Anomalous hydrologic and biogeochemical conditions in the Columbia River Estuary during 2014-2015

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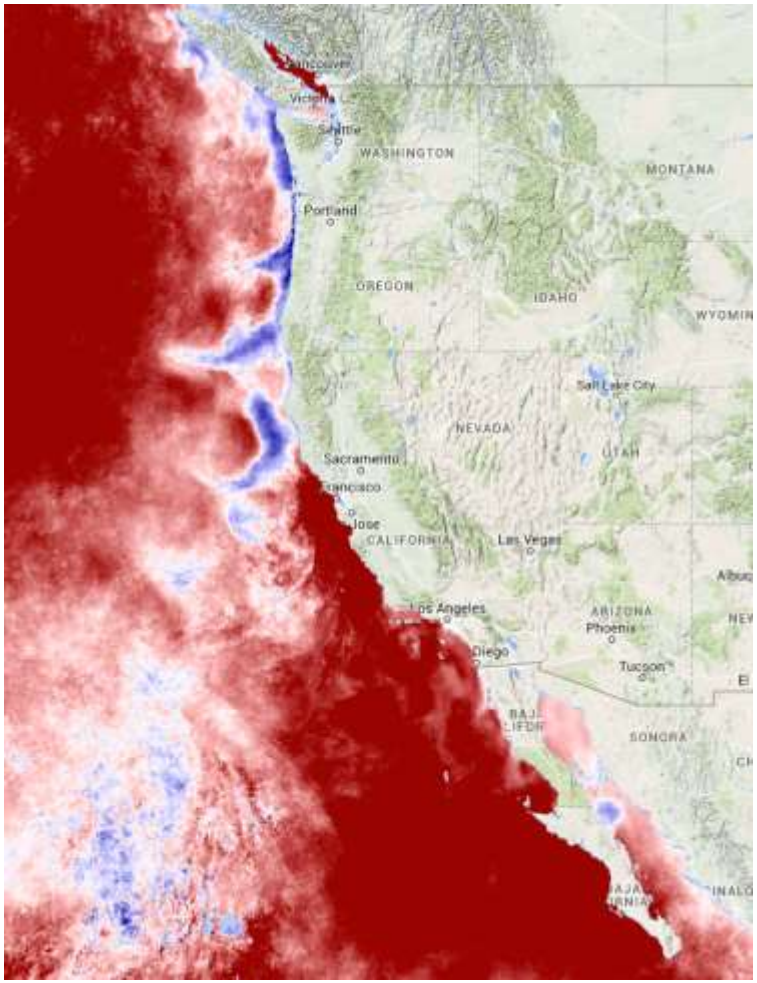
CMOP
Center for Coastal Margin Observation & Prediction

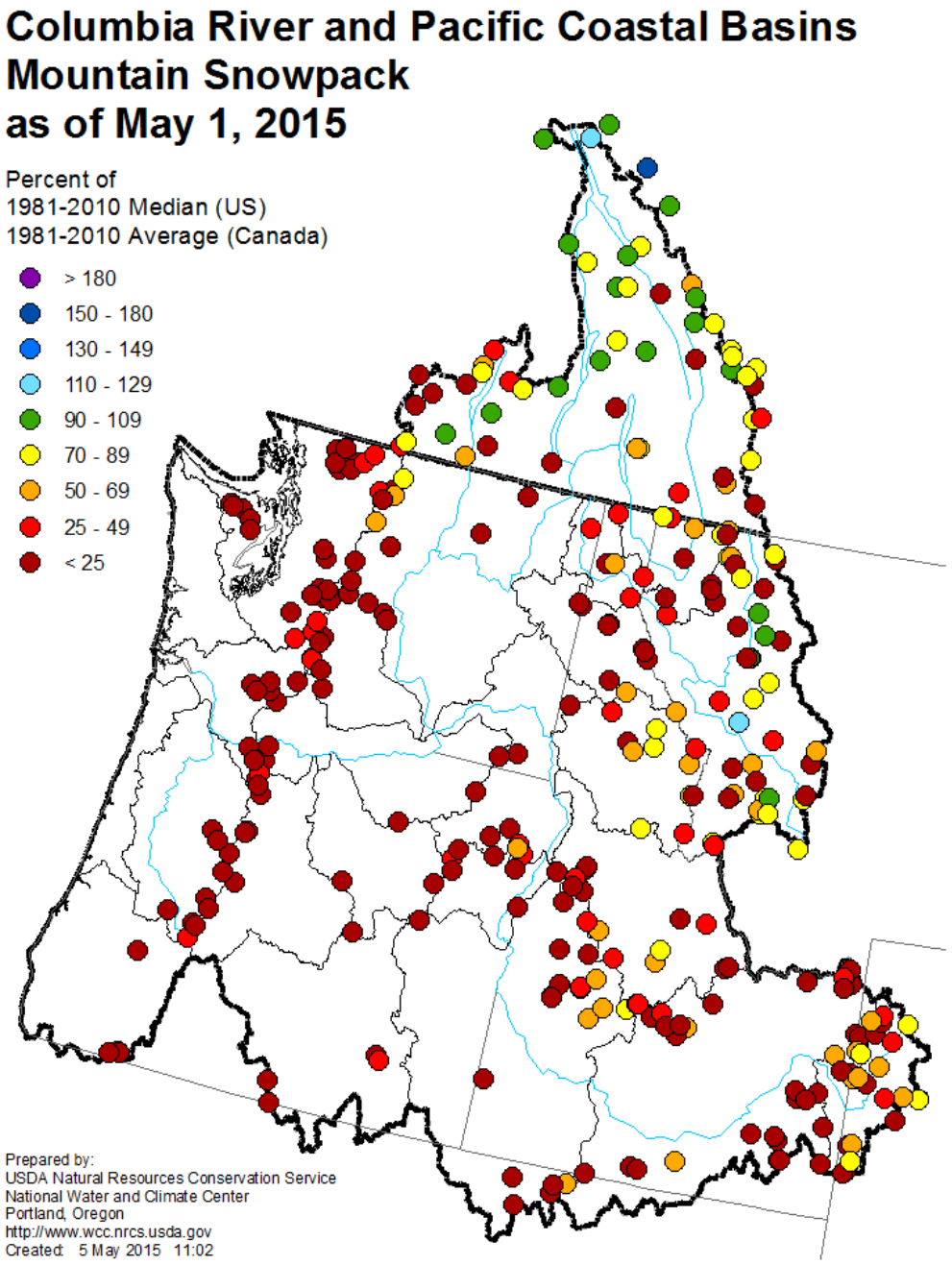
How did the Blob influence the CRE?

August 2014



October 2014

In 2015 the estuary was also influenced by warm river conditions



For the CRE, how does 2014-2015 compare to previous “anomalous” warm years?

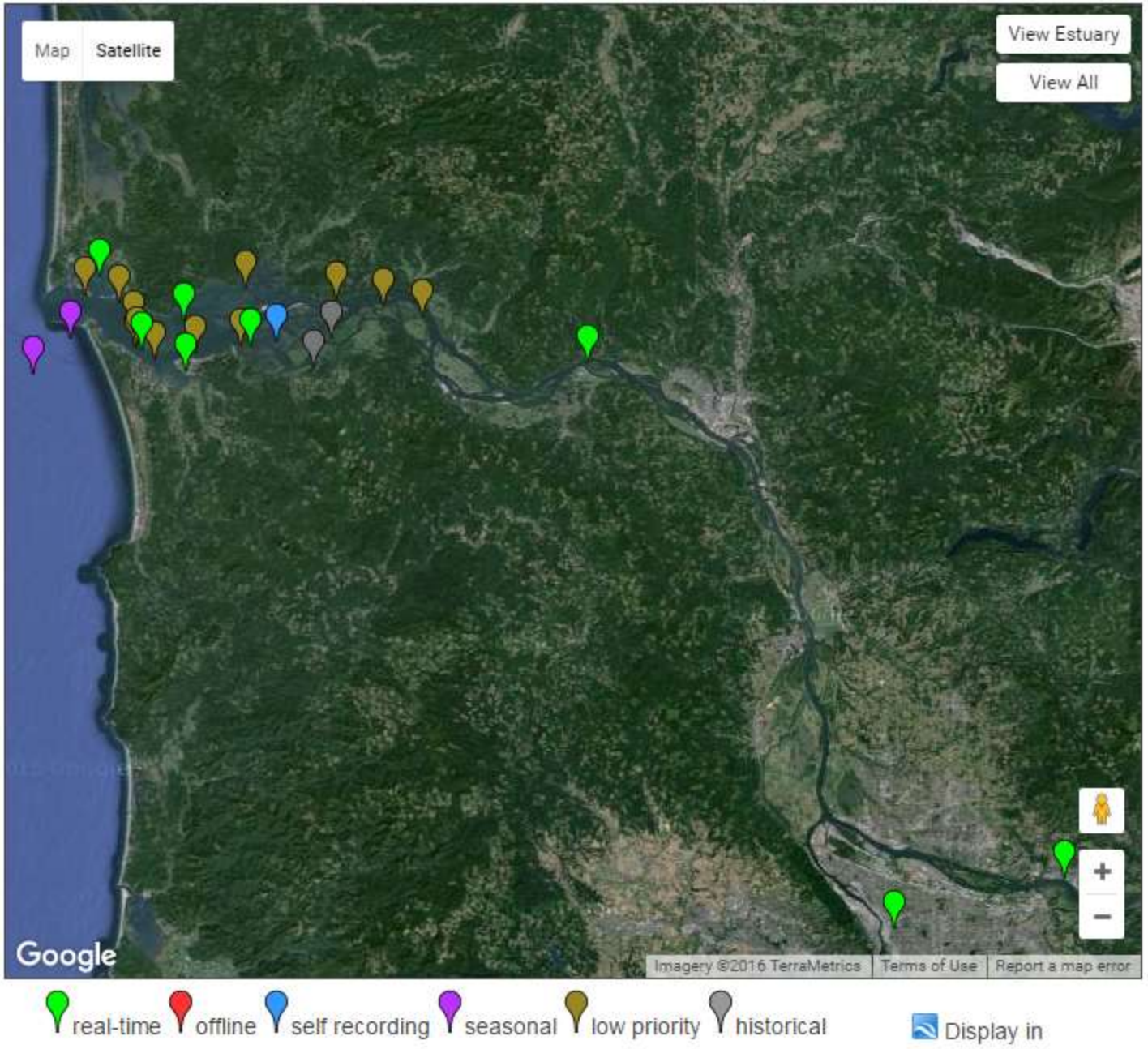
- **1997** Strong El Niño - warm ocean
- **2001** Low snowpack - warm river
- **2005** Delayed upwelling - warm ocean
- **2014-2015** The Blob - **warm ocean and river**

Temp and River Flow Data Sets

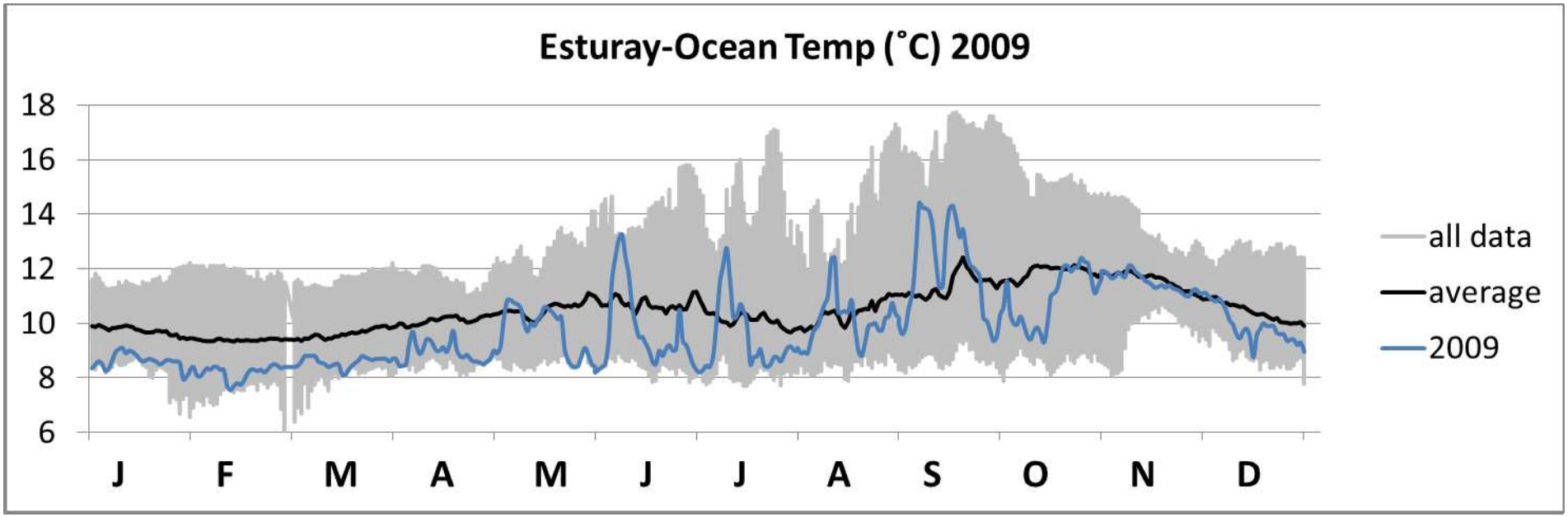
CORIE/CMOP
1996 -2016

USGS
NASQAN/NAWQA
1991-2003 (temp)

1992-2015 (flow)

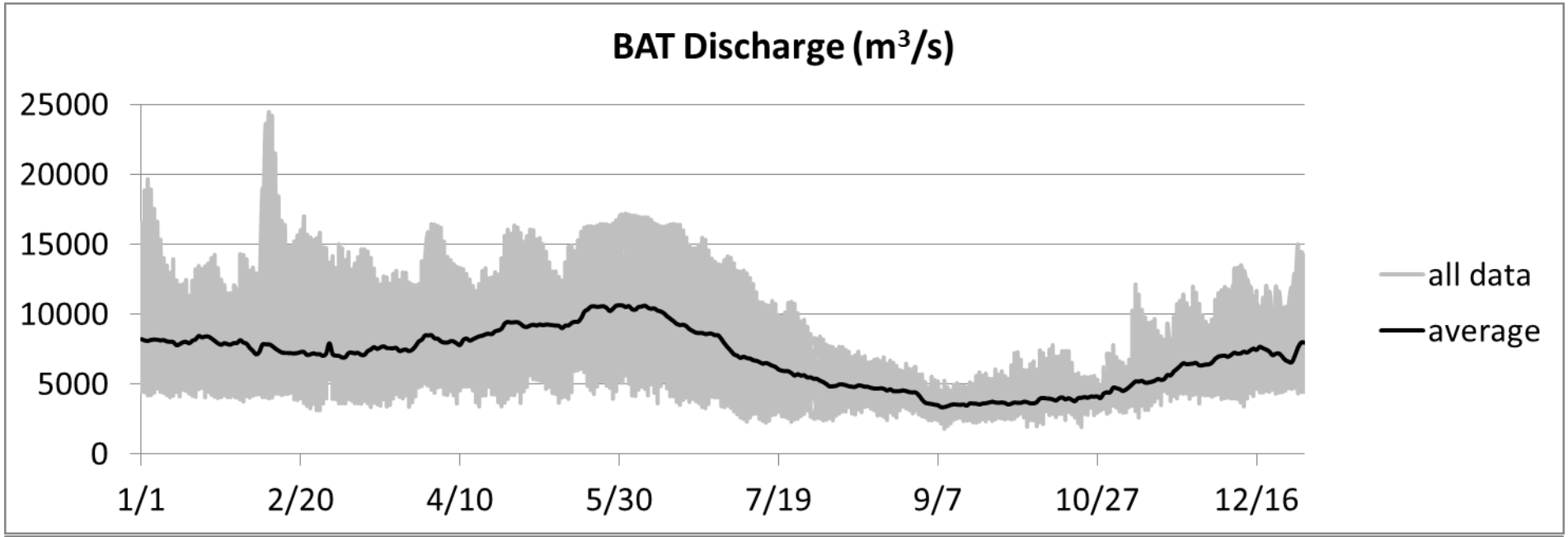


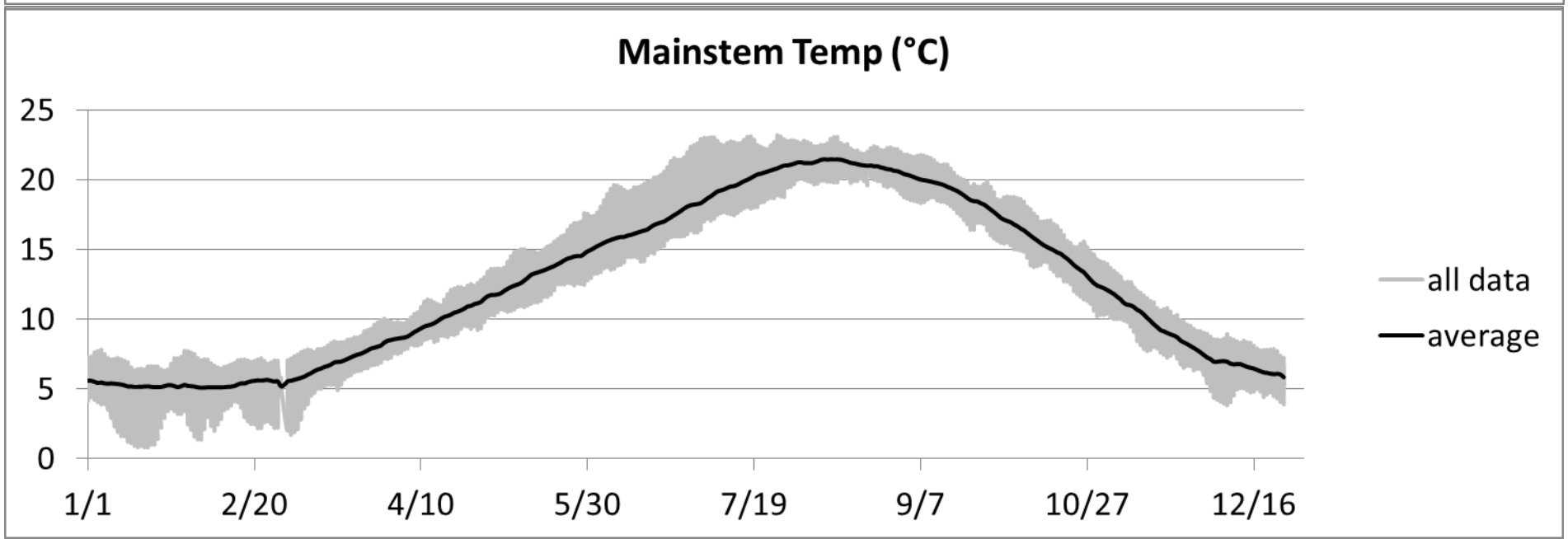
Measuring ocean water in the estuary



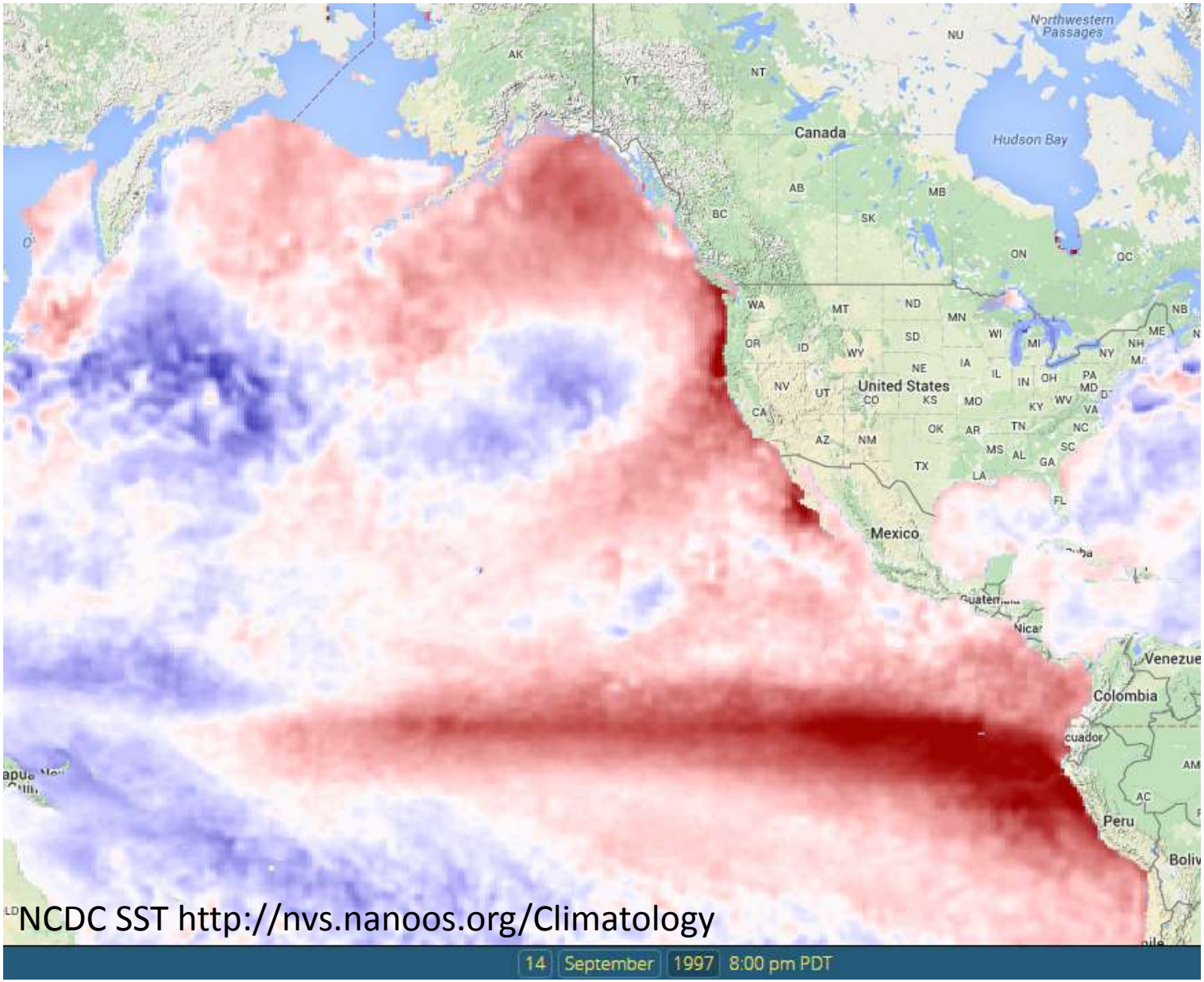
Temperature corresponding to daily highest salinity measurement – 1996-2015

River Flow and Temperature 1992-2015





1997 Strong El Niño - warm ocean



NCDC SST http://nvs.nanoos.org/Climatology

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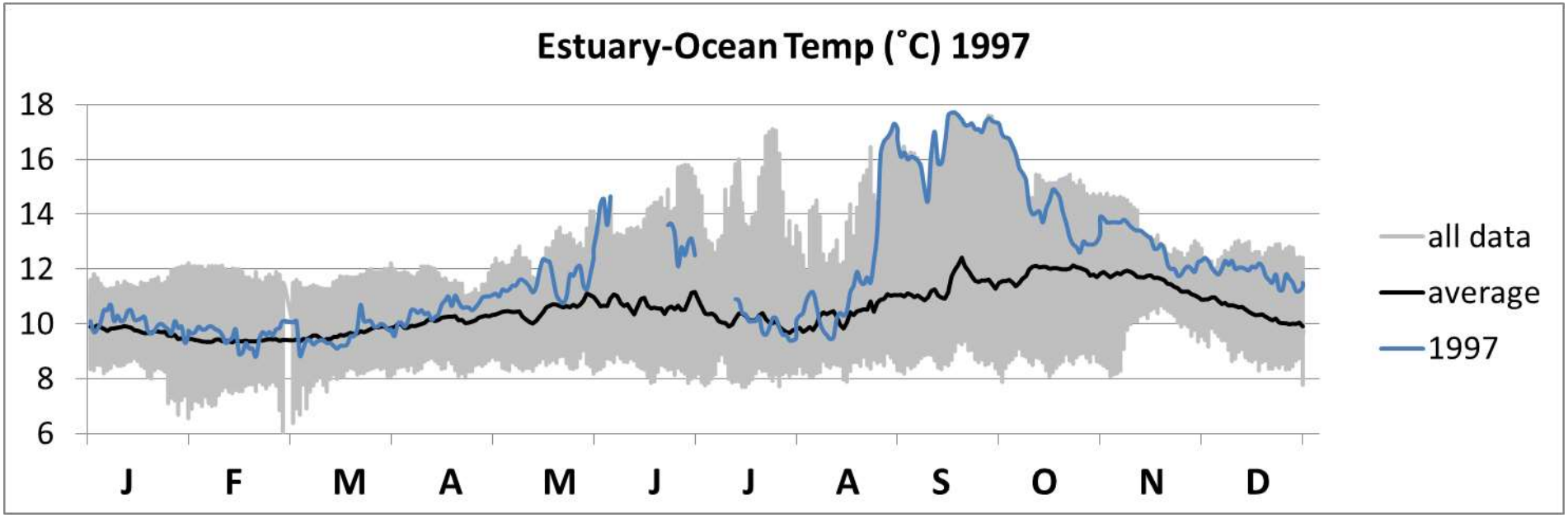

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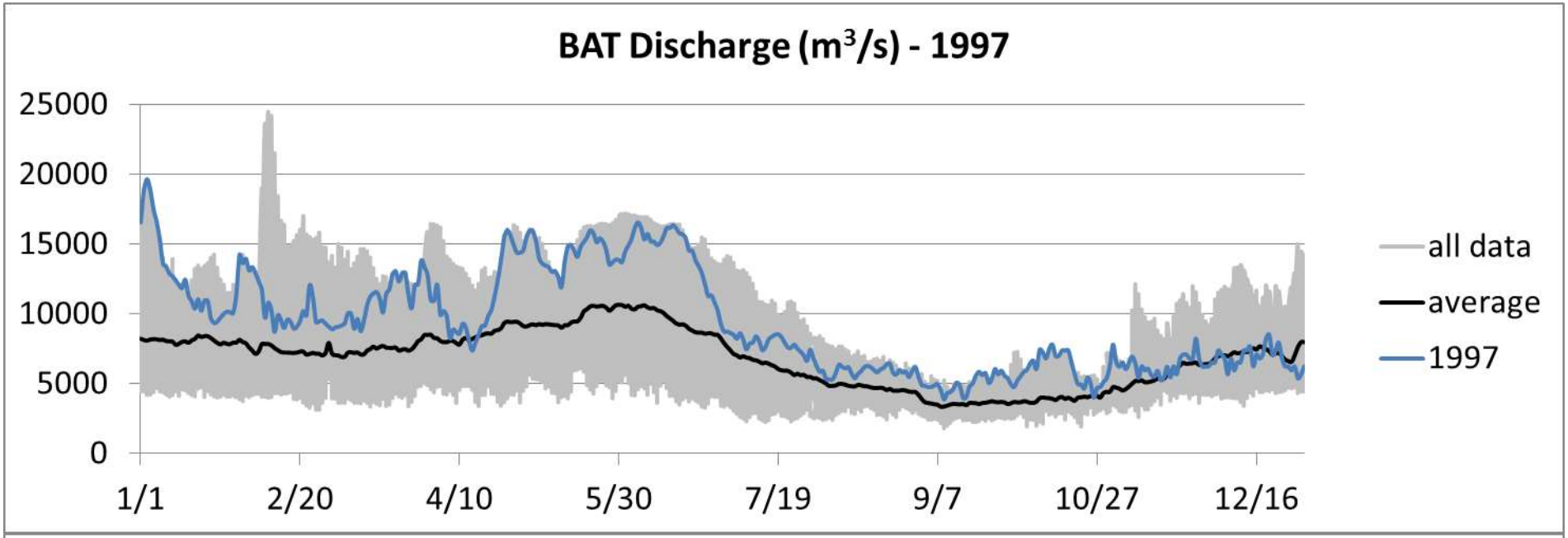
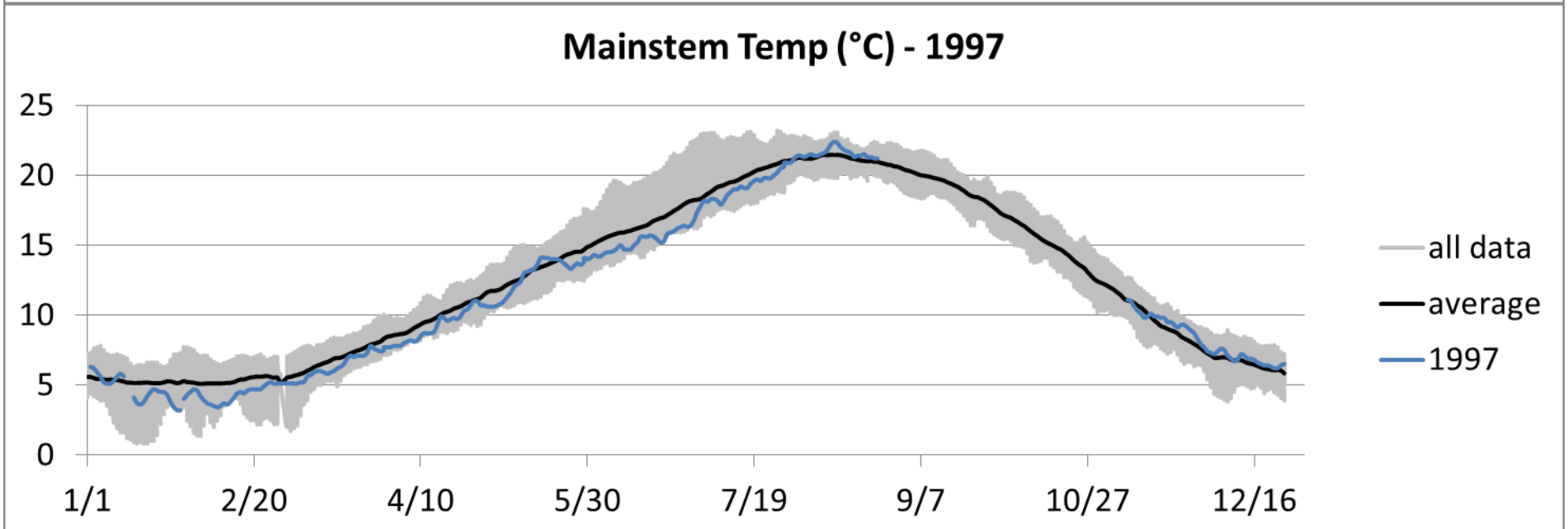
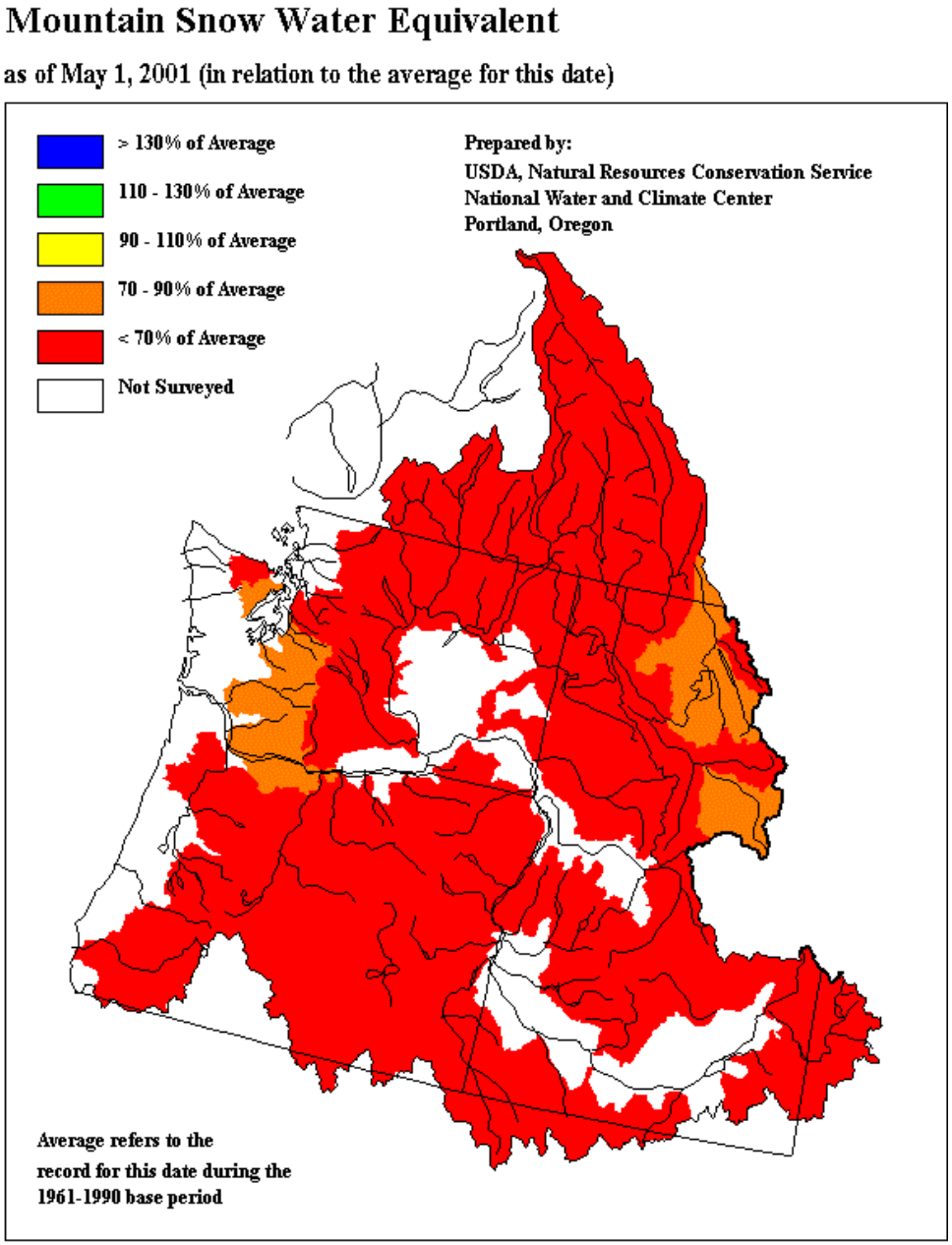




2001 Low snowpack - warm river



http://www.wcc.nrcs.usda.gov/ftpref/support/snow/snowpack_maps/columbia_river/wy2001/cusn0105.gif

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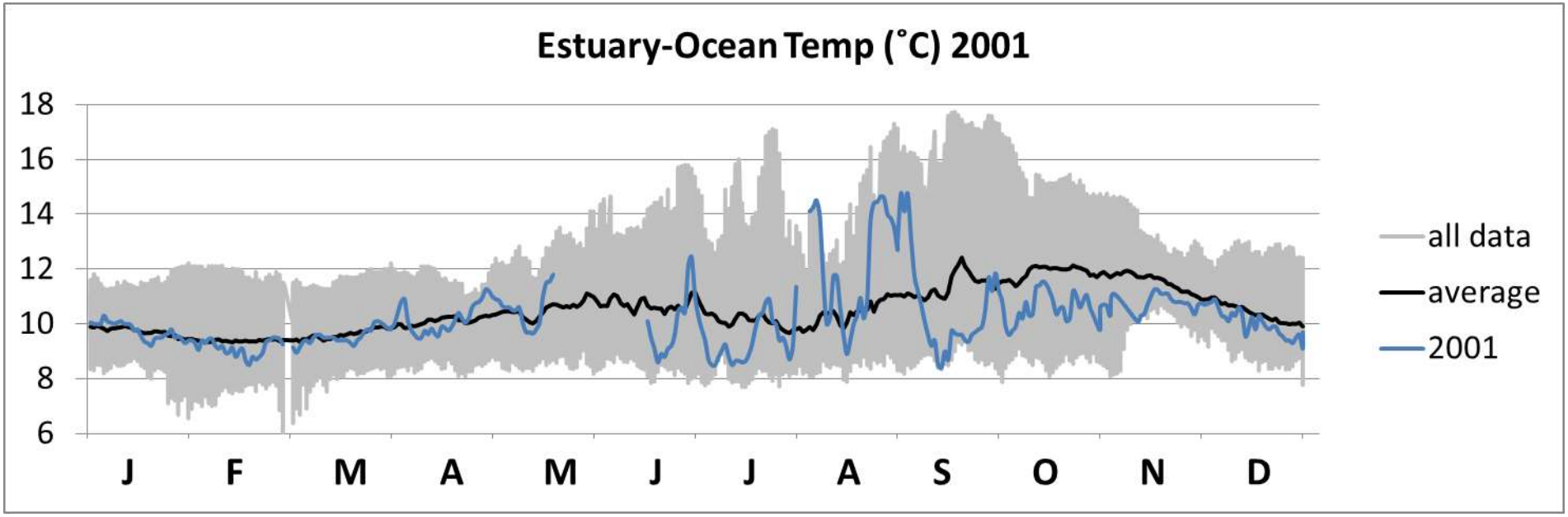

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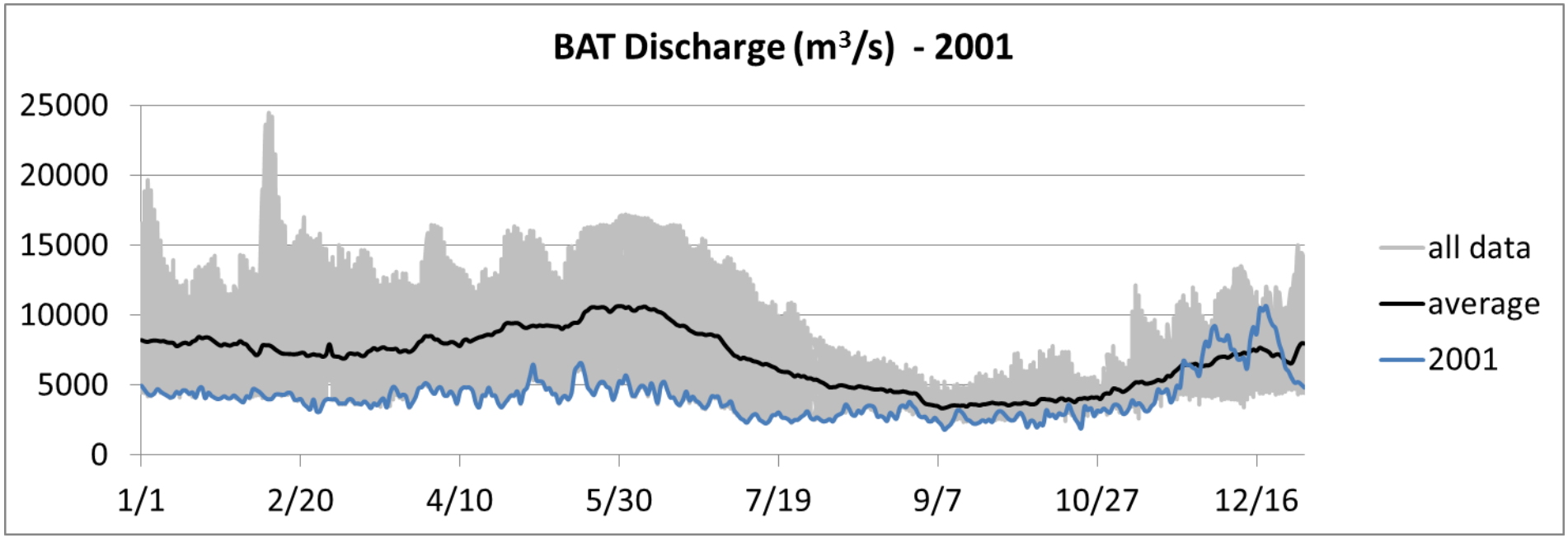
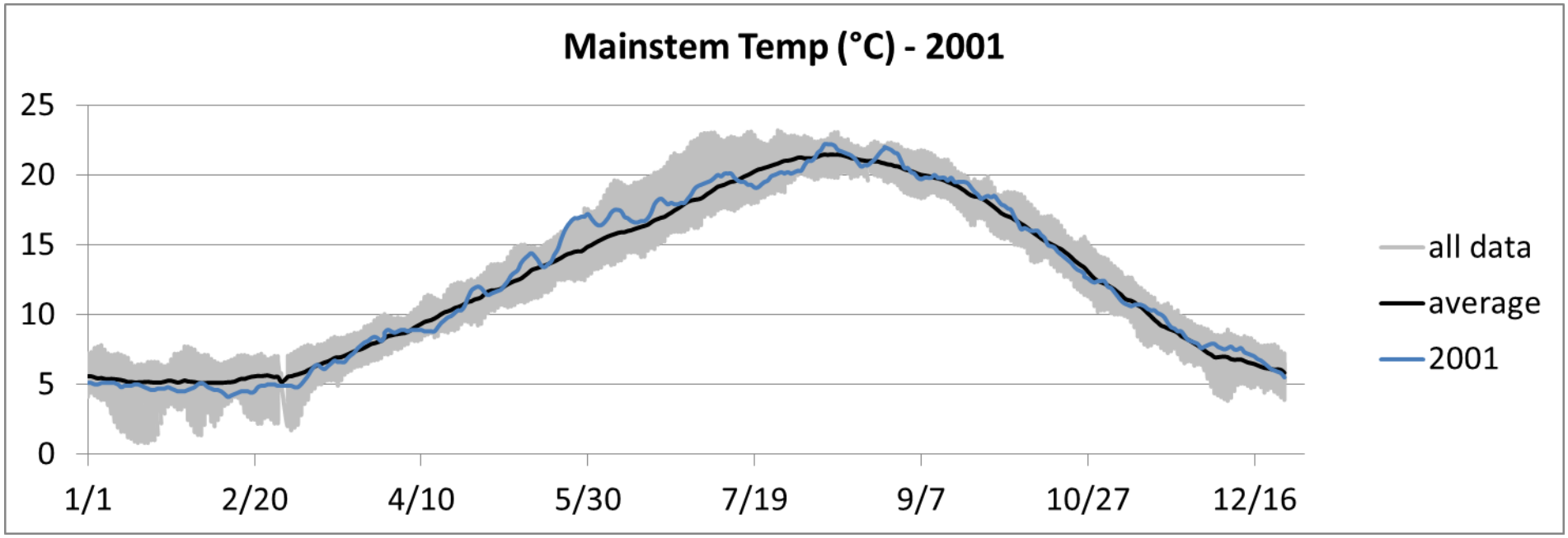
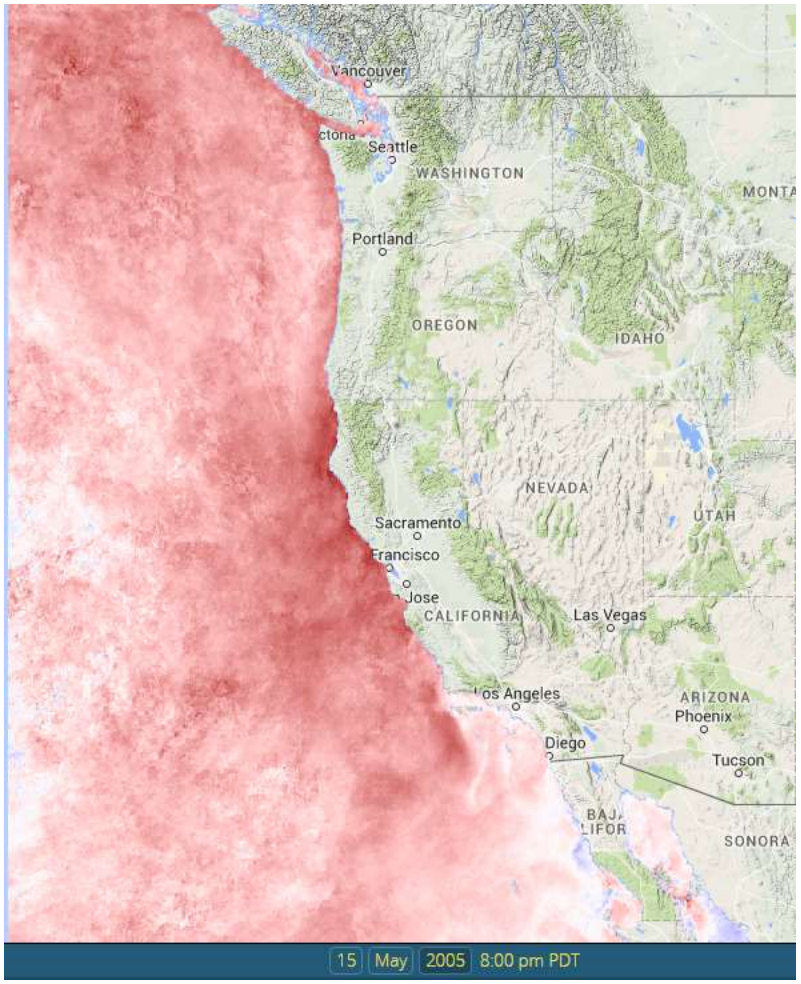


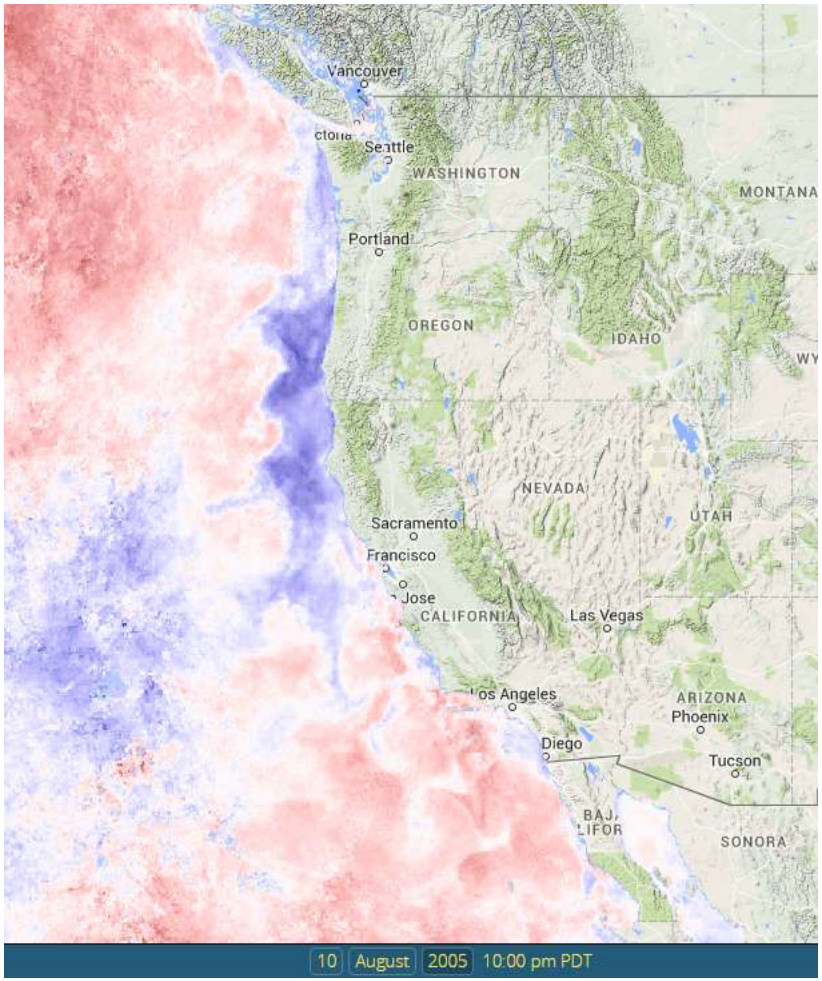


2005 Delayed upwelling - warm ocean

May 2005



August 2005



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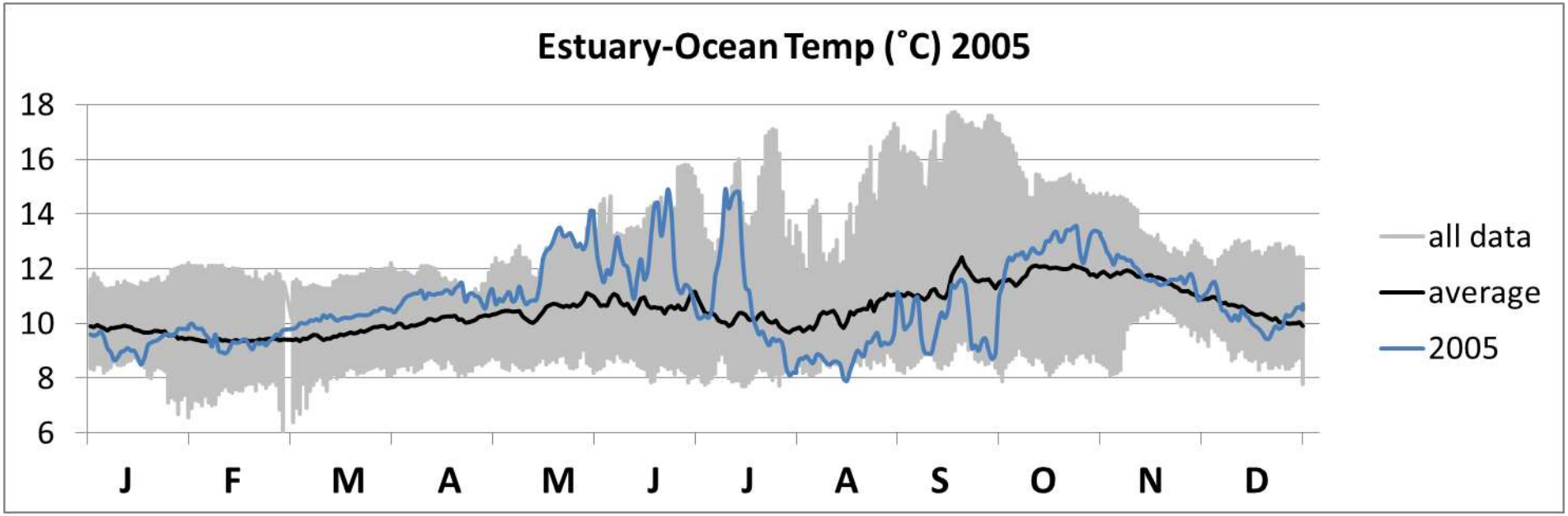

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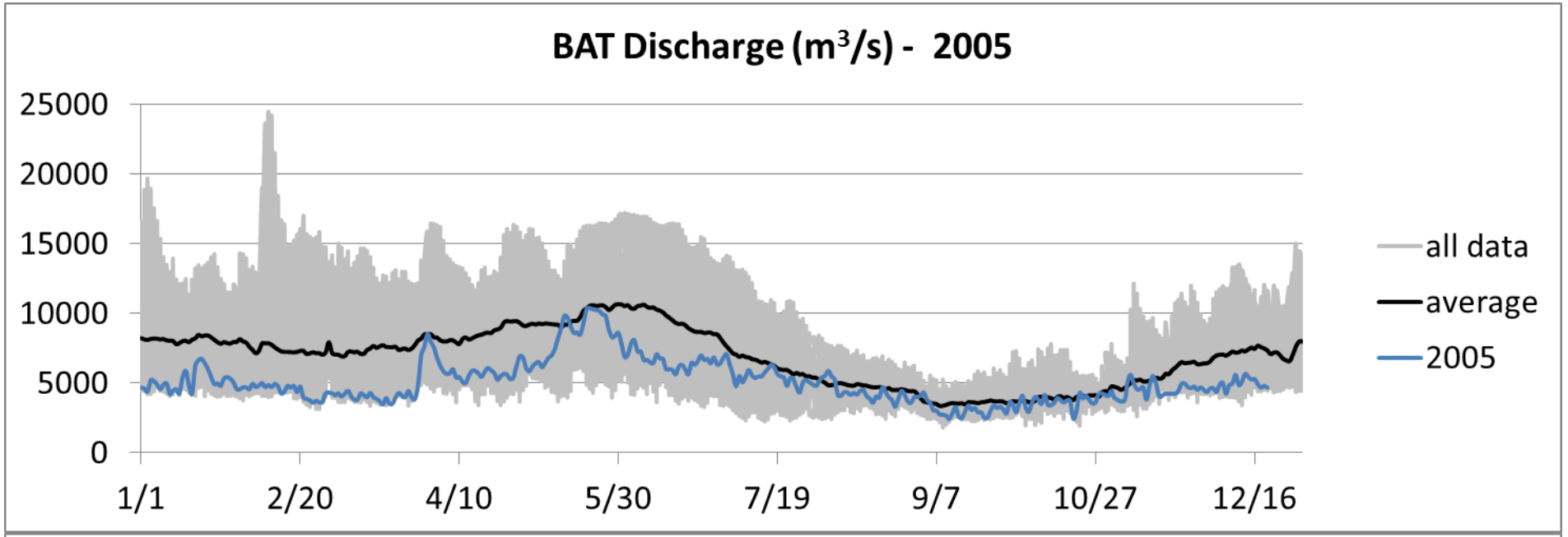
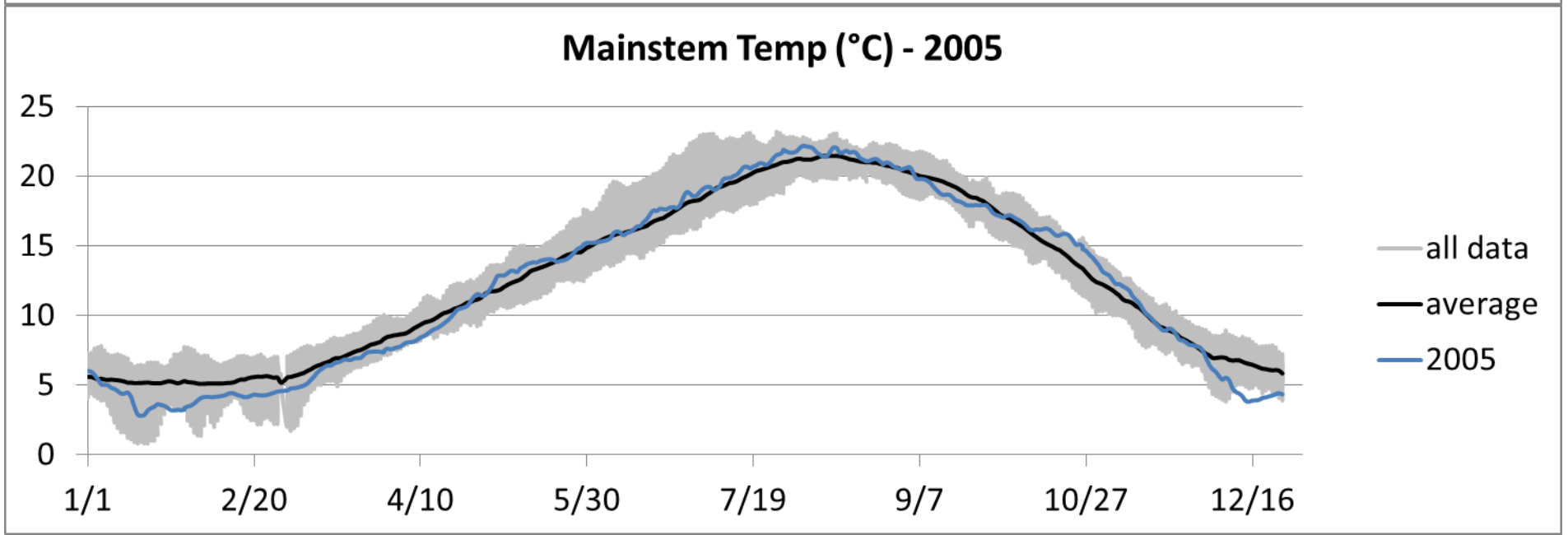
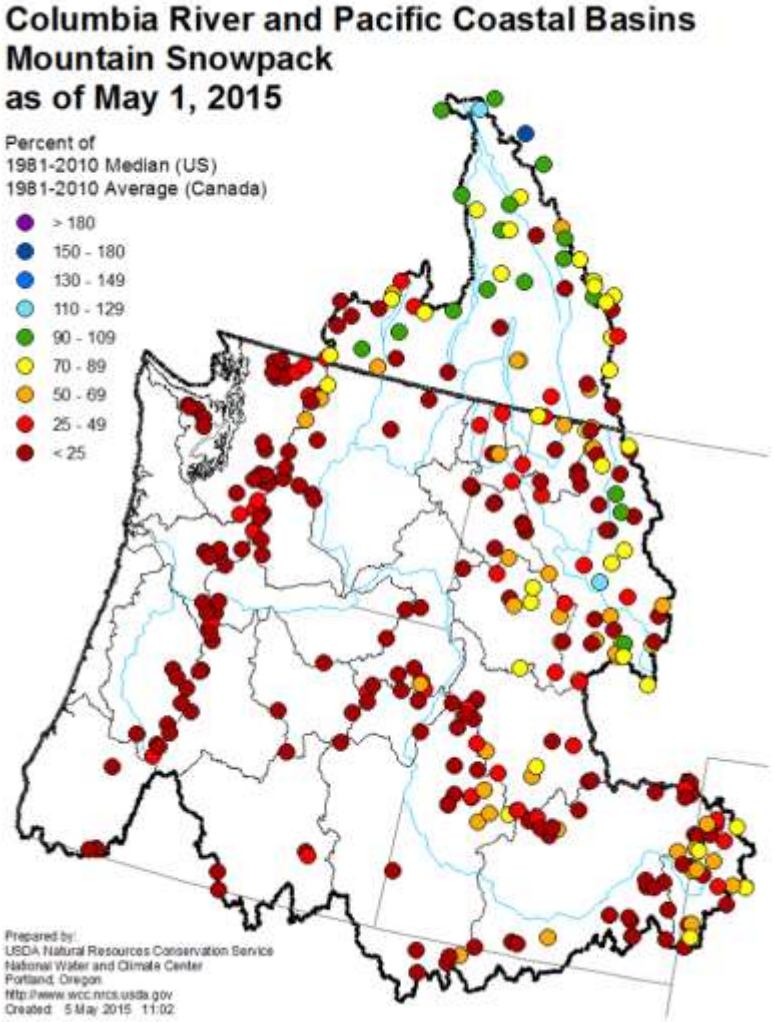




2014-2015 The Blob - **warm ocean and river**



October 2014

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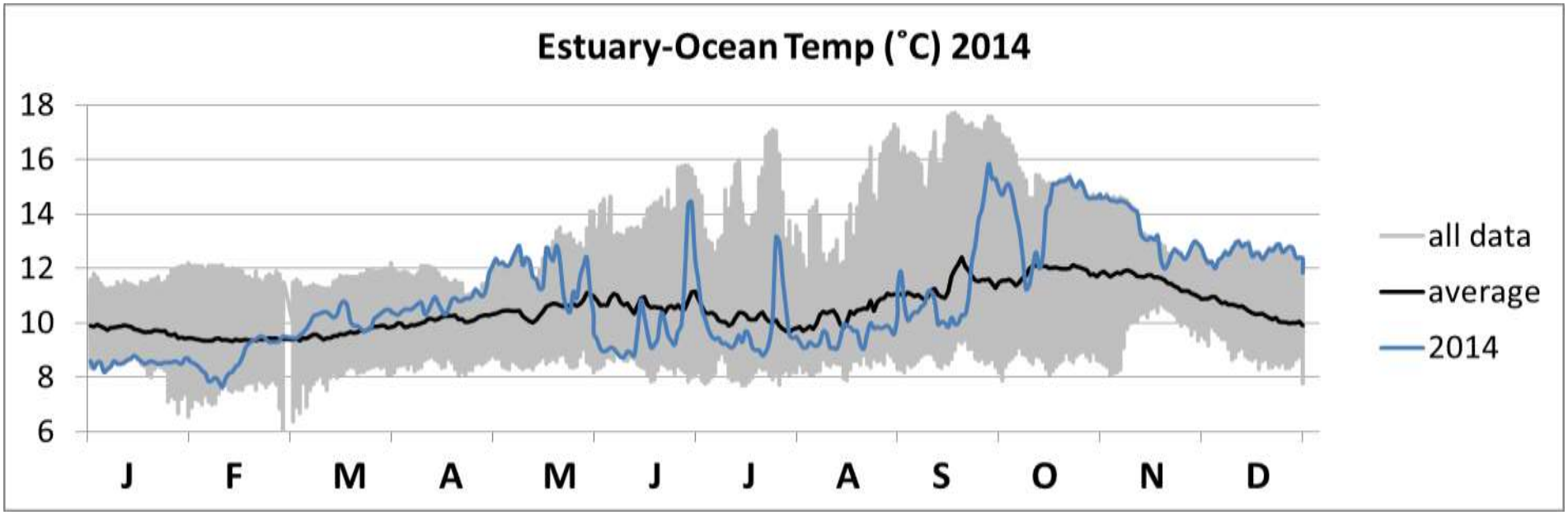

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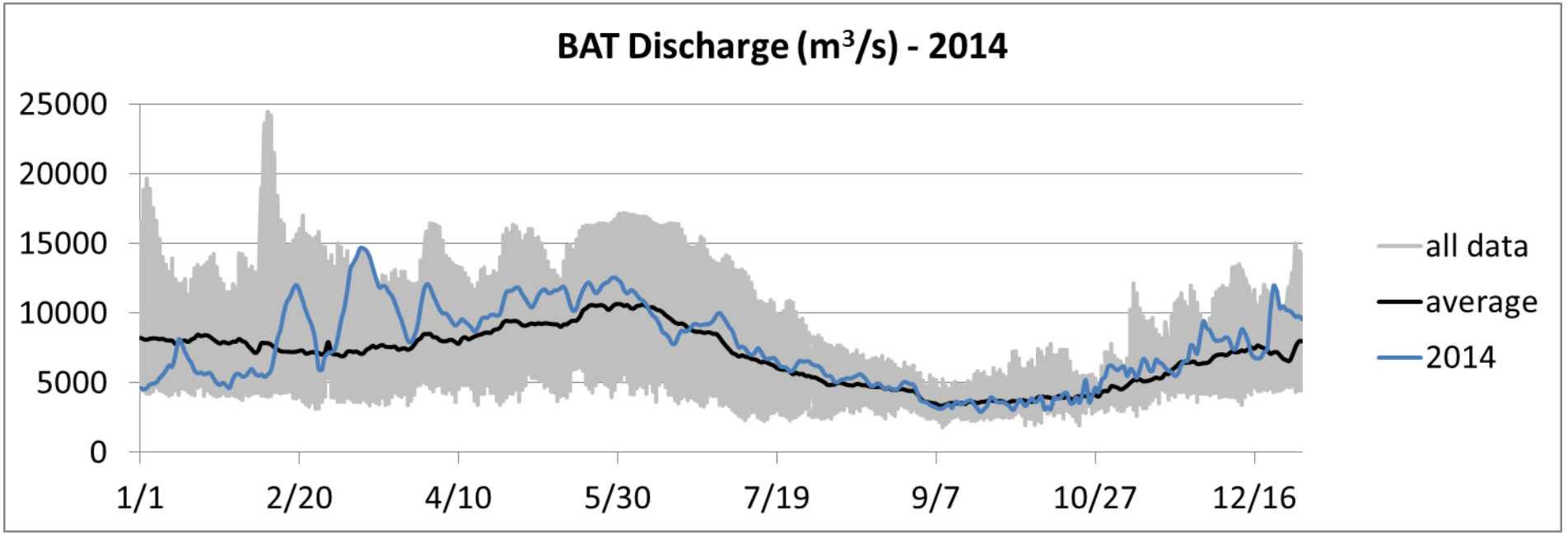

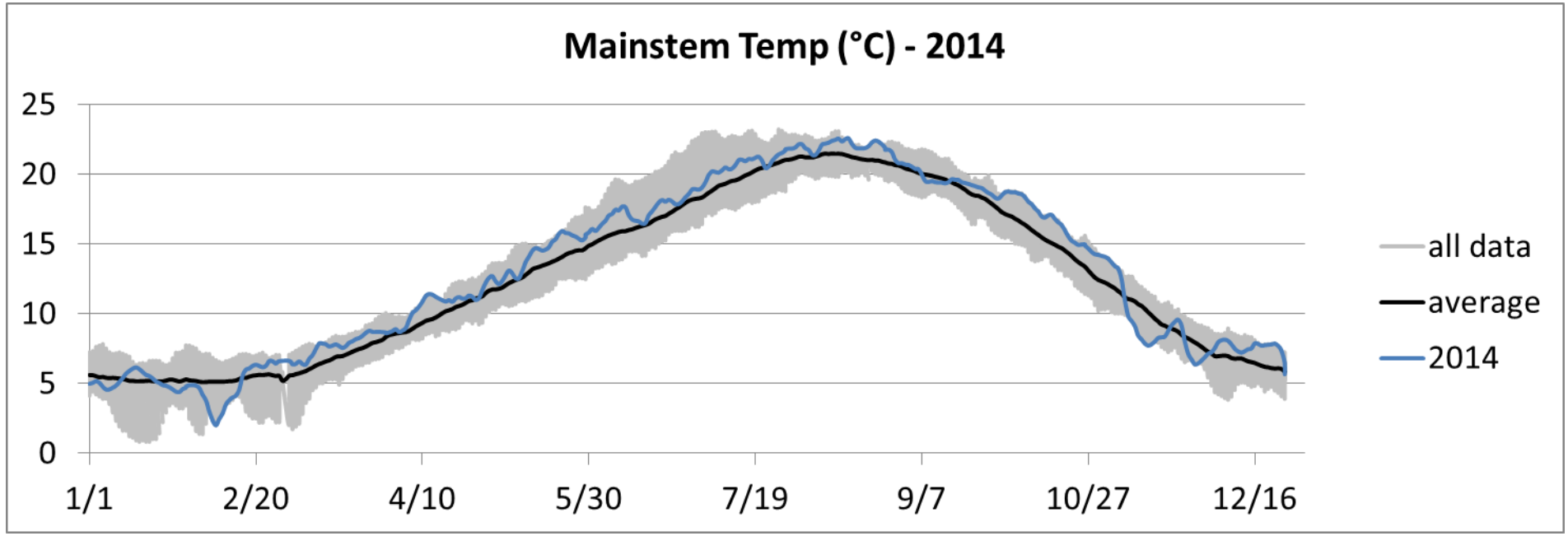

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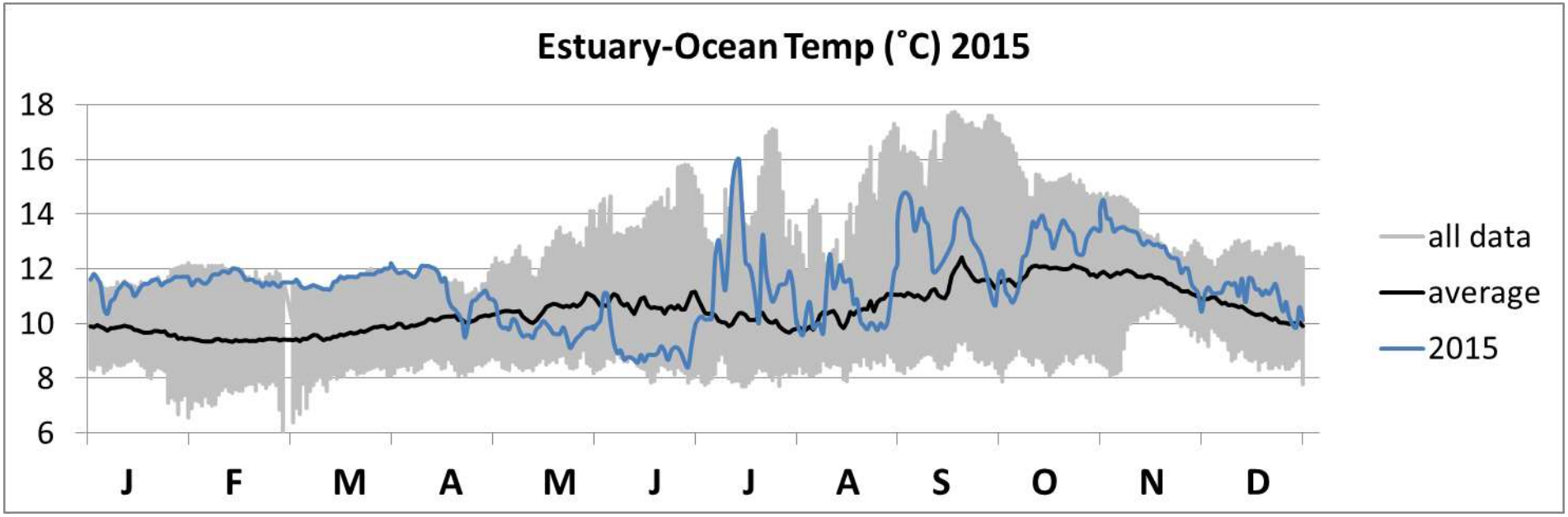

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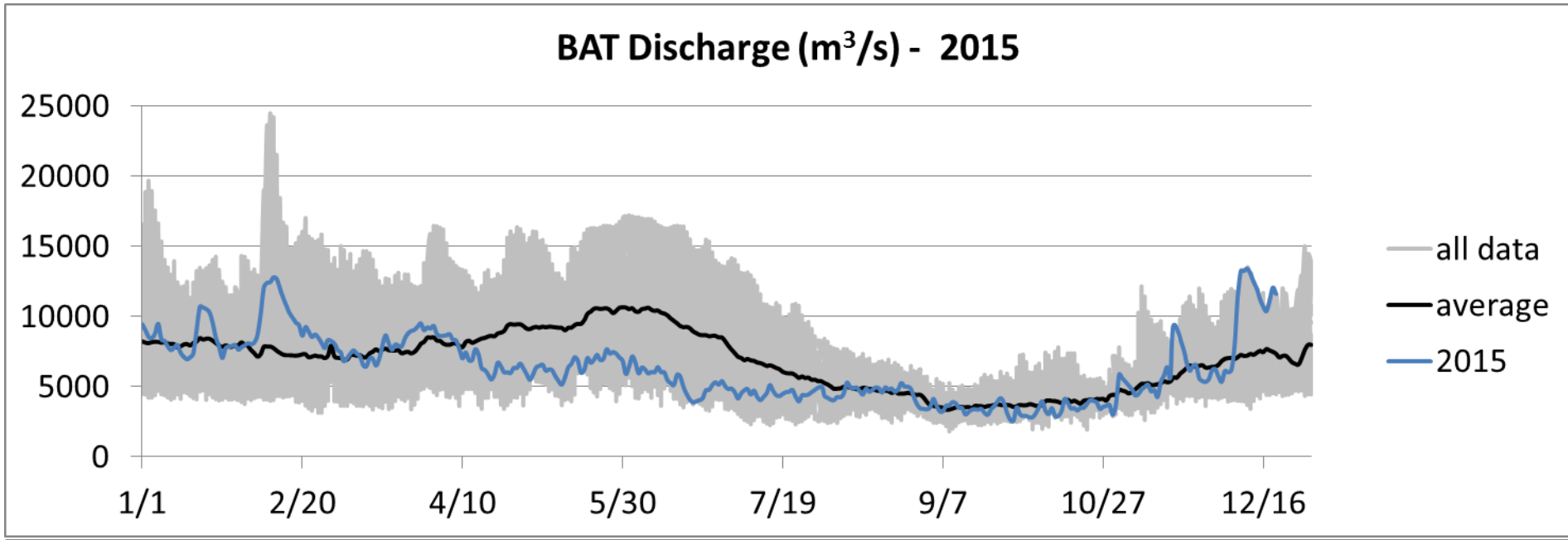
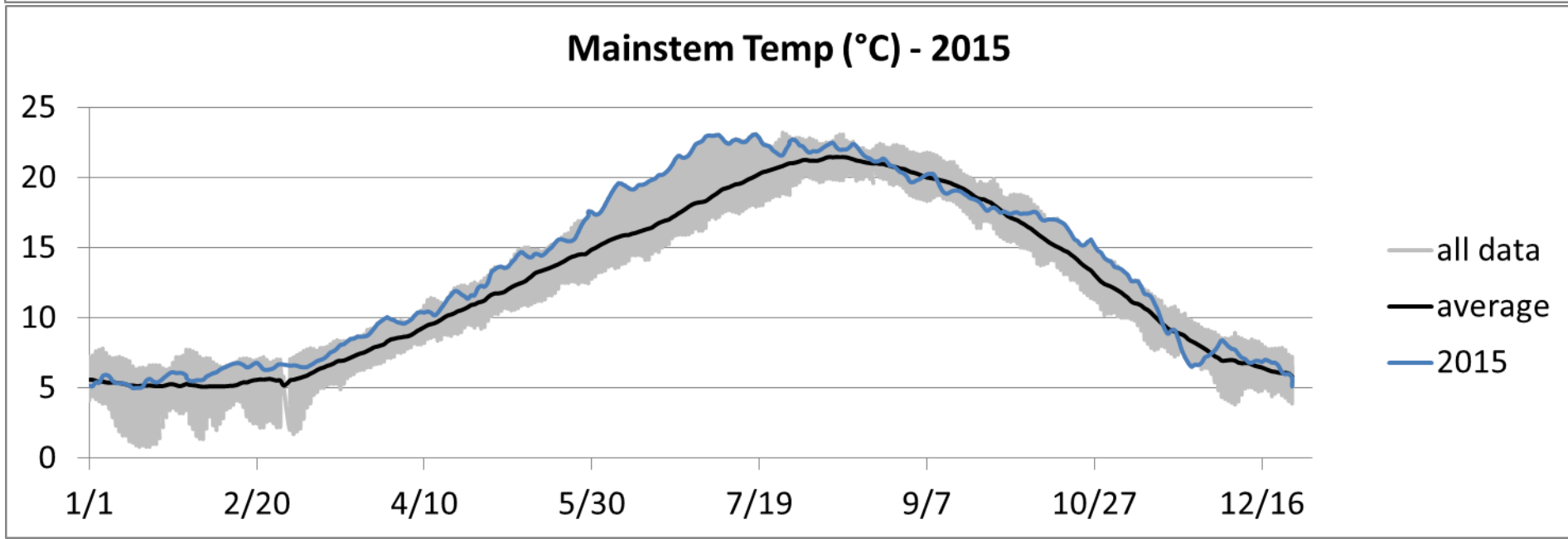
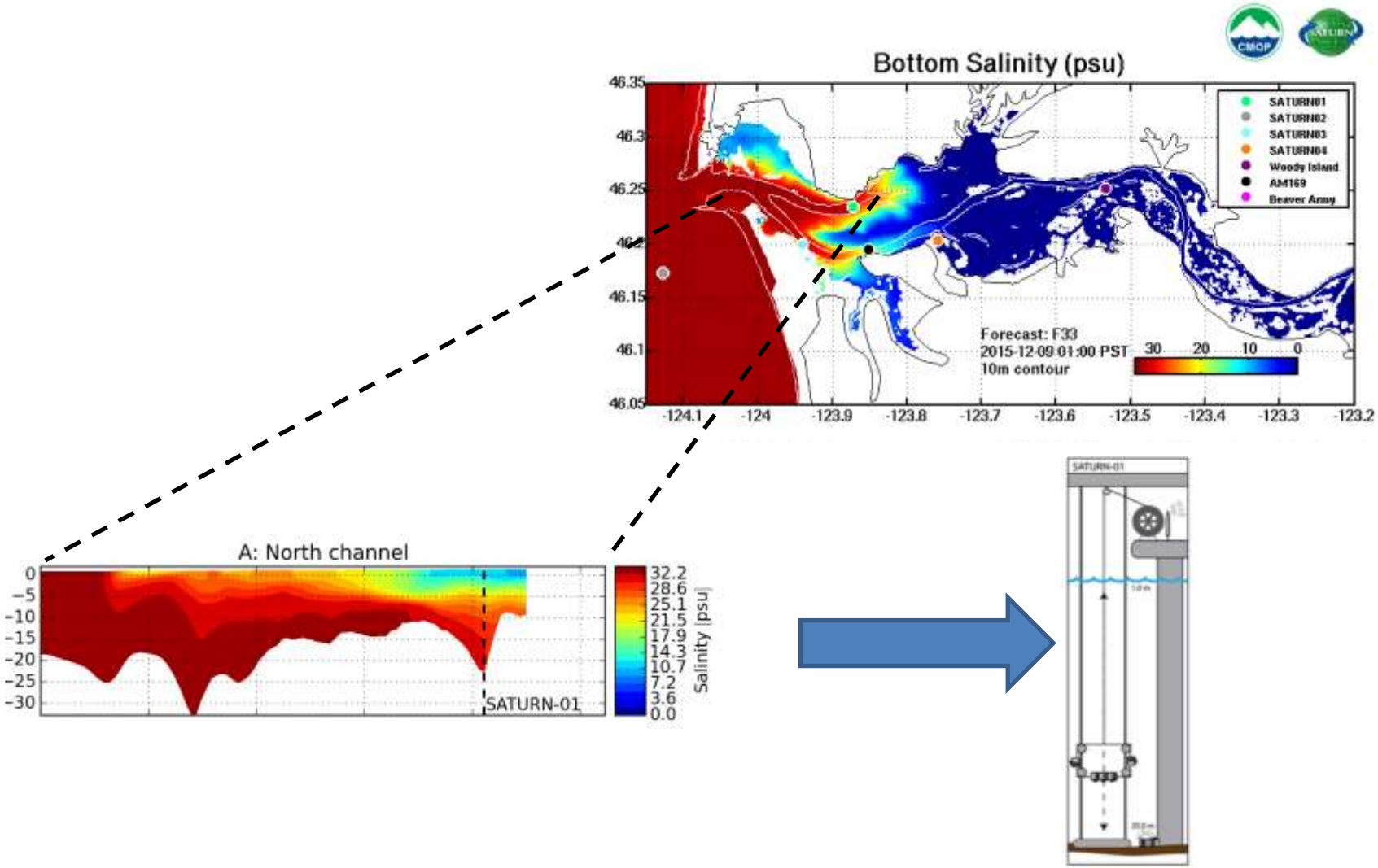




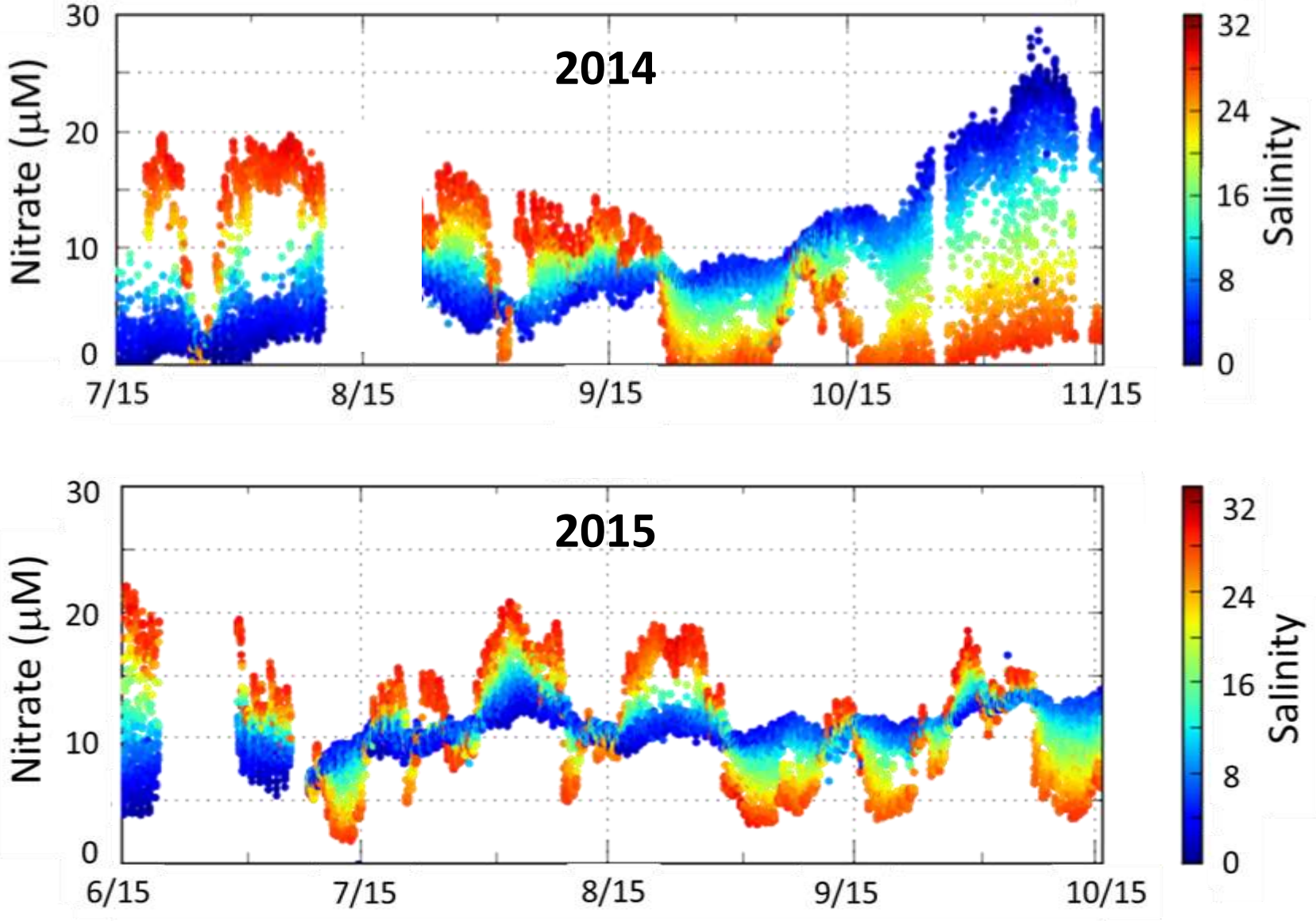
Summary of Estuary Conditions

Year	Event	Ocean end member	River end member
1997	El Nino	Warm	Cold
2001	Small snowpack	Cold	Average
2005	Delayed upwelling	Warm	Average
2014	Upwelling - blob	Cold - Warm	Average
2015	Blob + small snowpack + unusual warm weather in spring	Warm	Warm

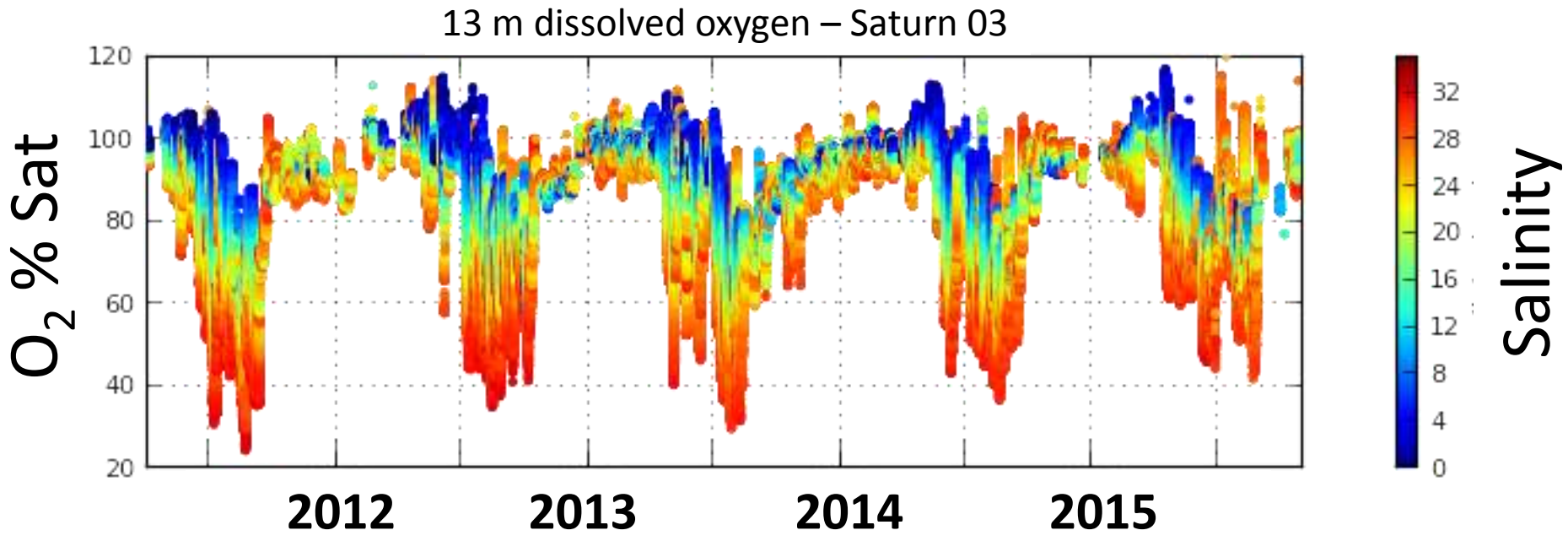
CMOP Biogeochemical Data



Nitrate (colored by salinity)



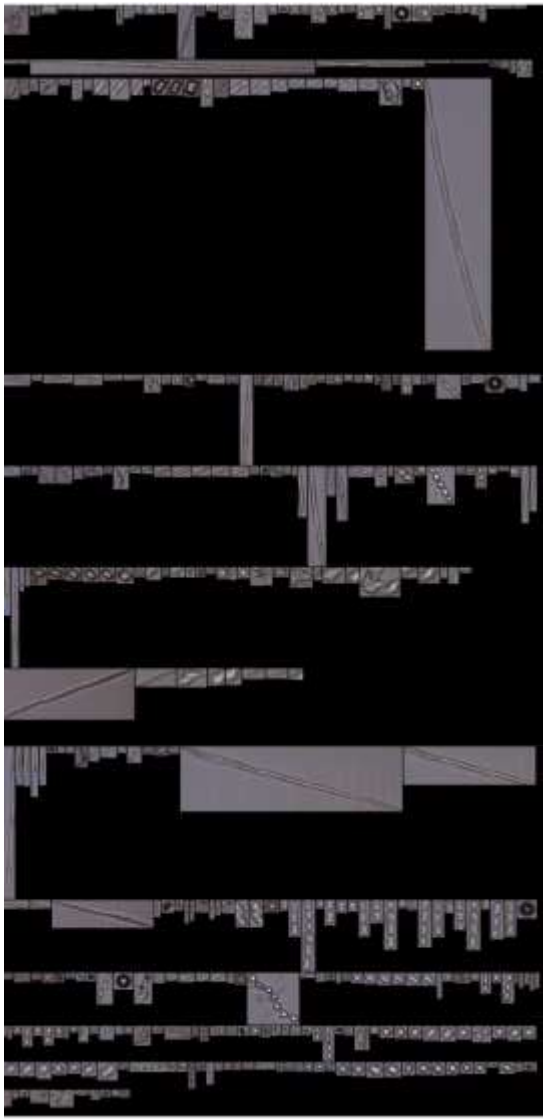
SATURN-03 Dissolved Oxygen Time Series



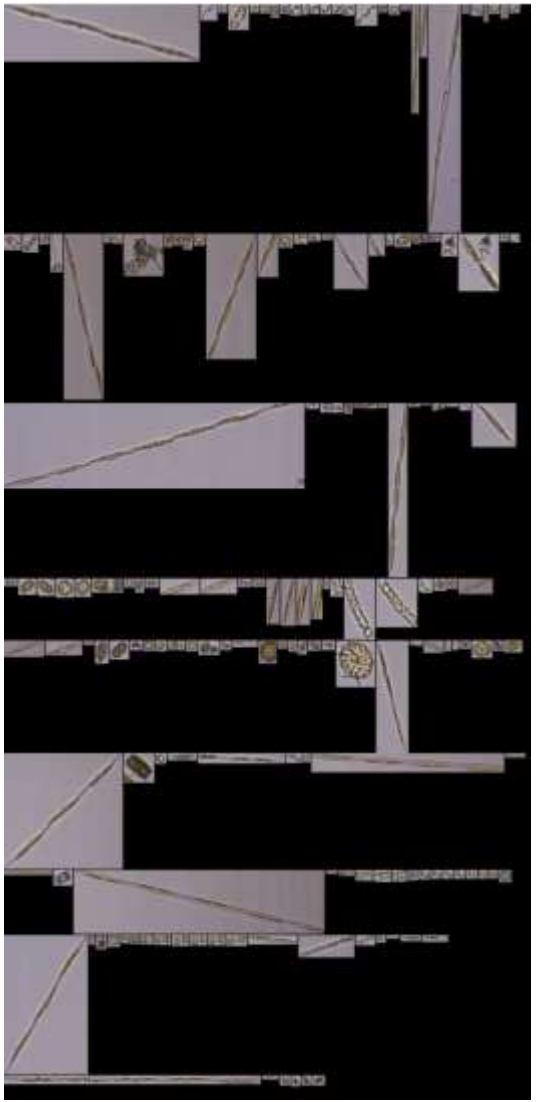
No evidence for strong hypoxia formation associated with the blob

Remnants of persistent bloom of Pseudo-nitzschia spp. in NE Pacific were see in the CR estuary

Offshore sample (surface, CR-40)



Estuary sample (surface, SAT-03)



Biogeochemical consequences of warm waters in the Columbia River (ongoing research)

No significant hypoxia detected in estuary

Summer-Fall: Nutrient supply depends on strength of upwelling

HAB blooms widespread in river and ocean end-members