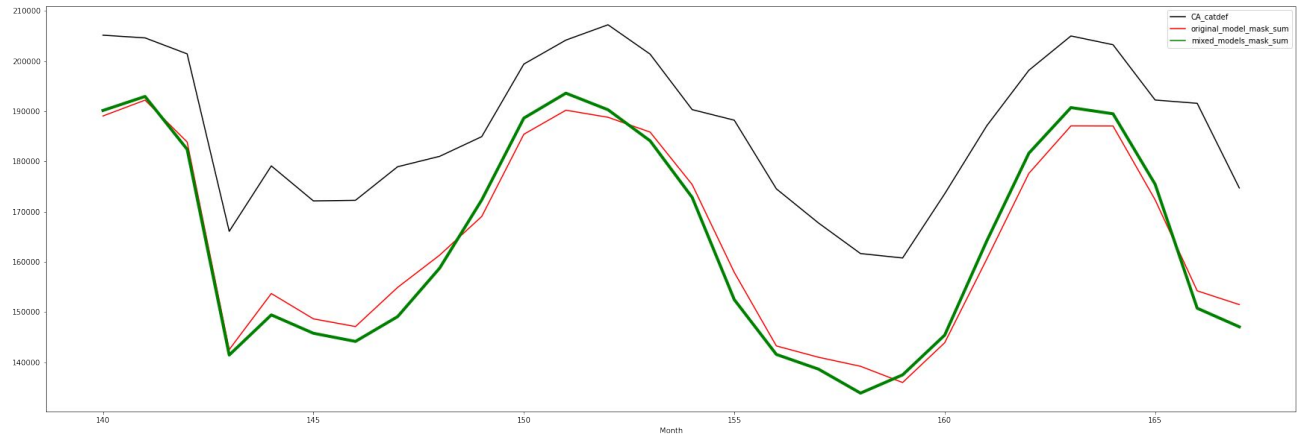
Region accuracy



Modeling Projects Underway : Snowpack Re-Analysis

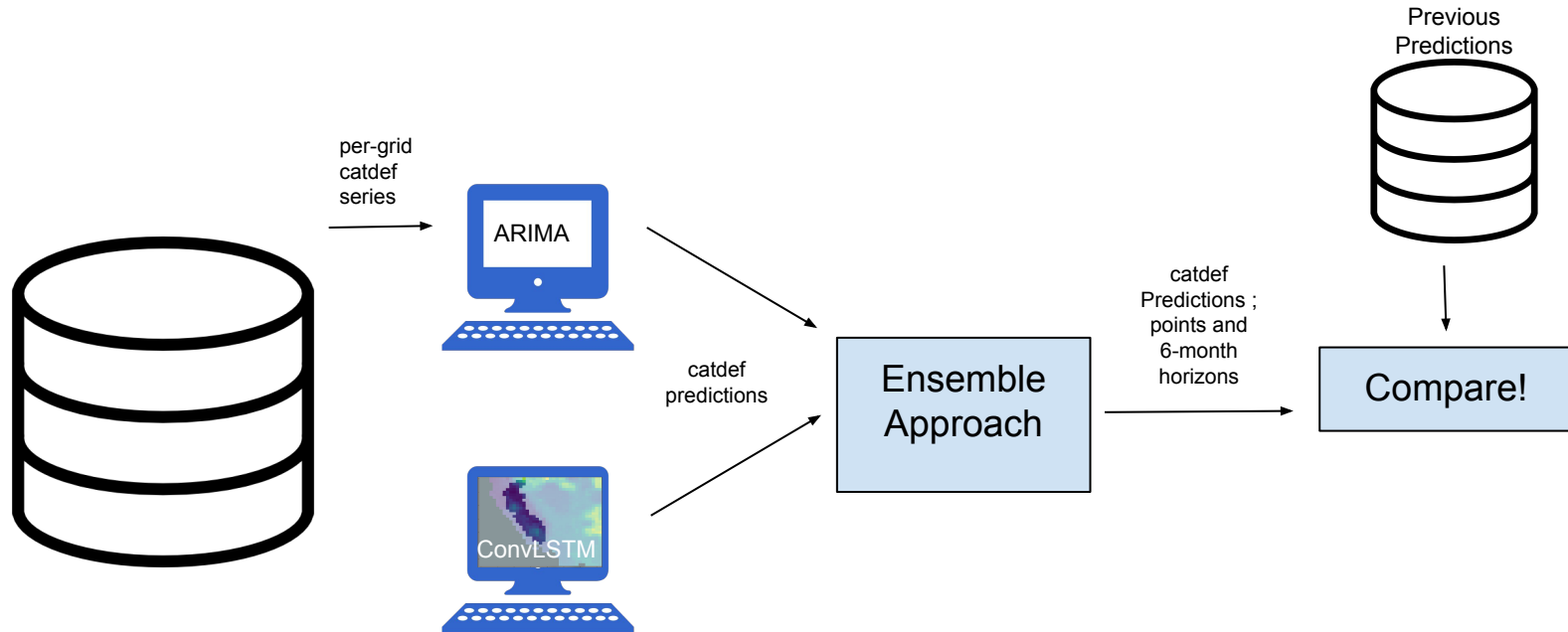


88.17% → 90.24%
Over 2% Accuracy Gain!



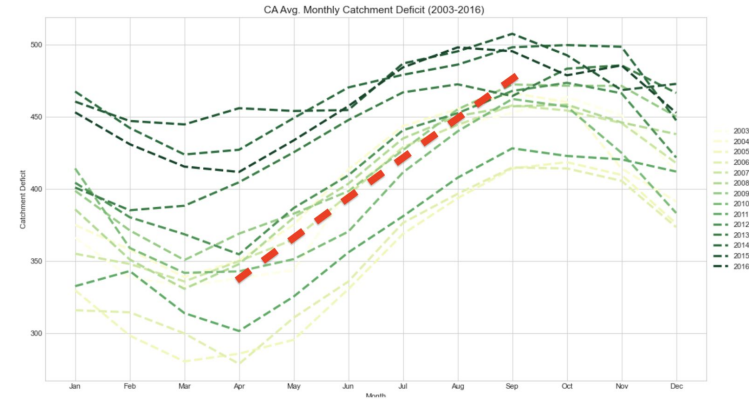
Modeling Underway : CA Natural Res. Data EDA

Modeling Next Steps



Prediction Time Frames

- Will predict catchment deficit values for the 6-month dry season (Apr - Sep) in 2015-2016
- Includes monthly prediction, as well as min, max, avg pred

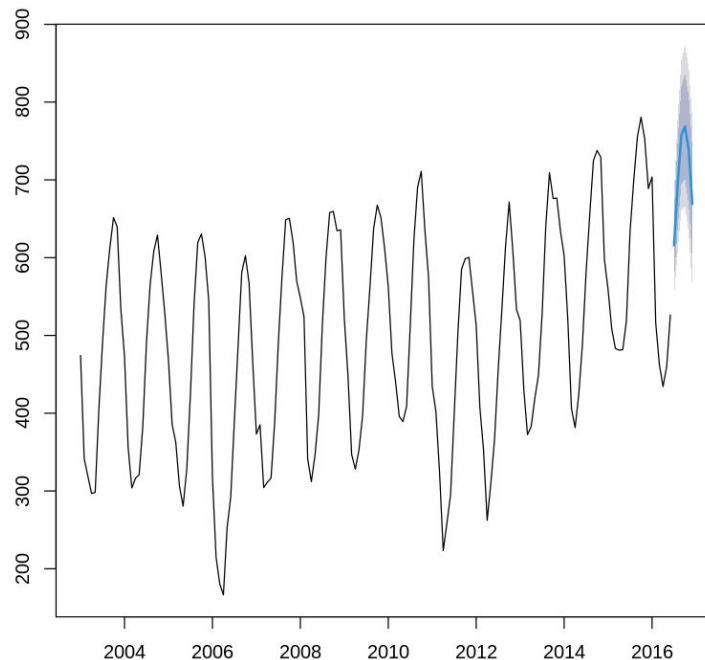


Modeling Next Steps

ARIMA-based predictions of catdef at
6-month horizons!

A	B	C	D	E	F	G
"Point.Forecast"	"Lo.80"	"Hi.80"	"Lo.95"	"Hi.95"	"end_month"	"pred_month"
218.62	159.130933605624	278.109066394376	127.639324121117	309.600675878883	12	13
218.62	134.489755492161	302.750244507839	89.9538942582134	347.286105741787	12	14
218.62	115.581914510103	321.658085489897	61.0368468708189	376.203153129181	12	15
218.62	99.641867211249	337.598132788751	36.6586482422346	400.581351757765	12	16
218.62	85.5984036241781	351.641596375822	15.1810240959429	422.058975904057	12	17
218.62	72.9021420592297	364.33785794077	-4.23623235680407	441.476232356804	12	18
-26.776	-76.7081961783782	23.1561961783783	-103.140704167812	49.5887041678121	13	14
-149.474	-261.125784920709	-37.822215079291	-320.230669600889	21.2826696008893	13	15
-272.172	-459.001170668674	-85.3428293313255	-557.902559438301	13.5585594383008	13	16
-394.87	-668.35990192671	-121.38009807329	-813.136710699194	23.3967106991944	13	17
-517.568	-887.875077755452	-147.260922244547	-1083.90380351684	48.7678035168357	13	18
-640.266	-1116.58879347396	-163.943206526036	-1368.73884910284	88.2068491028394	13	19

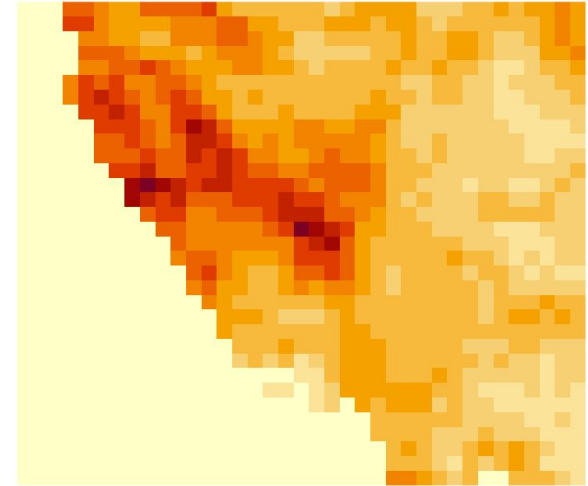
Data & 6-Mo. Forecast Near Crescent City, CA [0,10]



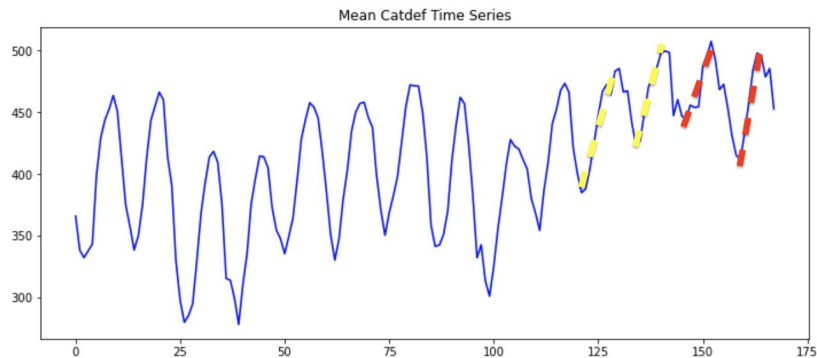
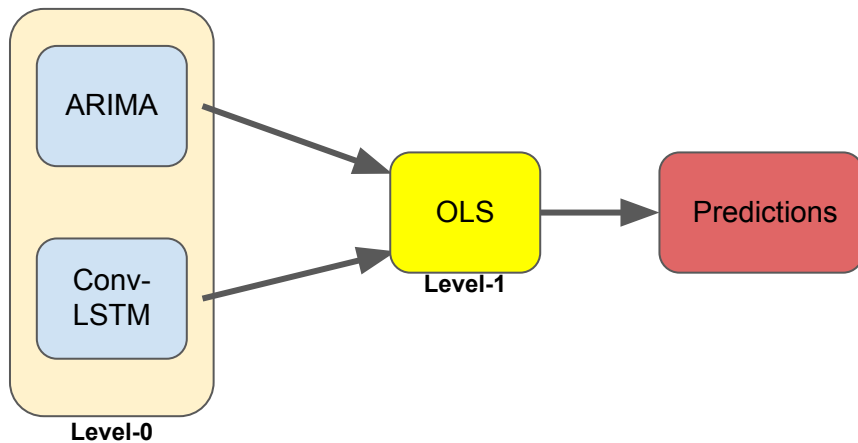
Ensembling/Stacking

- ARIMA forecast errors reveal difficulty of predicting catdef in certain areas (agricultural use?)
- Regional ConvLSTM incorporates wide-ranging weather/hydrologic data and may increase accuracy for important regions like the Central Valley

RMSE of ARIMA Predictions



Ensembling/Stacking

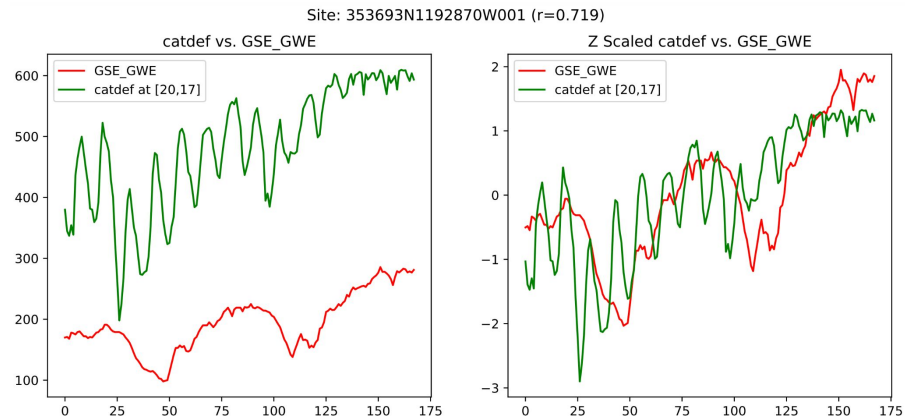


— - Dev/Ensembling

— - Test/Predictions

(TBD) Apply to Other Hydrology Data Sources

- CA Natural Resources (Well Measurement GSE_GWE)



- GES DISC Land Catchment

