Project B: Streamflow, Water Quality, and Sediment Transport in the Colorado River Ecosystem

USGS

The USGS team

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How do operations at Glen Canyon Dam affect flows, water quality, sediment transport, and sediment resources in the Colorado River Ecosystem?

- Development of new database and website with user-interactive tools for data visualization and downloading, and the construction of sand budgets

- Publication of 5 peer-reviewed interpretive papers and 18 USGS Water-data reports

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All products promised in the 2013-14 Biennial Work Plan were delivered

- 4-6 peer-reviewed journal articles and USGS reports promised….5 delivered
- Annual data reports for the 9 USGS gaging stations online
- Real-time posting of data from these stations
- Real-time to monthly posting of all data on NEW WEBSITE
- Monthly to bi-monthly updates of the mass-balance sand budgets on NEW WEBSITE

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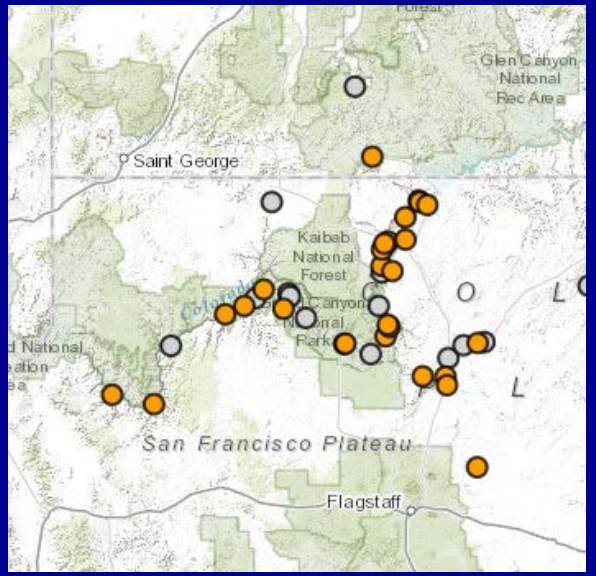
Monitoring project with some research

We collect, post, and analyze the following data at stations located through the Colorado River Ecosystem, including key tributaries…



- Stage
- Discharge
- Water temperature
- Salinity (specific conductance)
- Turbidity
- Dissolved Oxygen
- Suspended- and bed-sediment data
- Sediment loads (silt and clay loads and sand loads)
- User-interactive sand budgets in 6 reaches from Lees Ferry to Lake Mead

Virtually all other projects funded by the GCDAMP use these data!

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The single most significant accomplishment was the completion of the new database and website.

http://www.gcmrc.gov/discharge_qw_sediment/

http://cida.usgs.gov/gcmrc/discharge_qw_sediment/

The user-interactive tools available at this website to visualize and operate on the data are unique in the world.

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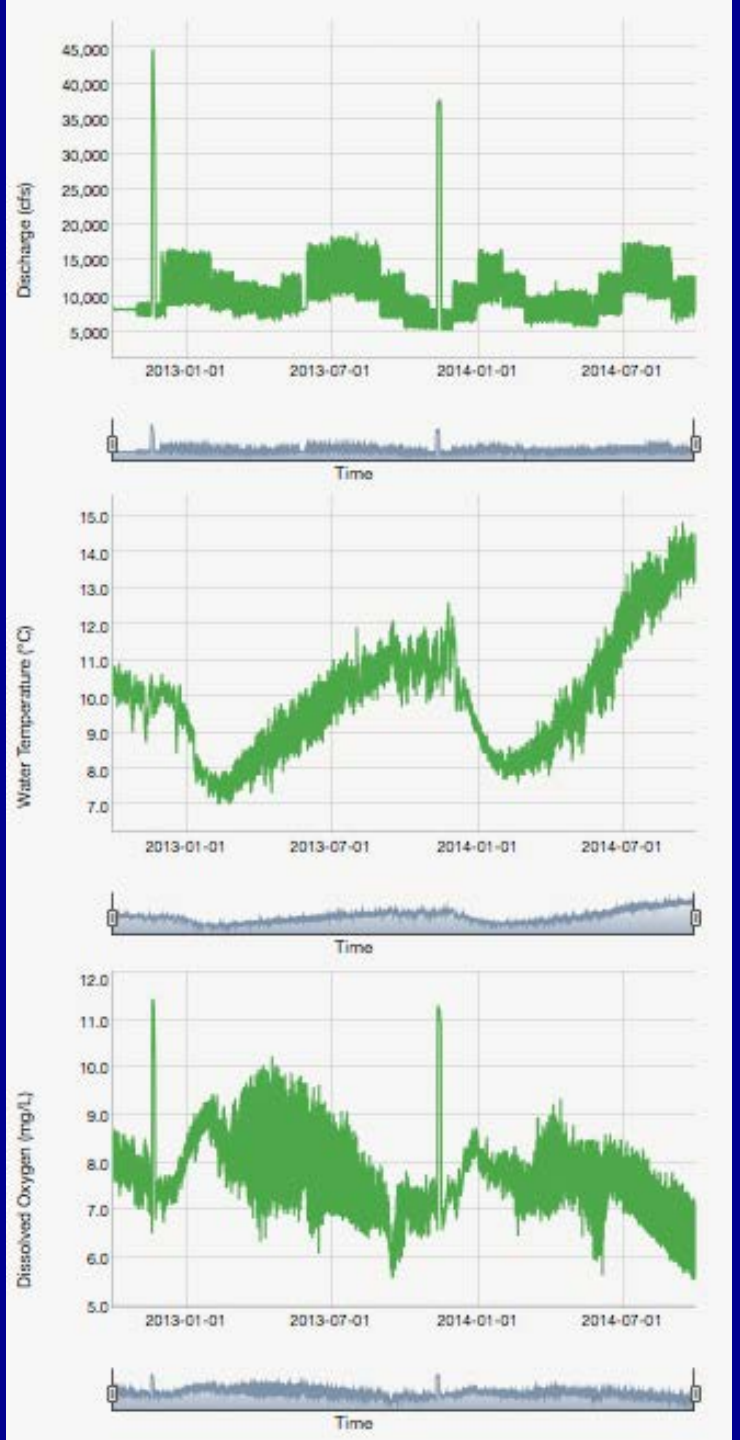

Colorado River at Lees Ferry, AZ
Water years 2013-2014

- Discharge
- Water temperature
- Dissolved oxygen

http://www.gcmrc.gov/discharge_qw_sediment/

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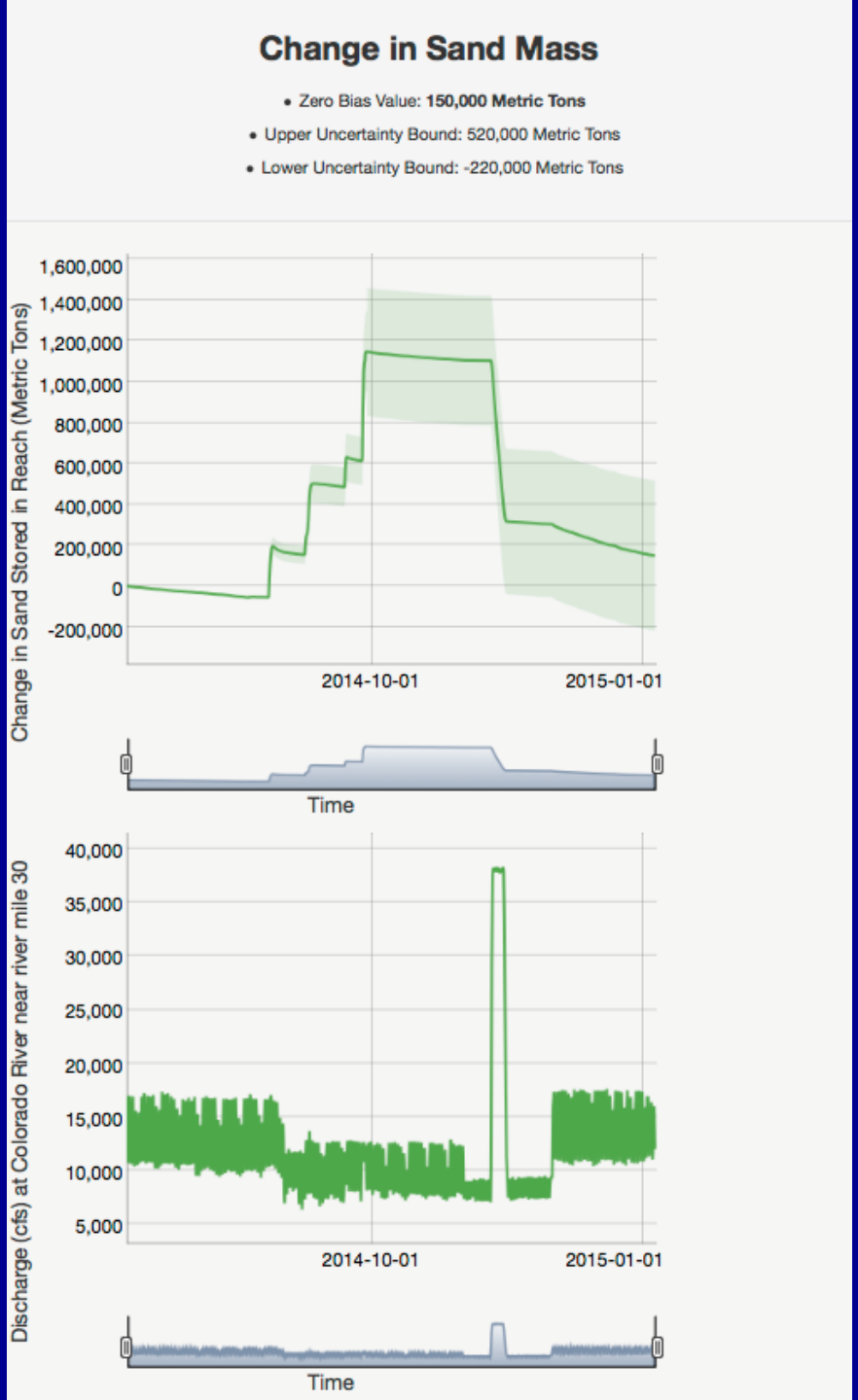

This project collects and processes the data used to trigger HFEs

Upper Marble Canyon sand budget

July 1, 2014 to January 5, 2015

http://www.gcmrc.gov/discharge_qw_sediment/

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We have made major improvements in quickly characterizing the sand loads of the Paria River

To date, we have processed 202 of the 231 suspended-sediment samples collected during August – September 2014

Calculated sand loads changed by ~33% between the September 29 flood and mid October

Calculated sand loads changed by ~5% between mid-October and the November HFE

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pubs.er.usgs.gov/publication/sir20145097

USGS science for a changing world

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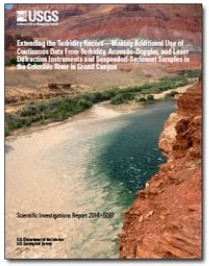


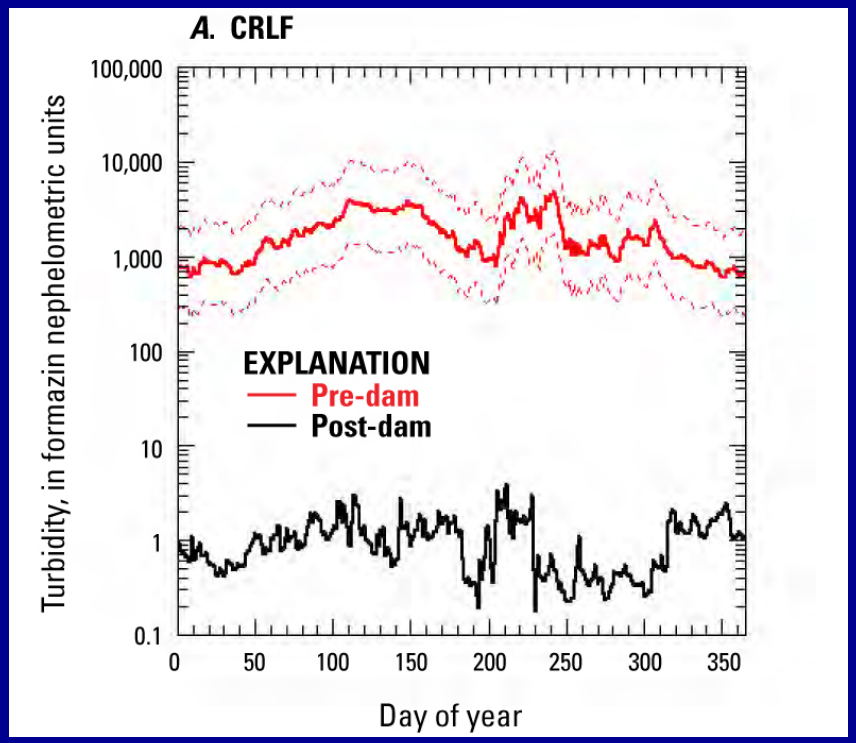
Extending the turbidity record: making additional use of continuous data from turbidity, acoustic-Doppler, and laser diffraction instruments and suspended-sediment samples in the Colorado River in Grand Canyon

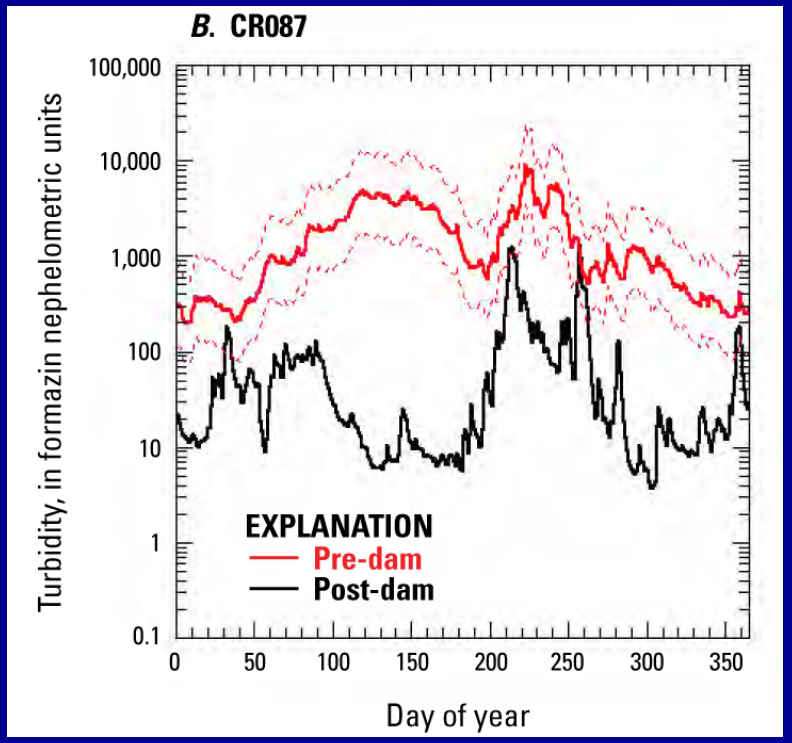
Scientific Investigations Report 2014-5097

By: Nicholas Voichick, David J. Topping

DOI: 10.3133/sir20145097

Tweet 0





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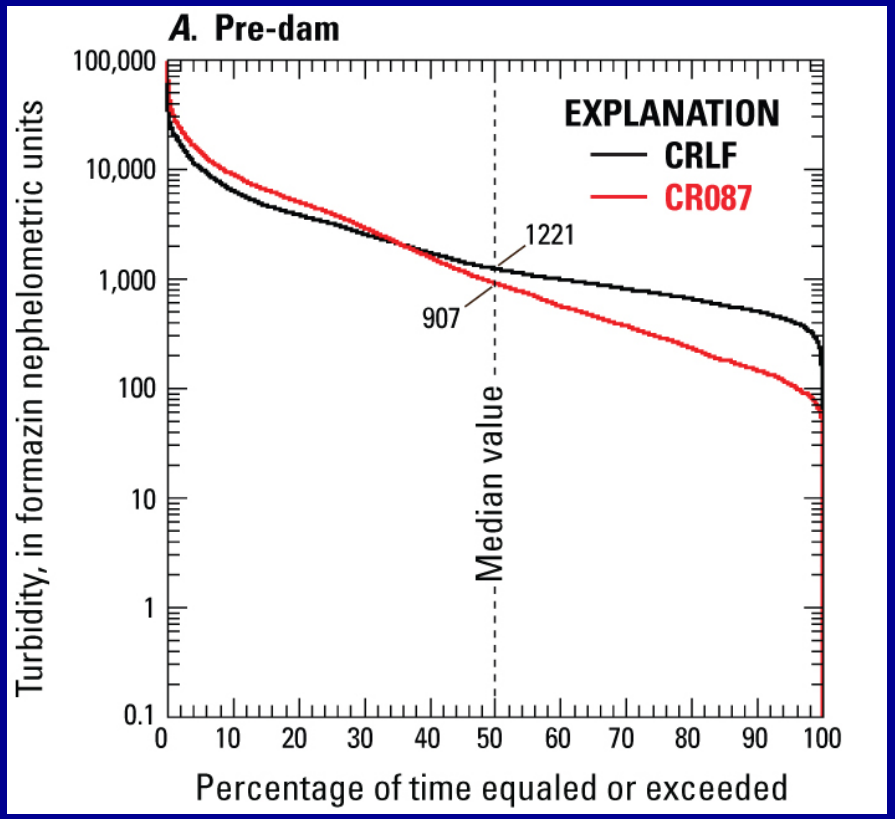

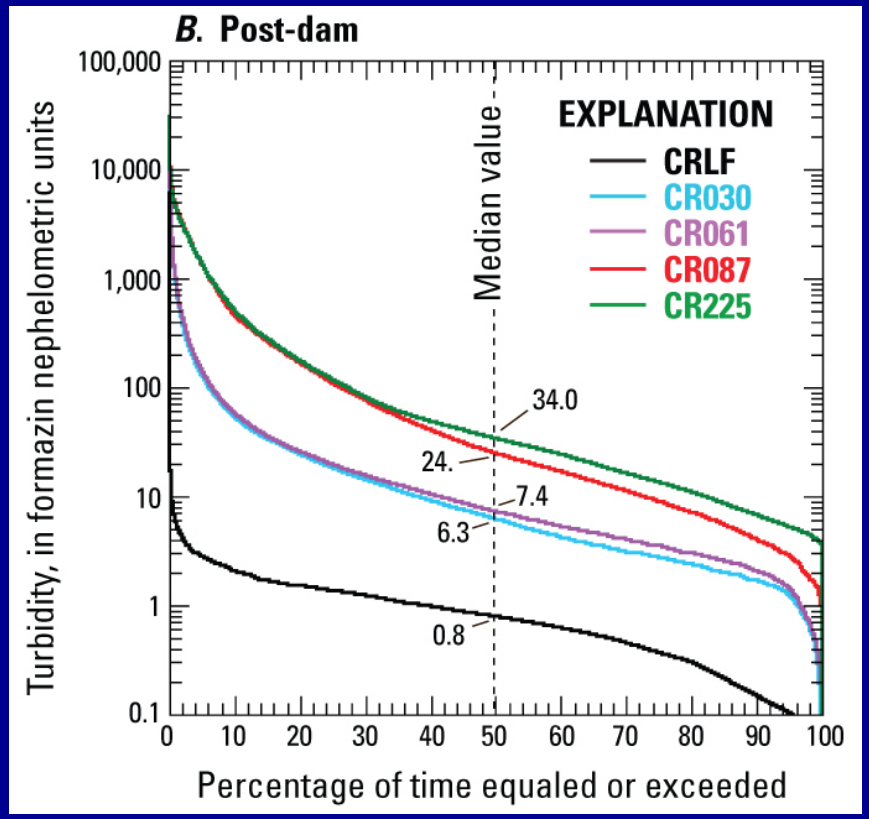

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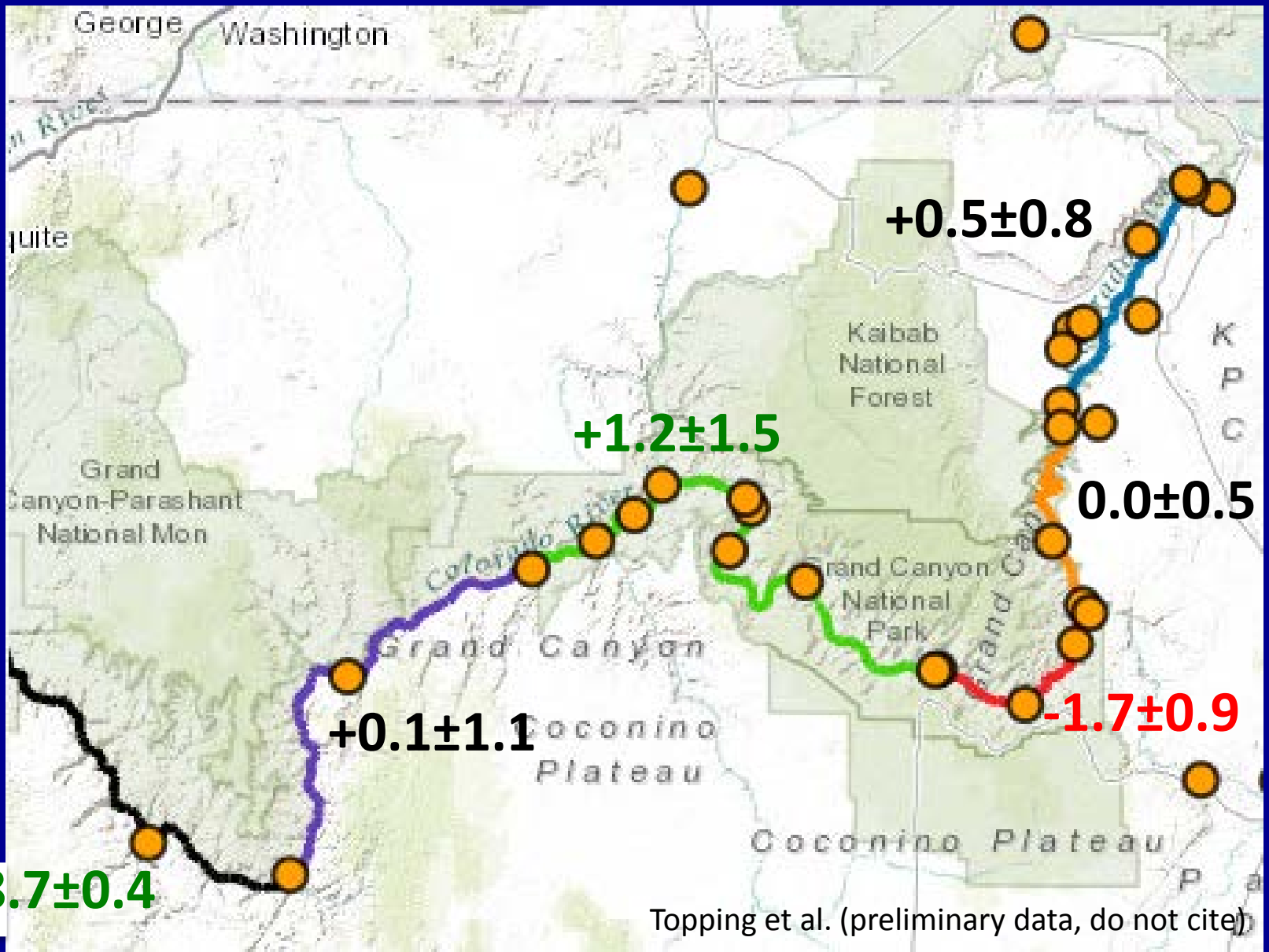
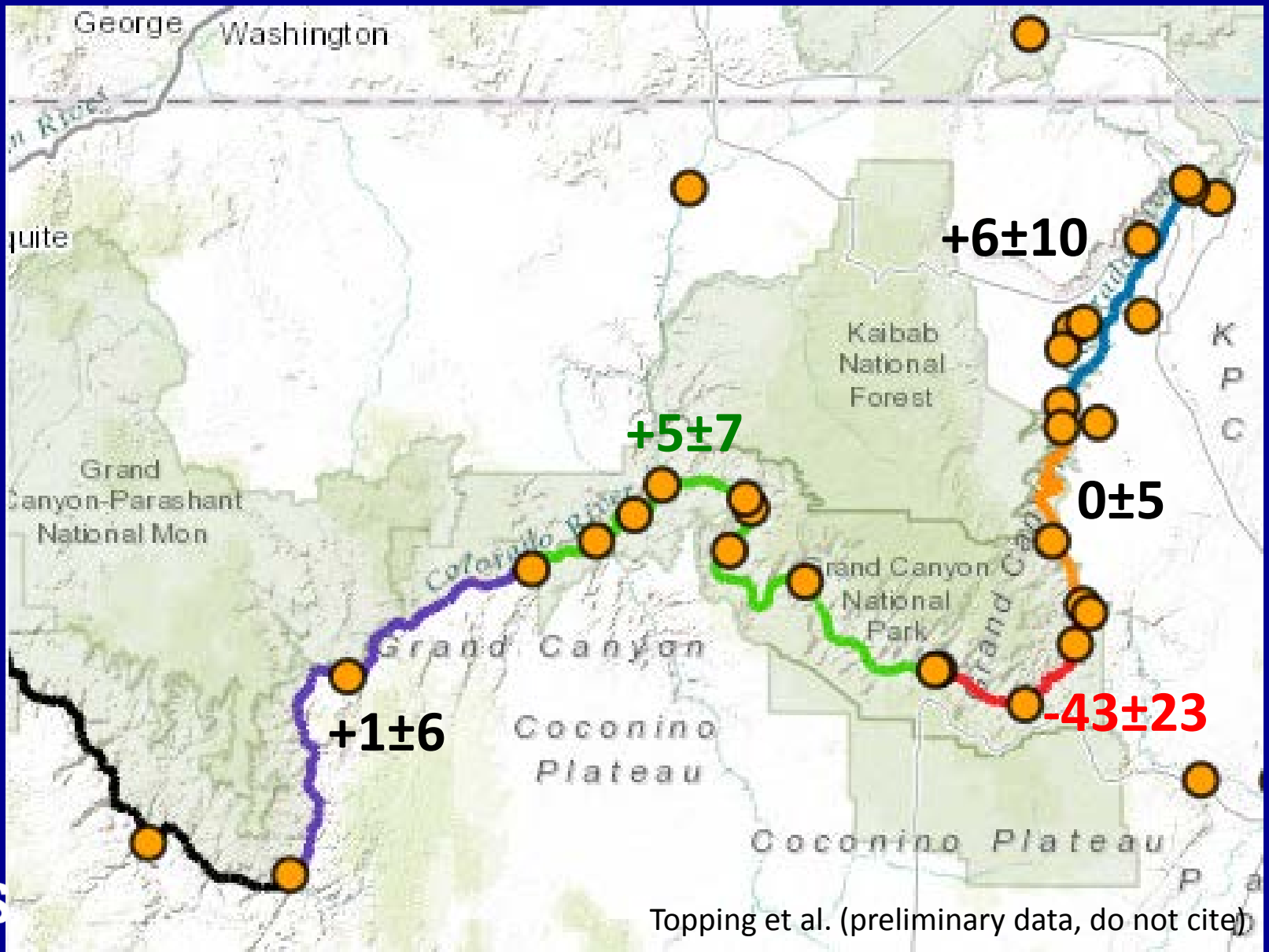
Voichick and Topping (2014)

July 2010 – June 2014 change in sand mass balance by reach (in million metric tons)



Topping et al. (preliminary data, do not cite)

July 2010 – June 2014 change in sand thickness by reach (in cm)



Topping et al. (preliminary data, do not cite)

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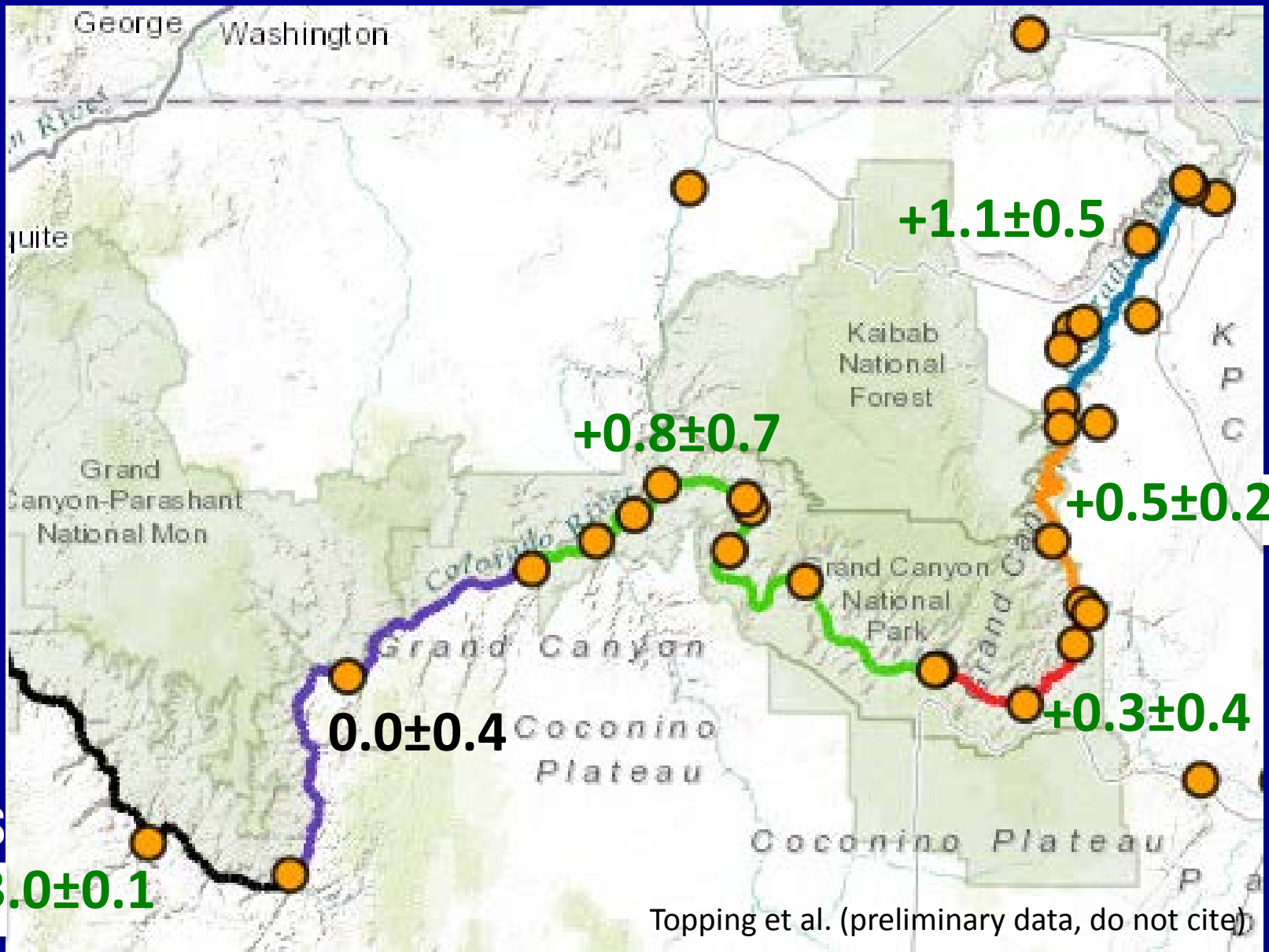
July 2012 – June 2014 change in sand mass balance by reach (in million metric tons)



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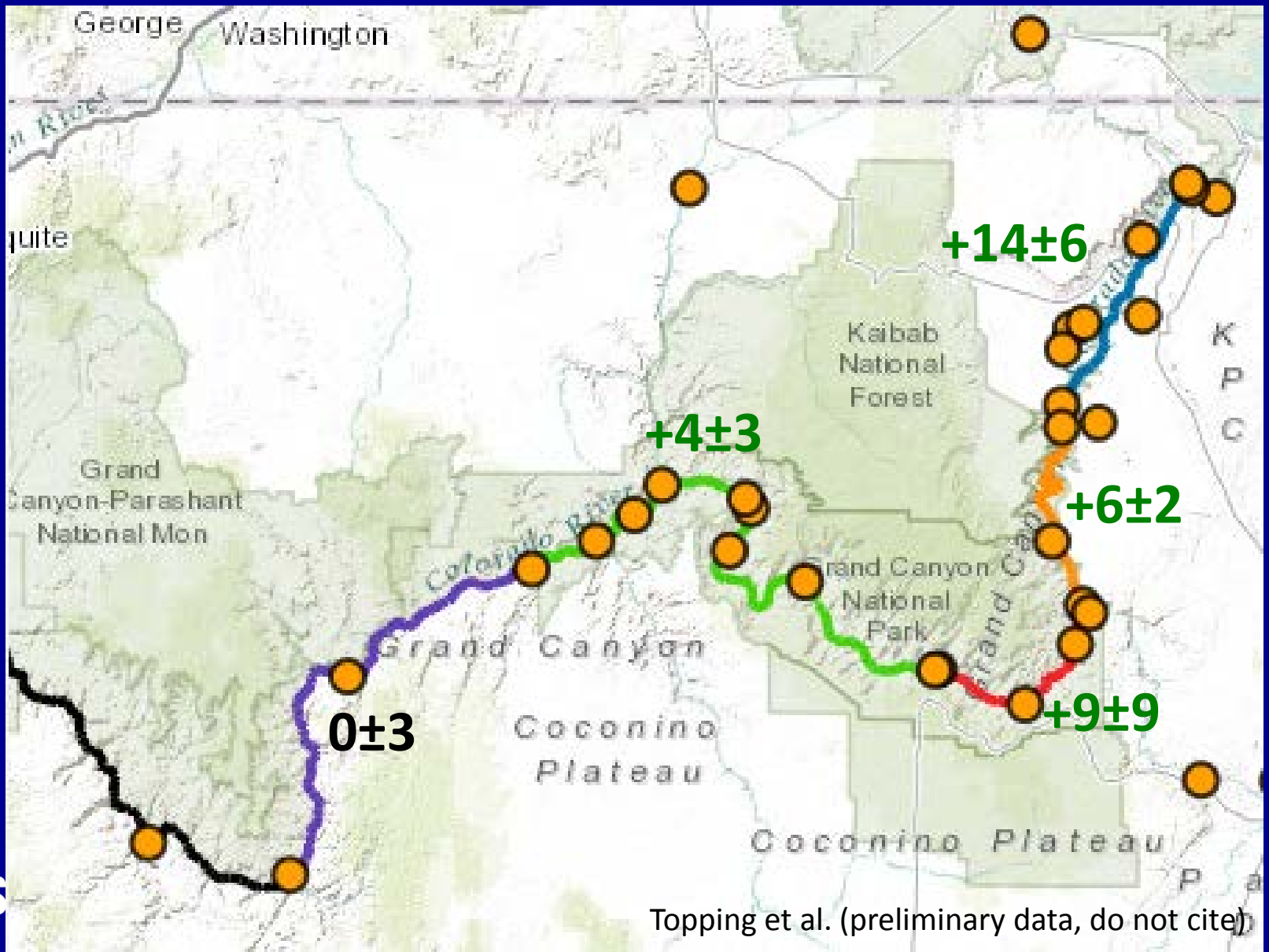

Topping et al. (preliminary data, do not cite)

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2014 HFE….luck ran out

- Unfortunately, 1 of the 2 acoustic-Doppler profilers at the River Mile 30 station, and 2 of the 3 acoustic-Doppler profilers at the Grand Canyon gaging station broke immediately before or during the 2014 HFE.

- We will be developing new acoustic calibrations once we retrieve and process the suspended-sediment samples still in the canyon (this happens in early March).

- As a result, we will not have final verified sediment-transport results and sand budgets until May-June 2015.

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What can we say today?

Increases in the upstream sand supply generally lead to increases in sand concentration at any given discharge

(Topping et al., Water Resources Research, 2000a, 2000b, Journal of Sedimentary Geology, 2007)

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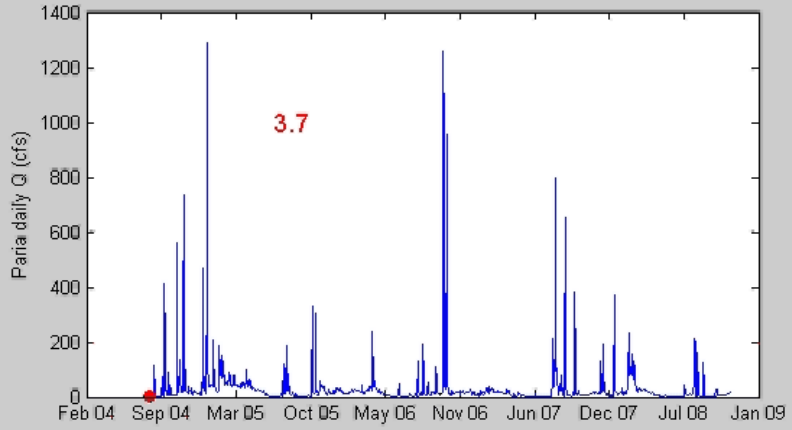
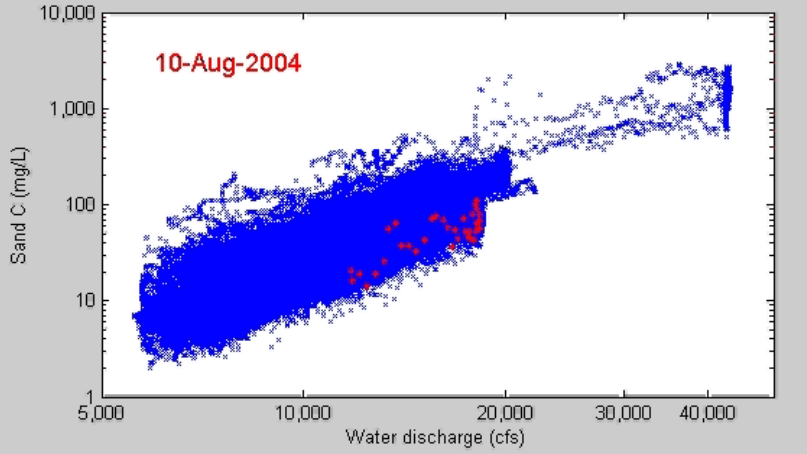
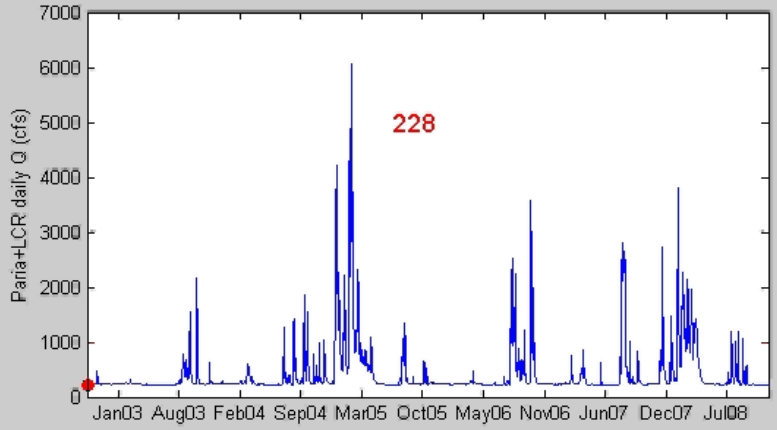
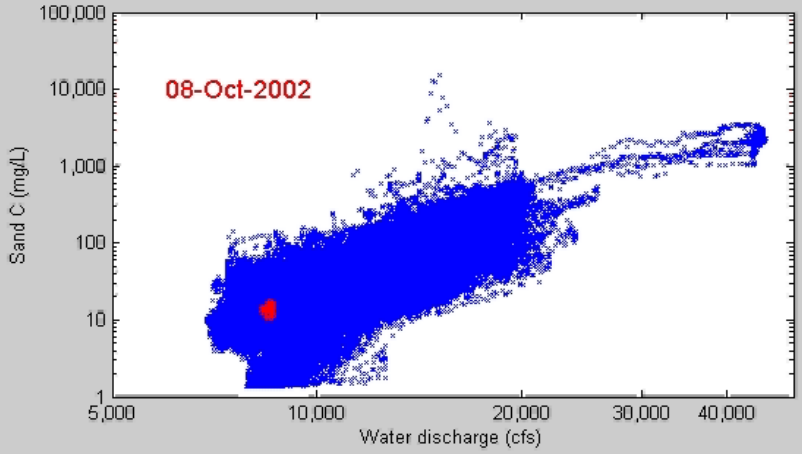
River mile 30





River mile 225





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Rubin (preliminary data, do not cite)

Average peak-flow sand concentrations increased at the River mile 30 and 61 stations between the 2012 and 2013 HFEs, suggesting that both the Upper and Lower Marble Canyon reaches were gaining sand.

	River mile 30	River mile 61
2012 HFE (higher Q)	1,200 mg/L	1,200 mg/L
2013 HFE	2,200 mg/L	1,700 mg/L
2014 HFE	Unknown until April	1,400 mg/L

These increases in sand concentration imply that bar building was more efficient during the 2013 HFE than during the 2012 HFE, especially near river mile 30.

Results from 2014 HFE remain unclear, stay tuned until May-June 2015 for final results at all stations.

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Topping et al. (preliminary data, do not cite)