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Monitoring Willamette River Off-Channel Water Quality

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U.S. Department of the Interior
U.S. Geological Survey

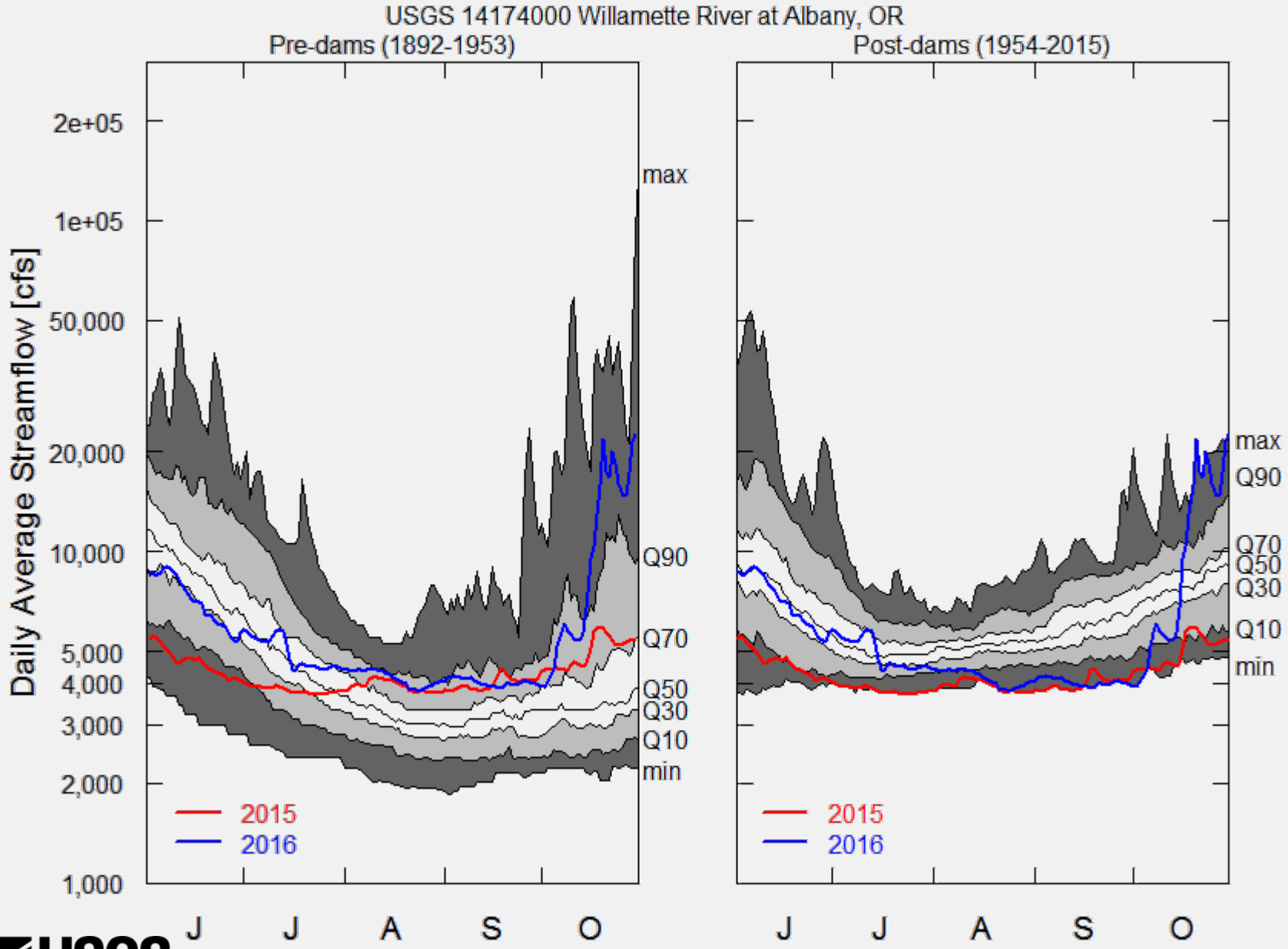
Photo credit: JoJo Mangano, USGS

Project Goal:

Better describe Willamette off-channel water quality as it changes with flow

- **Synoptic monitoring (OSU/UO, USGS)**
  - **Water depth, substrate quality**
  - **Spatial profiles of water quality (temperature, specific conductance, dissolved oxygen, pH)**
  - **Water isotopes**
- **Continuous monitoring (Summer 2015, 2016)**
  - **Temperature (~30 sites)**
  - **Dissolved oxygen, specific conductance, pH (~5 sites)**
  - **Water level (10 sites)**

2015-2016 Willamette River Streamflow at Albany



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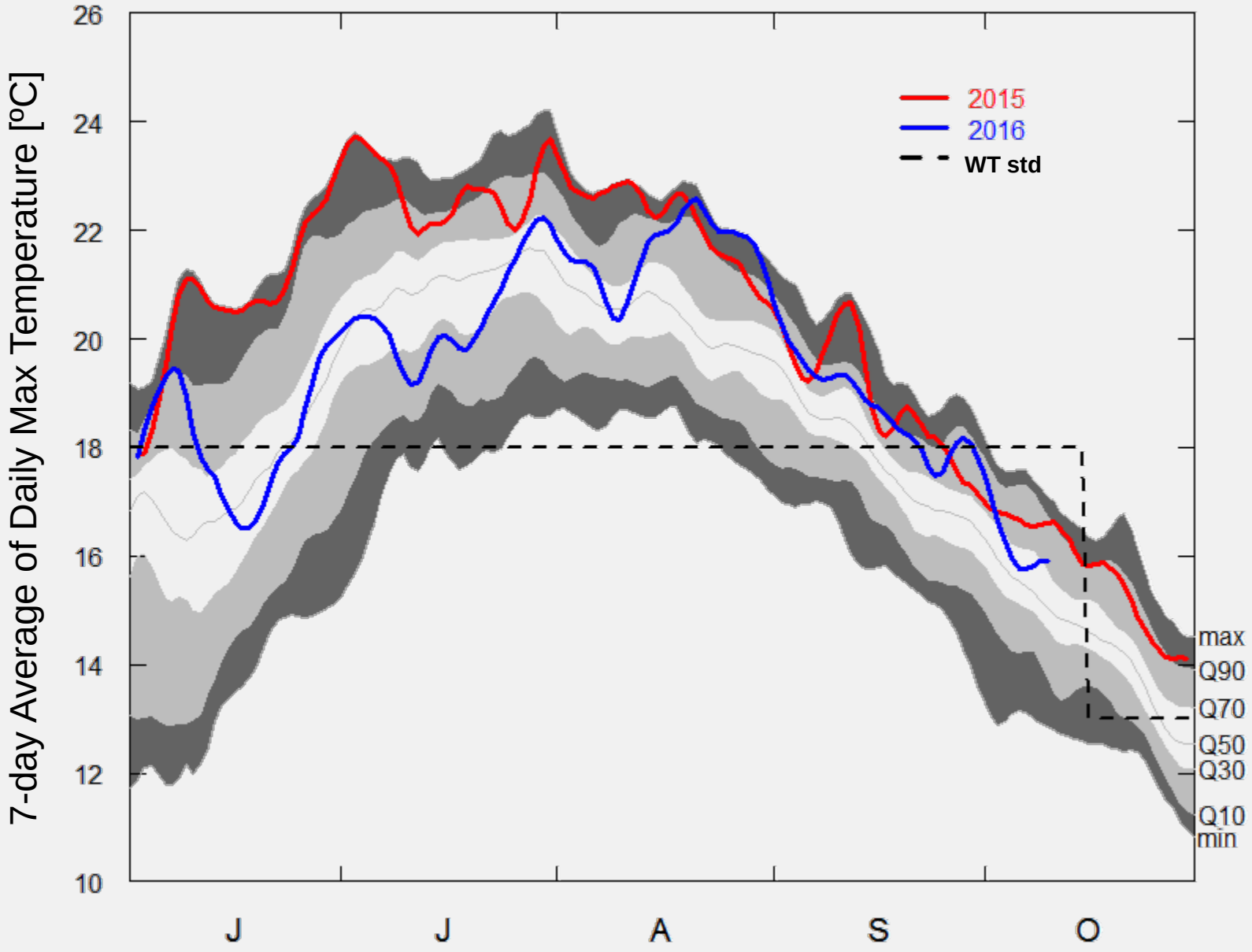
Data from USGS site 14174000 at http://waterdata.usgs.gov/nwis

2015-2016 Willamette Temperature at Albany

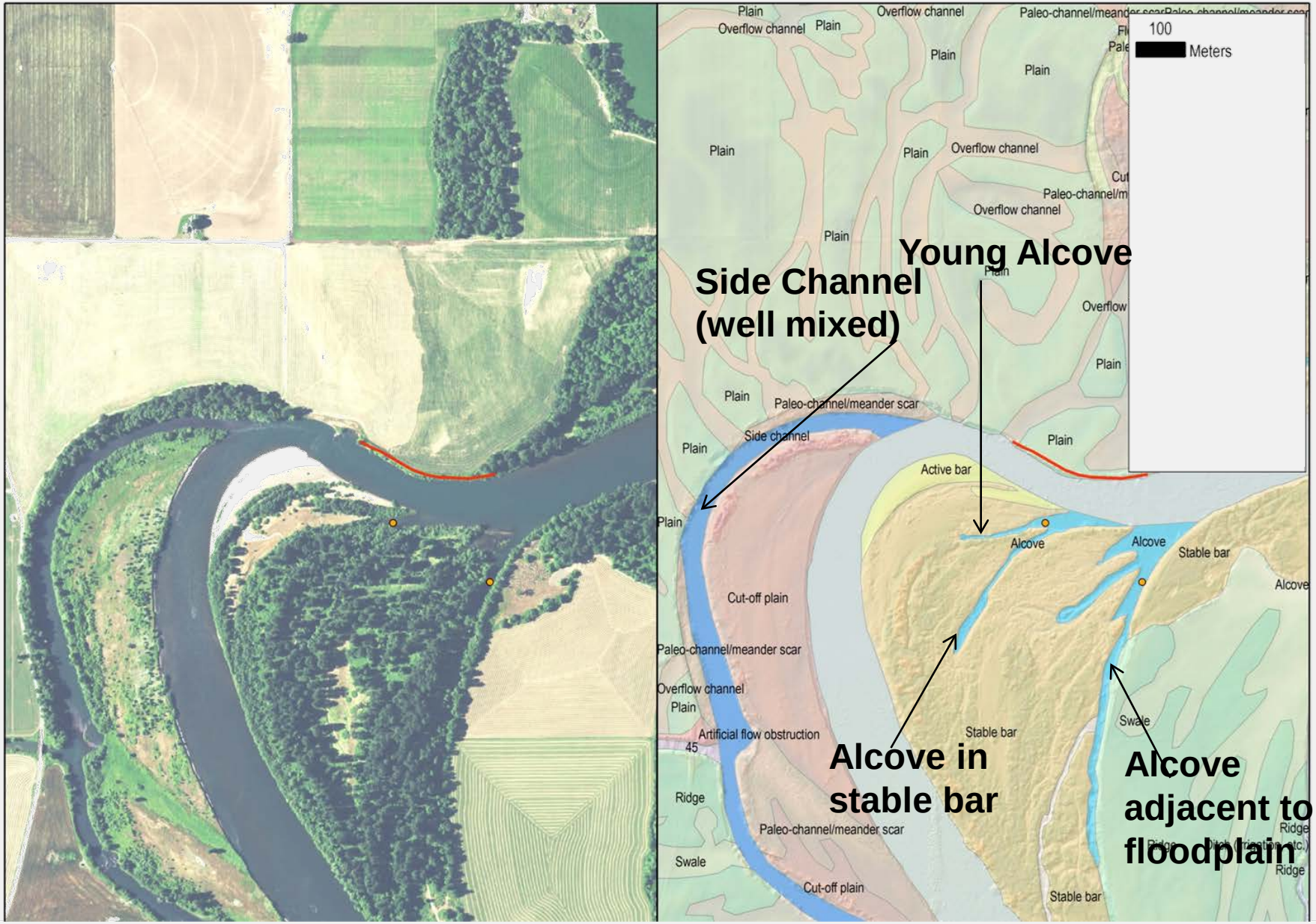


Quantiles based on 2000-2016 period

USGS

Data from USGS site 14174000 at http://waterdata.usgs.gov/nwis

Willamette River Features – Near Long Tom Confluence

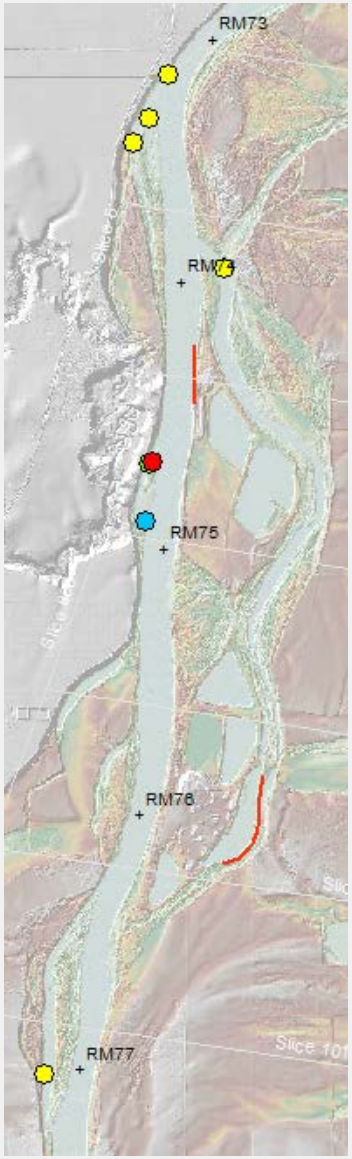


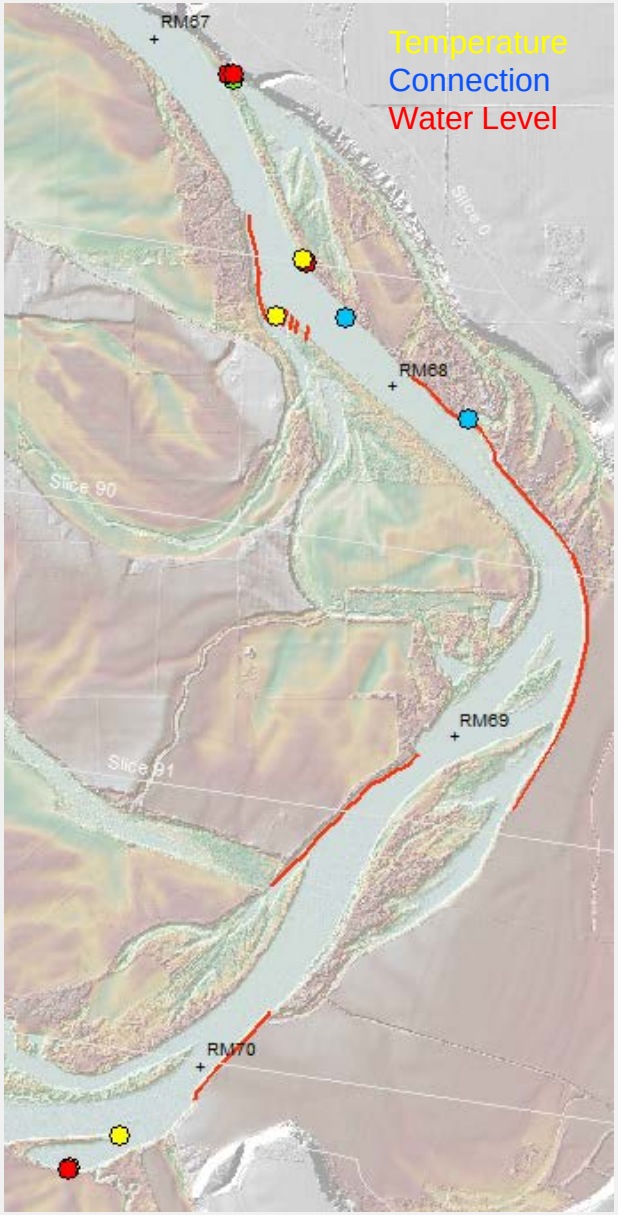
2014 NAIP Air Photos

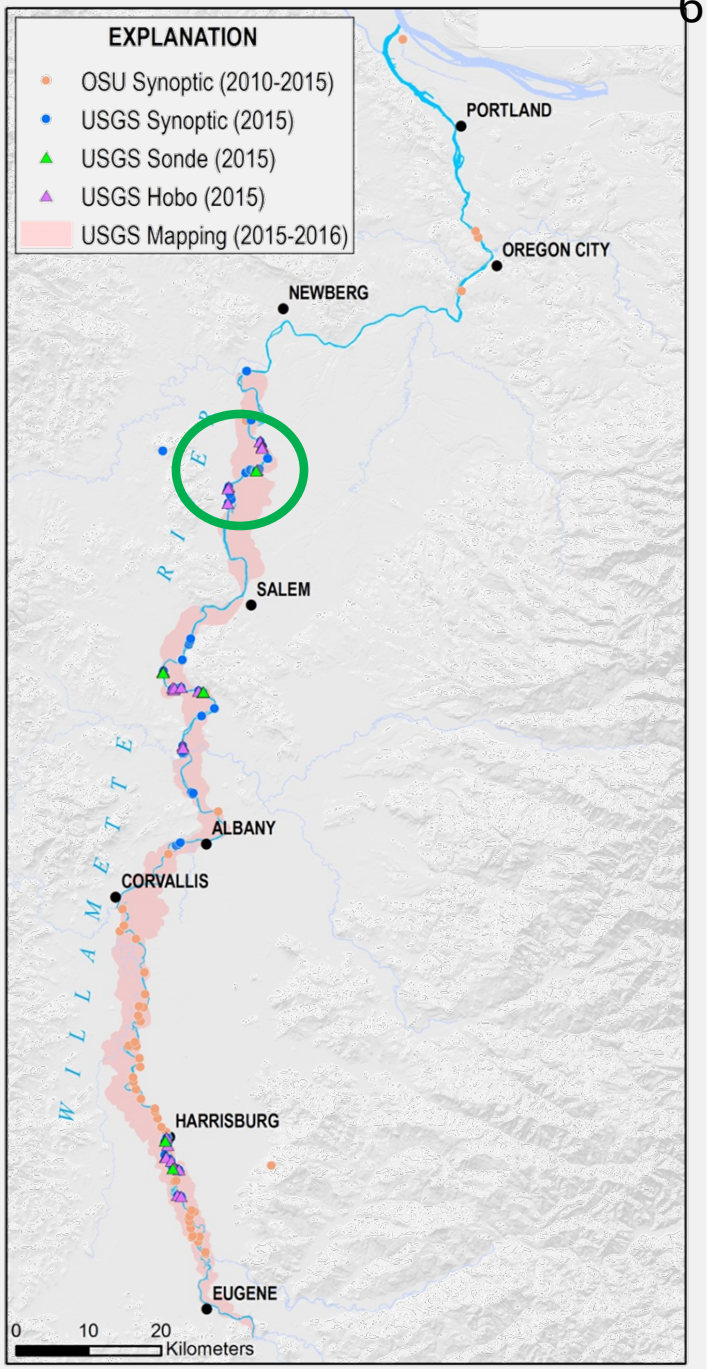
Preliminary USGS mapping from 2008 LiDAR

Provisional Data

Wheatland Ferry Reach (RM 67-77)







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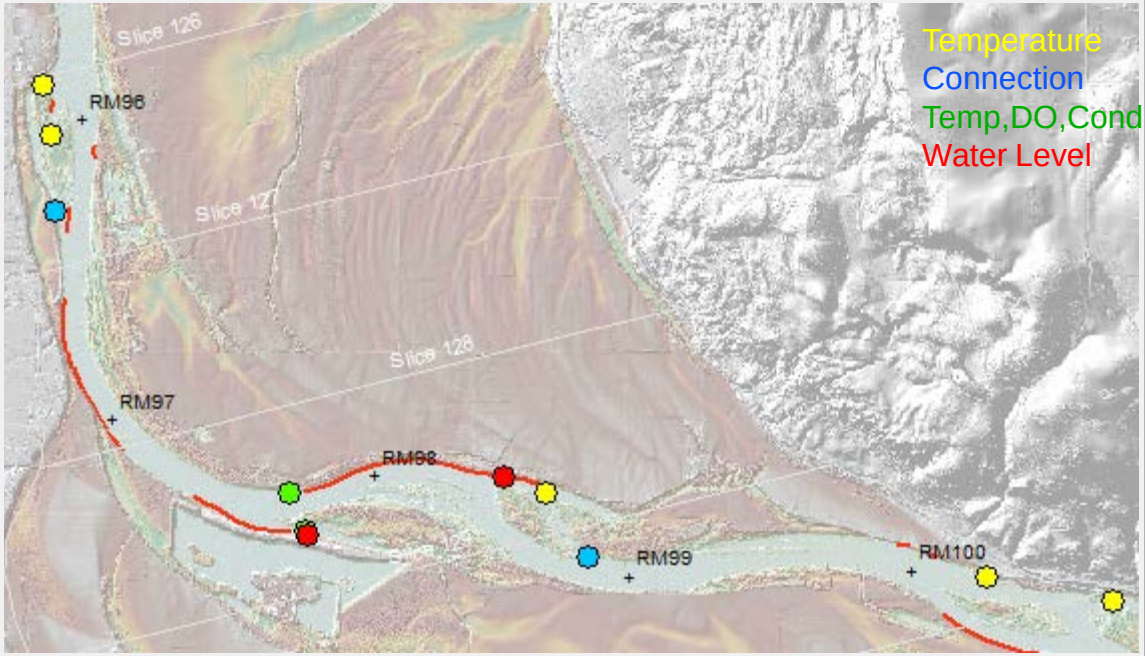
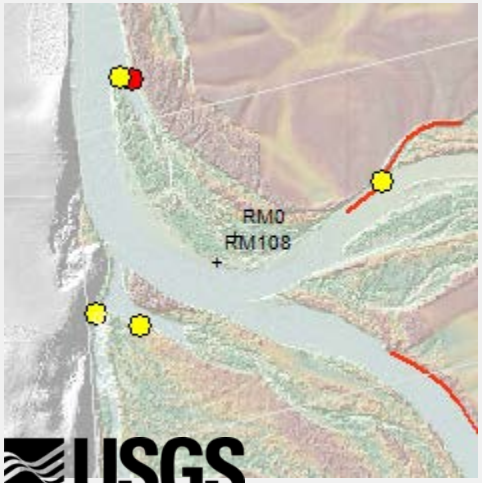
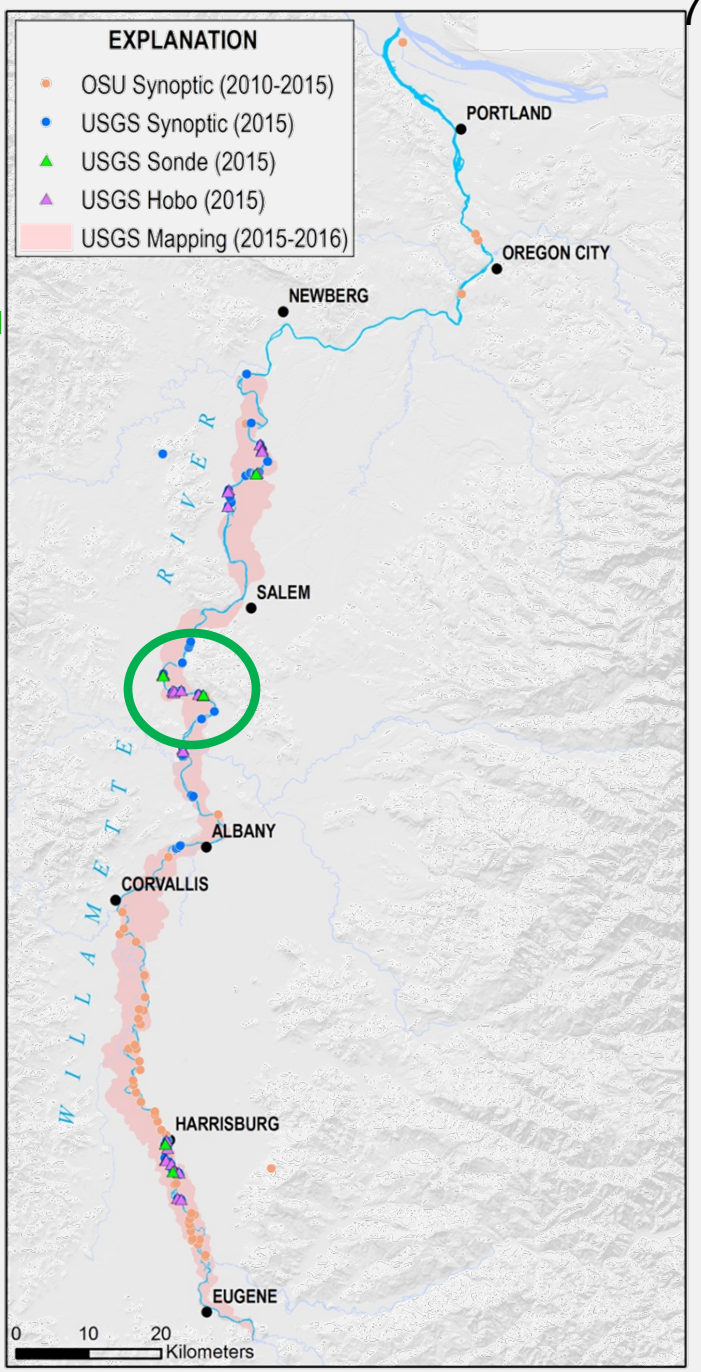
Independence (RM 96-101)





Santiam/Luckiamute (RM 108)



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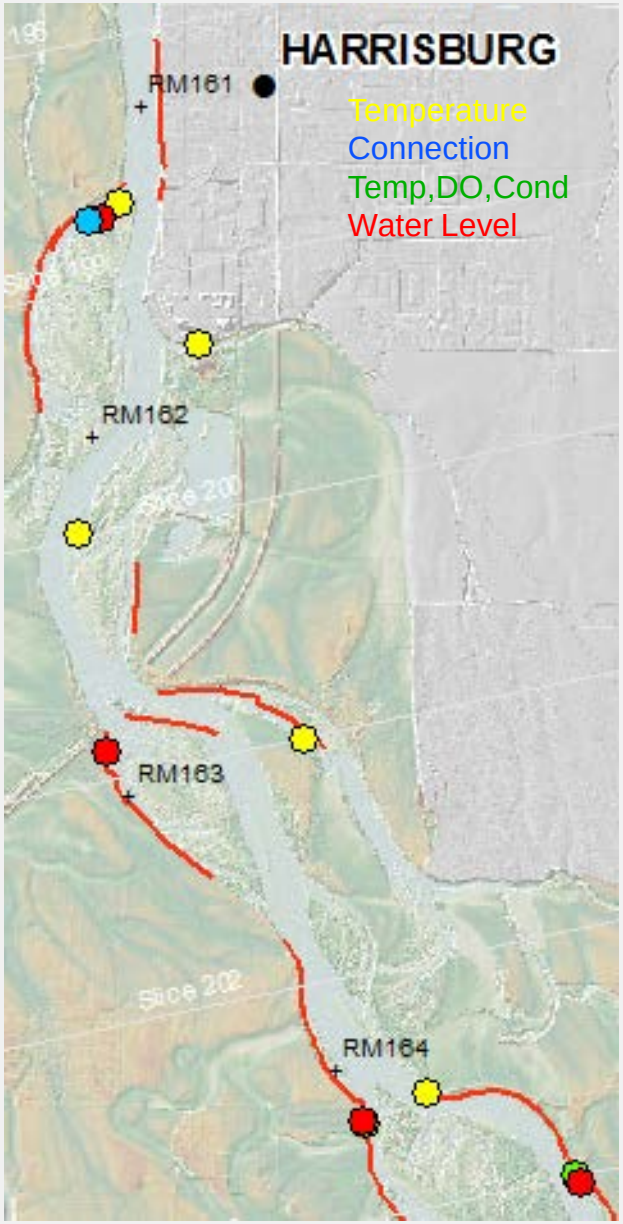
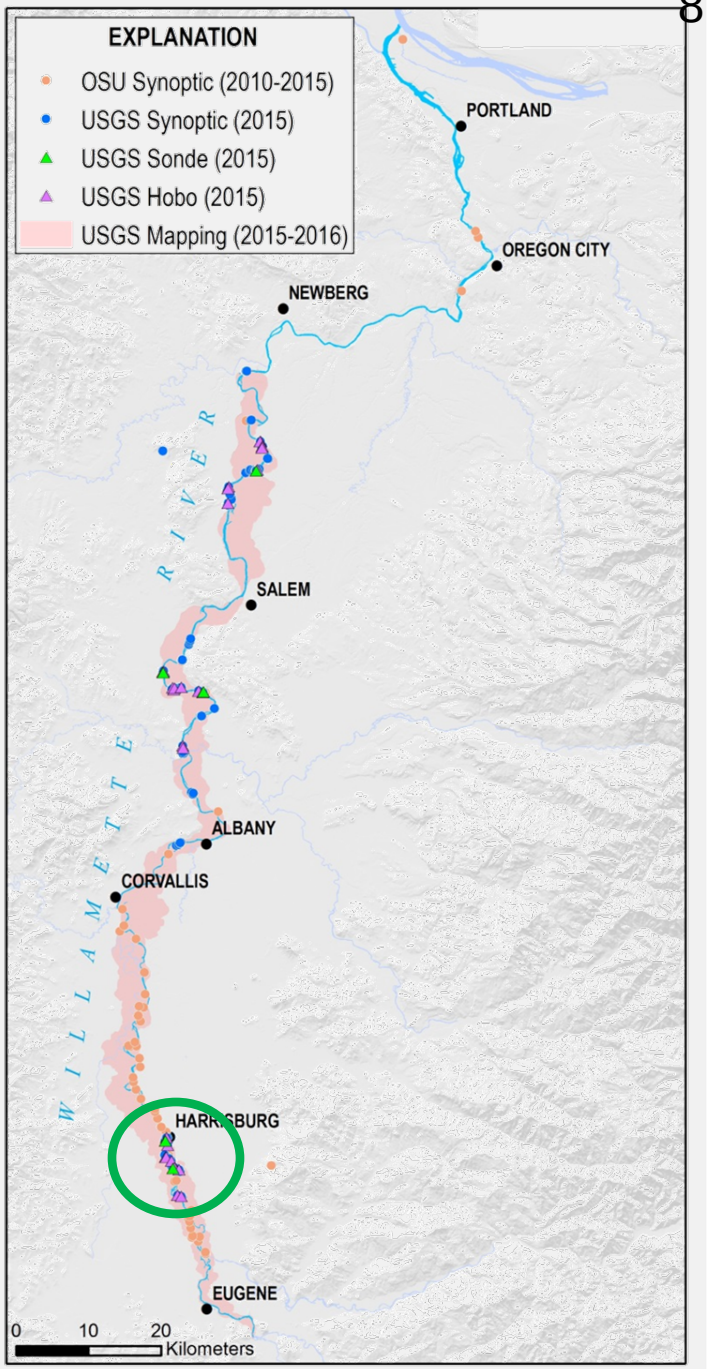
Upstream of Harrisburg (RM161-164)





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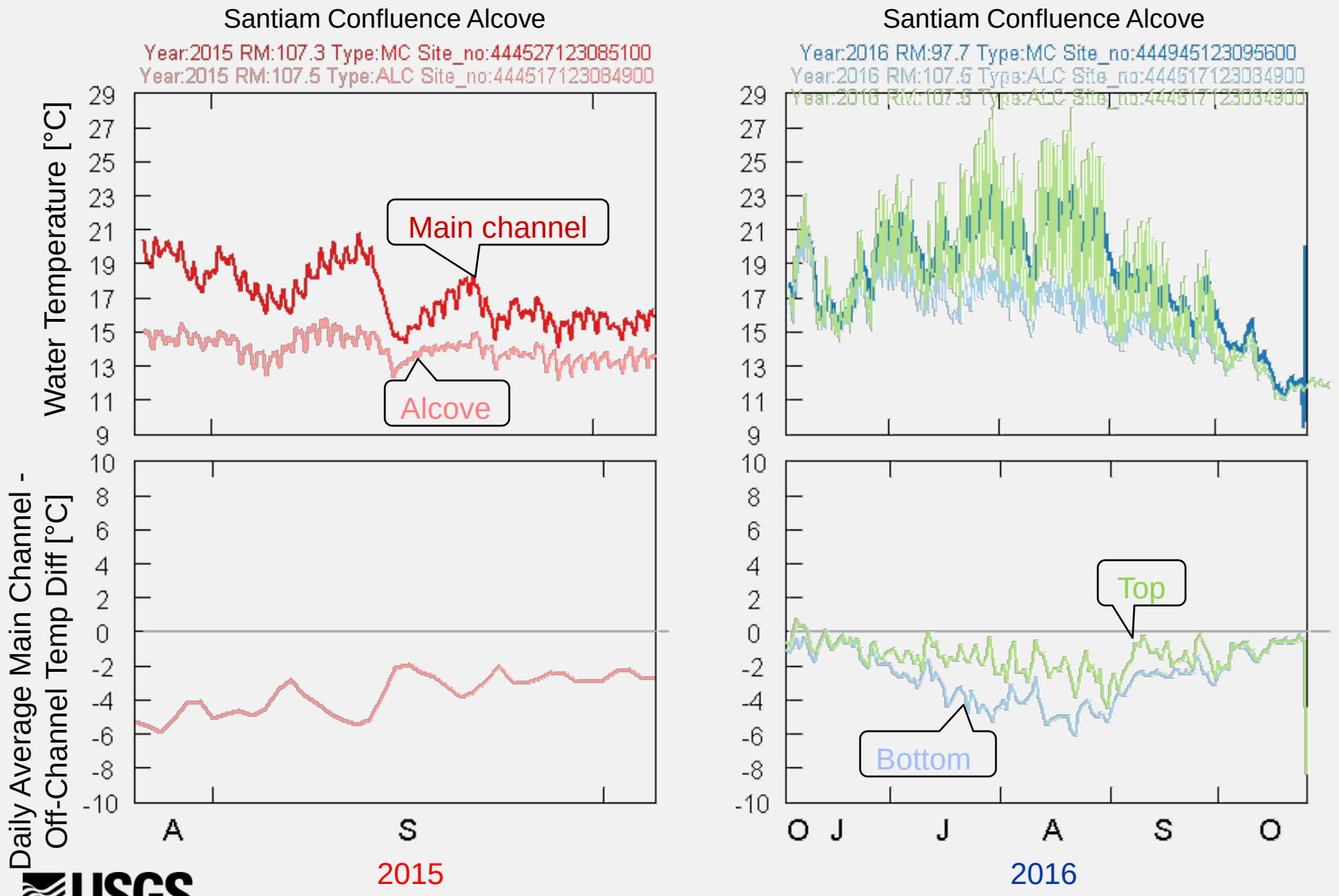
Example: Willamette - Santiam Confluence (RM 107.5)

NAIP 2014

Photo credit: JoJo Mangano, USGS

How can flow affect Off-Channel Temperature?



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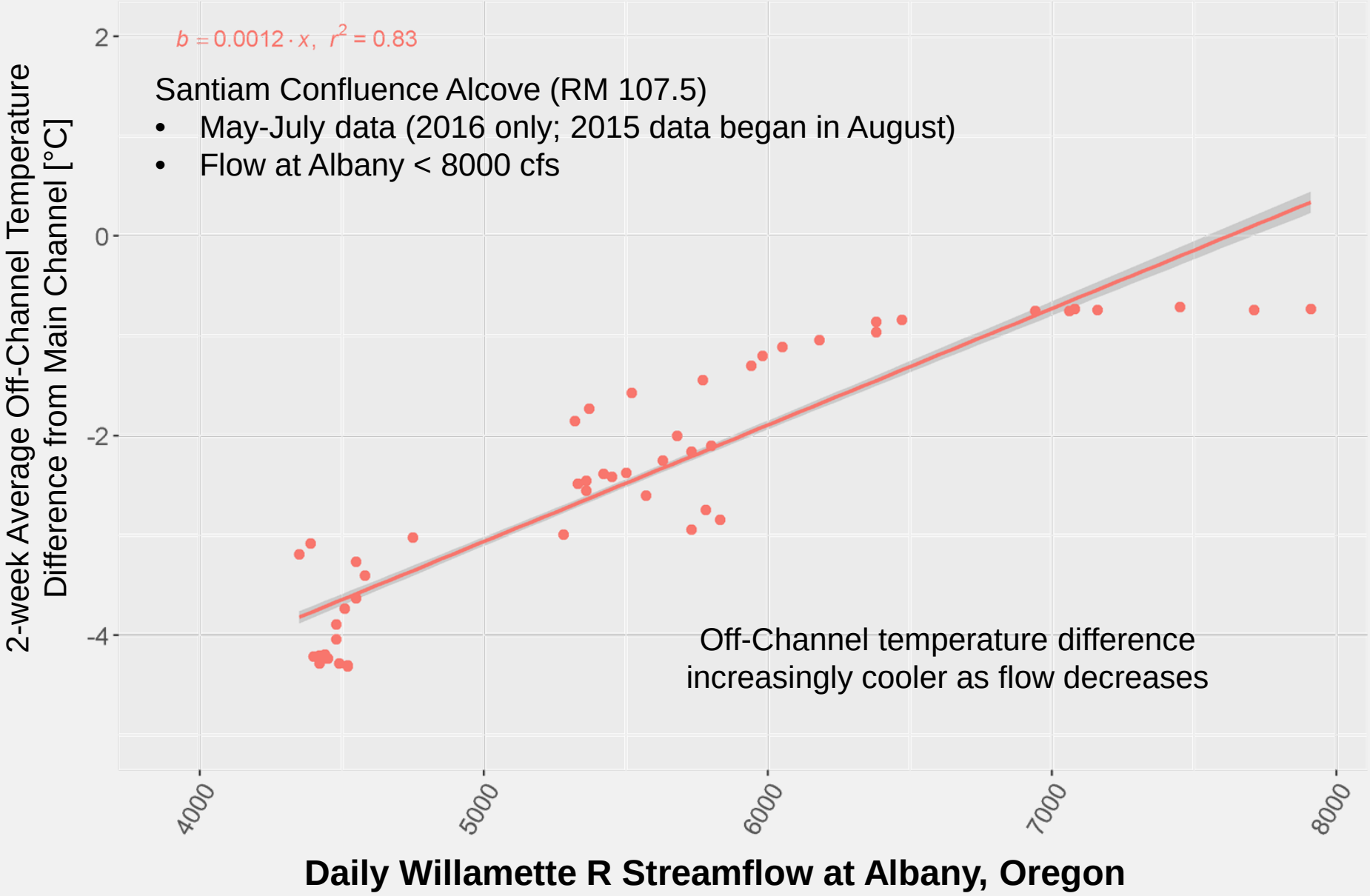

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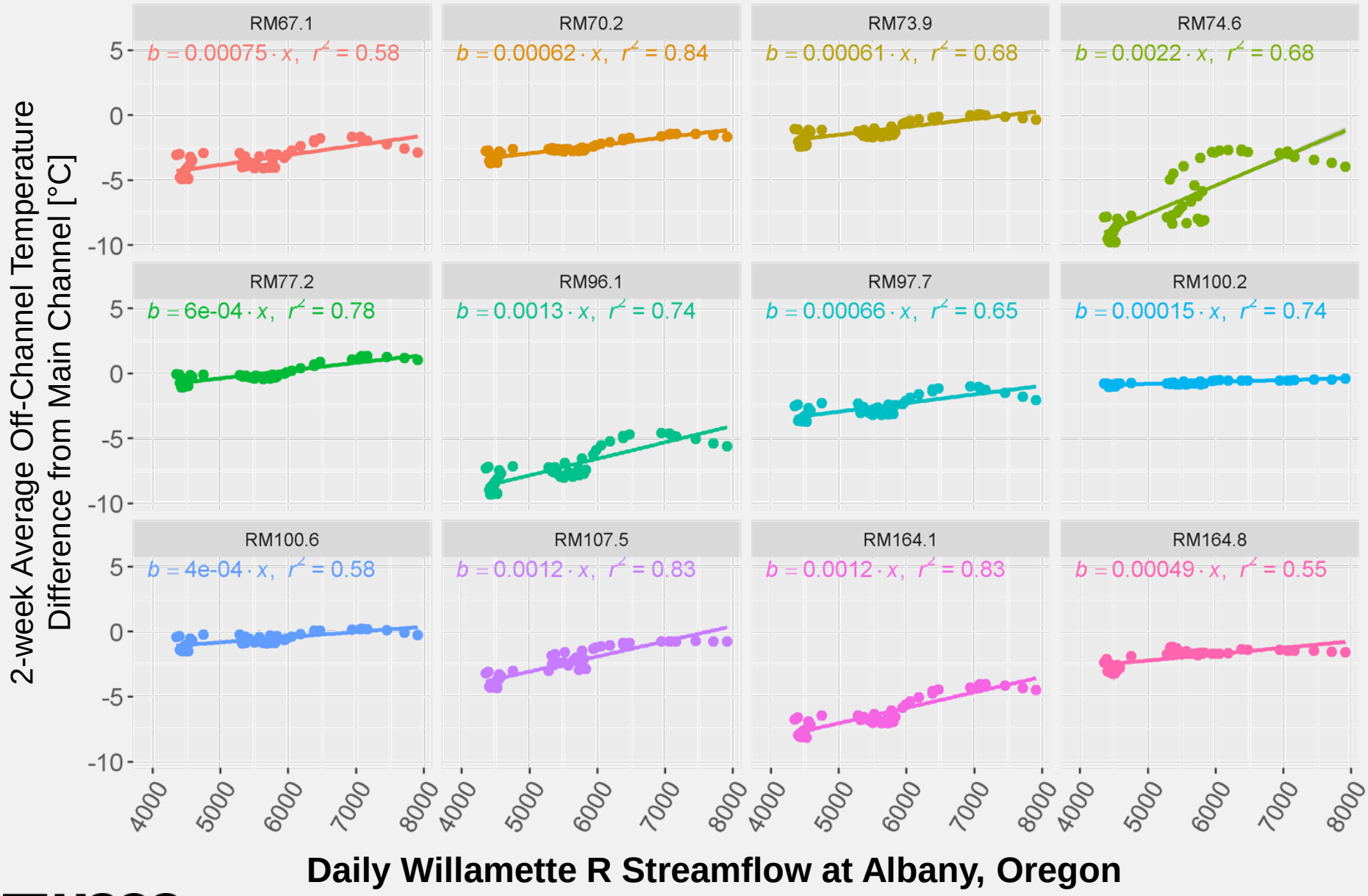
May-July Temperature Difference from Main Channel v. Streamflow



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May - July Off-Channel Temperature Difference Regressions w/ Streamflow

Site [RM]	Mean TDiff [°C]	Slope	r^2	Qcon [cfs]	Name
67.1	-3.43	7.50E-04	0.58	10,069*	Fairfield Area Alcove
70.2	-2.62	6.20E-04	0.84	9,687*	Hubbard Lake alcove
73.5	-1.24		0.47		Spring Valley Creek outer alcove
73.9	-1.19	6.10E-04	0.68	7,453*	Windsor Island alcove
74.6	-6.47	2.20E-03	0.68	8,449	Windsor bar alcove
77.2	-0.07	6.00E-04	0.78	5,589*	Lincoln access alcove
96.1	-7.17	1.27E-03	0.74	11,147*	Independance Island inner alcove
97.7	-2.59	6.60E-04	0.65	9,460*	Murphy bar alcove
100.2	-0.74	1.50E-04	0.74	10,295*	Judson Rocks seep
100.6	-0.61	4.00E-04	0.58	7,017	Wilkerson Creek alcove
107.5	-2.47	1.17E-03	0.83	7,604*	Santiam confluence alcove
161.3	-1.23		0.01		Harrisburg bridge side channel
164.1	-6.42	1.19E-03	0.83	10,902*	Blue Ruin alcove
164.8	-1.97	4.90E-04	0.55	9,542	Harpers Bend side channel

"Qcon" = Estimated Albany flow to achieve mainstem temperature

"*" = Flow connection estimate concurs w/ measurements

Grey sites have regressions with r^2 values below 0.5

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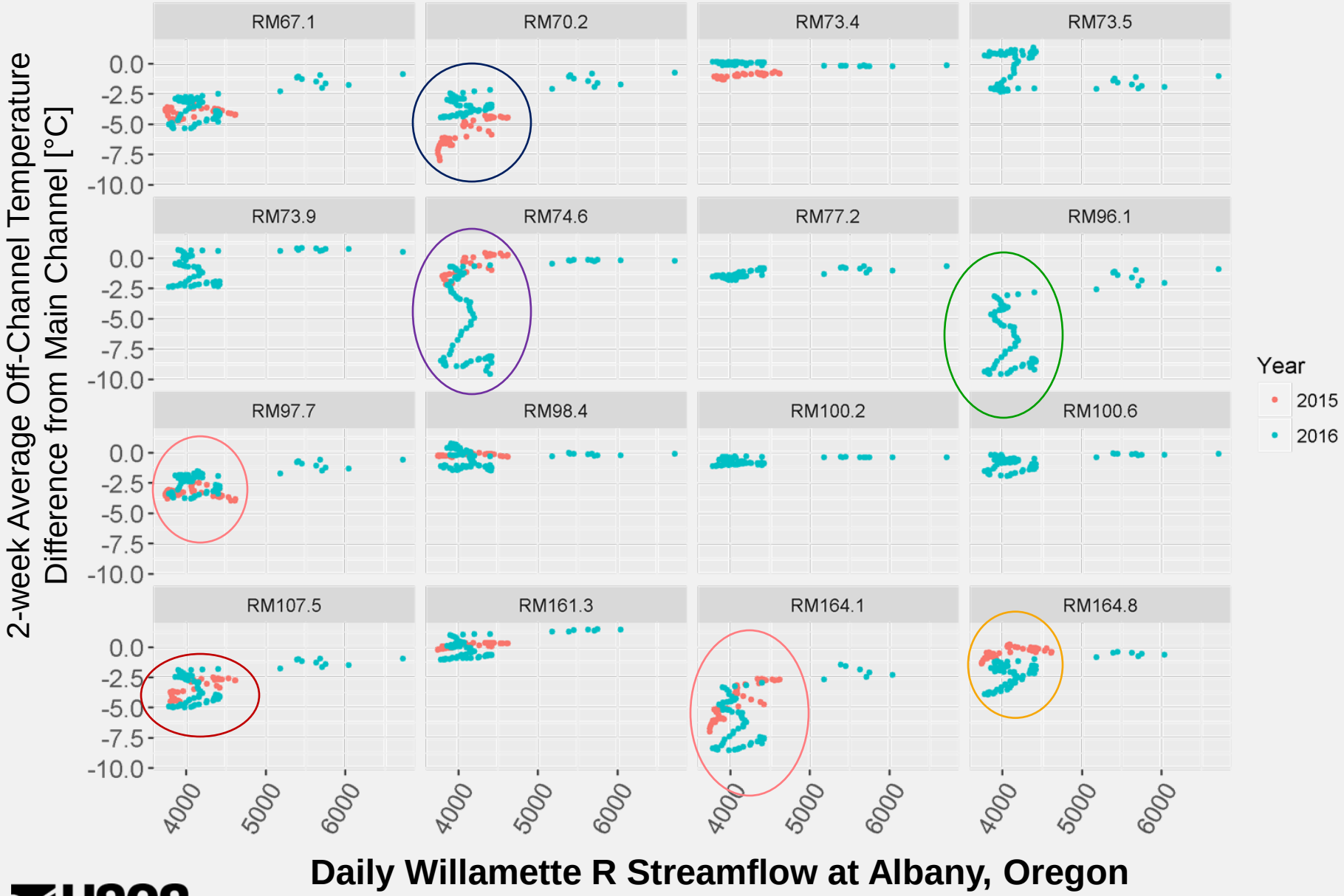
Aug-Oct Temperature Difference from Main Channel v. Streamflow

Cooler off-channels are not affected by mainstem heating in summer



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Summary

- **Upstream disconnection promotes cold water signal (hyporheic/groundwater flow)**
- **Seasonal Generalities:**
  - **May-July:**
    - **Cold water abundance increases as flow decreases**
    - **Regression estimates of flow connection accurate**
  - **Aug-Oct:**
    - **Cold water persists despite main channel changes**
- **Open Questions:**

  Hydraulic connection between off-channel area and main channel

  What fish use these areas?

Photo credit: JoJo Mangano, USGS

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Acknowledgements

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Dave Hulse

Contact: Norman Buccola (nbuccola@usgs.gov; 503-251-3245)

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