Report on modeling the 2008-2010 period to support development of the 2011 hydrograph

GCDAMP AMWG Meeting
August 24-25, 2010, Phoenix, AZ

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USGS

Temperature Modeling

Same approach for modeling monthly average mainstem temperature as published by Wright and others (2008) in *River Research and Applications*

3 years of annual volumes:

1) 9.0 MAF (2008)
2) 8.23 MAF (2009)
3) 8.23 MAF (2010)

2 monthly release patterns:

1) "Historical" Modified Low Fluctuating Flows (MLFF-historical)
2) DOI-DOE "Proposed" Modified Low Fluctuating Flows (DOI/DOE proposed)

- Monthly volumes for each case obtained from the DOI-DOE proposed hydrograph of July 23, 2010.

- Hourly hydrographs were not evaluated because previous work has shown that daily fluctuations result in negligible differences in mainstem water temperature (Anderson and Wright, 2007).

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Summary – Temperature Modeling

- The difference in predicted mainstem temperature between the scenarios is always less than 0.4 degrees Celsius at the Little Colorado River confluence (river mile 61).
    - **Model uncertainty is 0.5 degrees Celsius.**

- Near Diamond Creek, the predicted temperature differences do exceed 0.5 degrees Celsius in some months.

    - In June 2009, the predicted temperature for the recommended releases exceeded the predicted temperature for the actual releases by 1.0 degrees Celsius.

    - This difference occurs because the volume for that month associated with the recommended releases was less than the actual release volume by about 130,000 acre-feet.

- *Changes in mainstem temperatures of this magnitude are not likely to be biologically significant.*

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Sediment Modeling

Same modeling approach as used in Wright and Grams (2010) Open-file Report

3 years of annual volumes:

1) 9.0 MAF (2008)
2) 8.23 MAF (2009)
3) 8.23 MAF (2010)

2 daily/monthly release patters:

1) "Historical" Modified Low Fluctuating Flows (MLFF-historical)
2) DOI-DOE "Proposed" Modified Low Fluctuating Flows (DOI/DOE proposed)

Hydrographs for each case were provided by Western Area Power Administration and did not include the 2008 HFE

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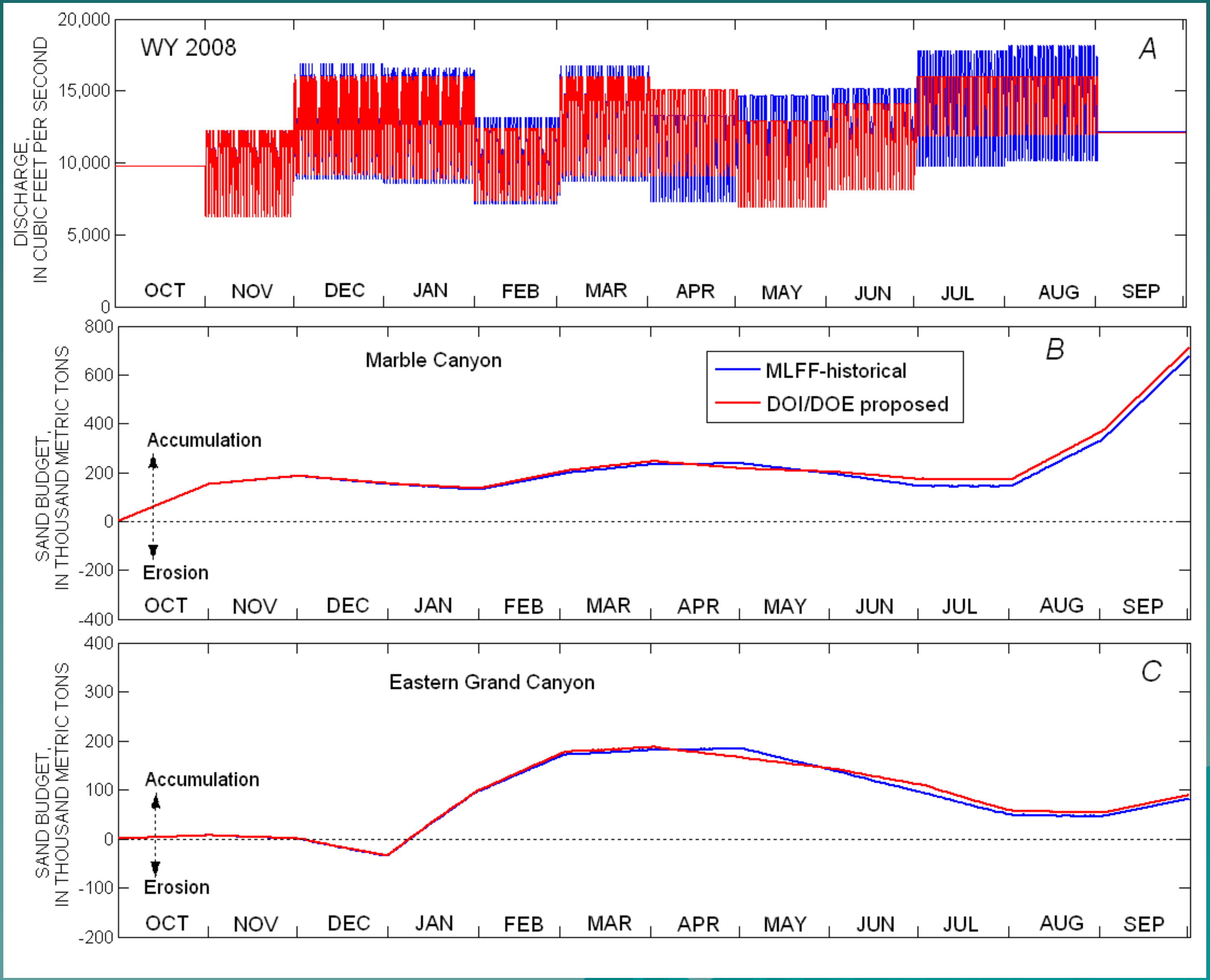
Sand modeling results: WY 2008

End of year sand <u>accumulation</u>

MLFF-historical:
678 ± 150 MMT

DOI/DOE proposed:
713 ± 150 MMT

Proposed has 5% more accumulation; uncertainty is about 20%



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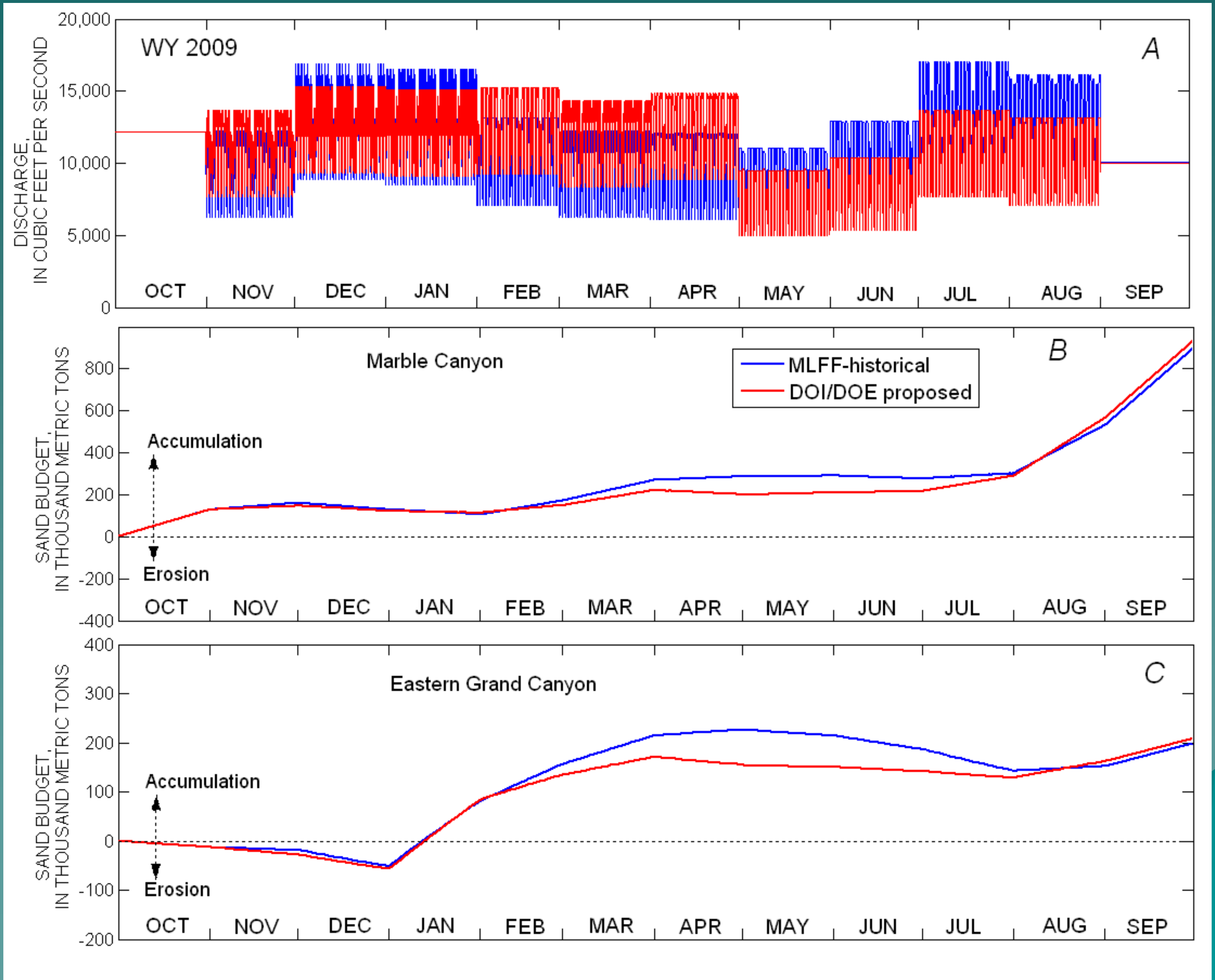
Sand modeling results: WY 2009

End of year sand <u>accumulation</u>

MLFF-historical: 897 ± 150 MMT

DOI/DOE proposed: 932 ± 150 MMT

Proposed has 4% more accumulation; uncertainty is about 20%



USGS

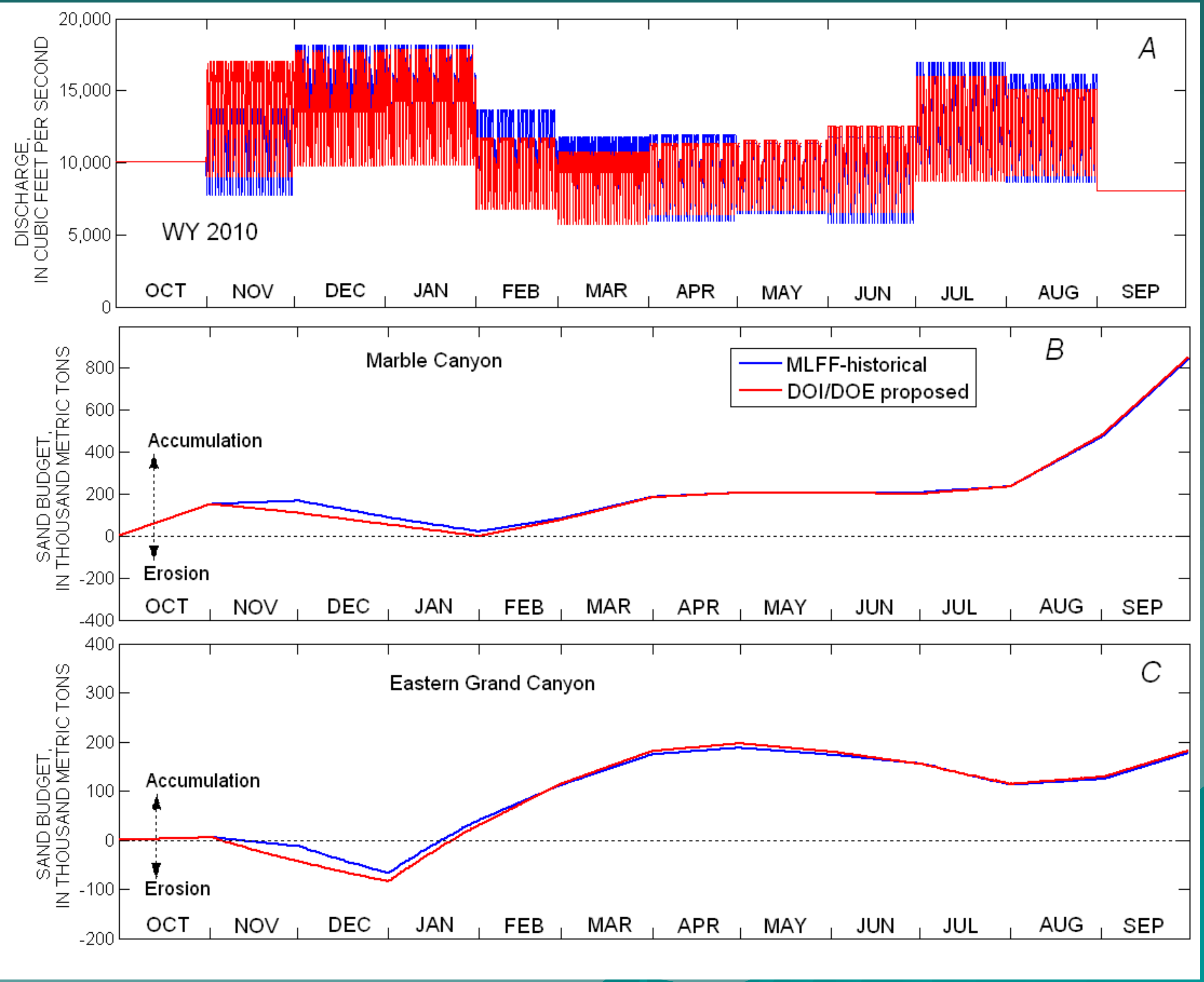
Sand modeling results: WY 2010

<u>End of year sand accumulation</u>

MLFF-historical: 846 ± 150 MMT

DOI/DOE proposed: 855 ± 150 MMT

Proposed has 1% more accumulation; uncertainty is about 20%



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Summary – Sand Transport Modeling

- The total annual release volume has the strongest impact on sediment transport and retention. Because we are comparing scenarios with identical annual volumes, the differences in sand accumulation result from the different distribution of monthly volumes and daily patterns.

- In general, historical MLFF has slightly higher sand retention in the early spring and summer and the DOI/DOE proposed scenario has slightly higher retention in late summer and early fall.

- The net result is slightly higher end of year sand retention under the DOI/DOE proposed scenario.

- *Depending on how an HFE trigger is defined, 5% could affect the determination to implement a high flow.*

- *It is uncertain whether the small increase in sand retention would occur in the visible sandbars (sandbars between the 8,000 and 20,000 cfs level) or at lower elevations.*

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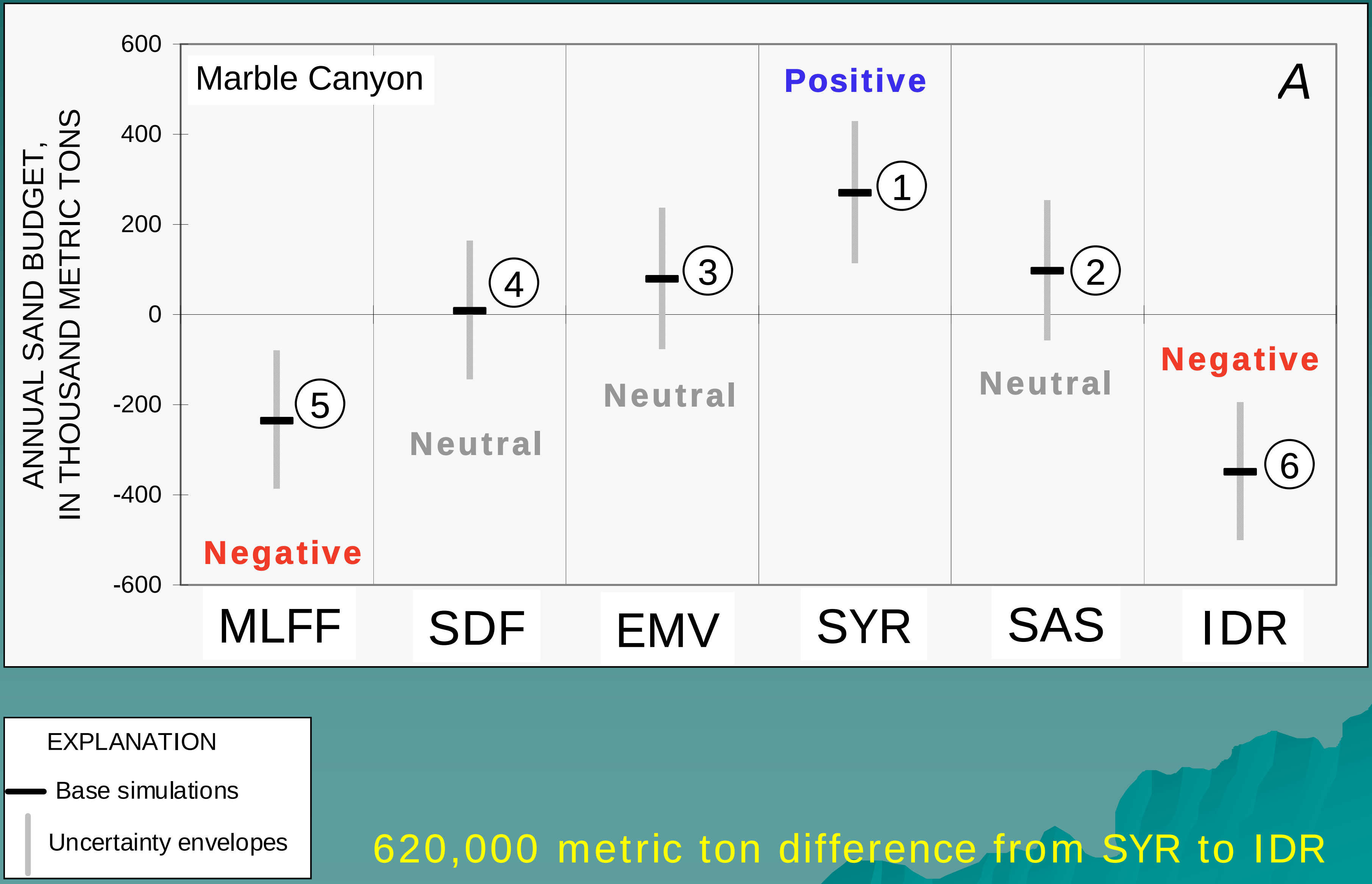
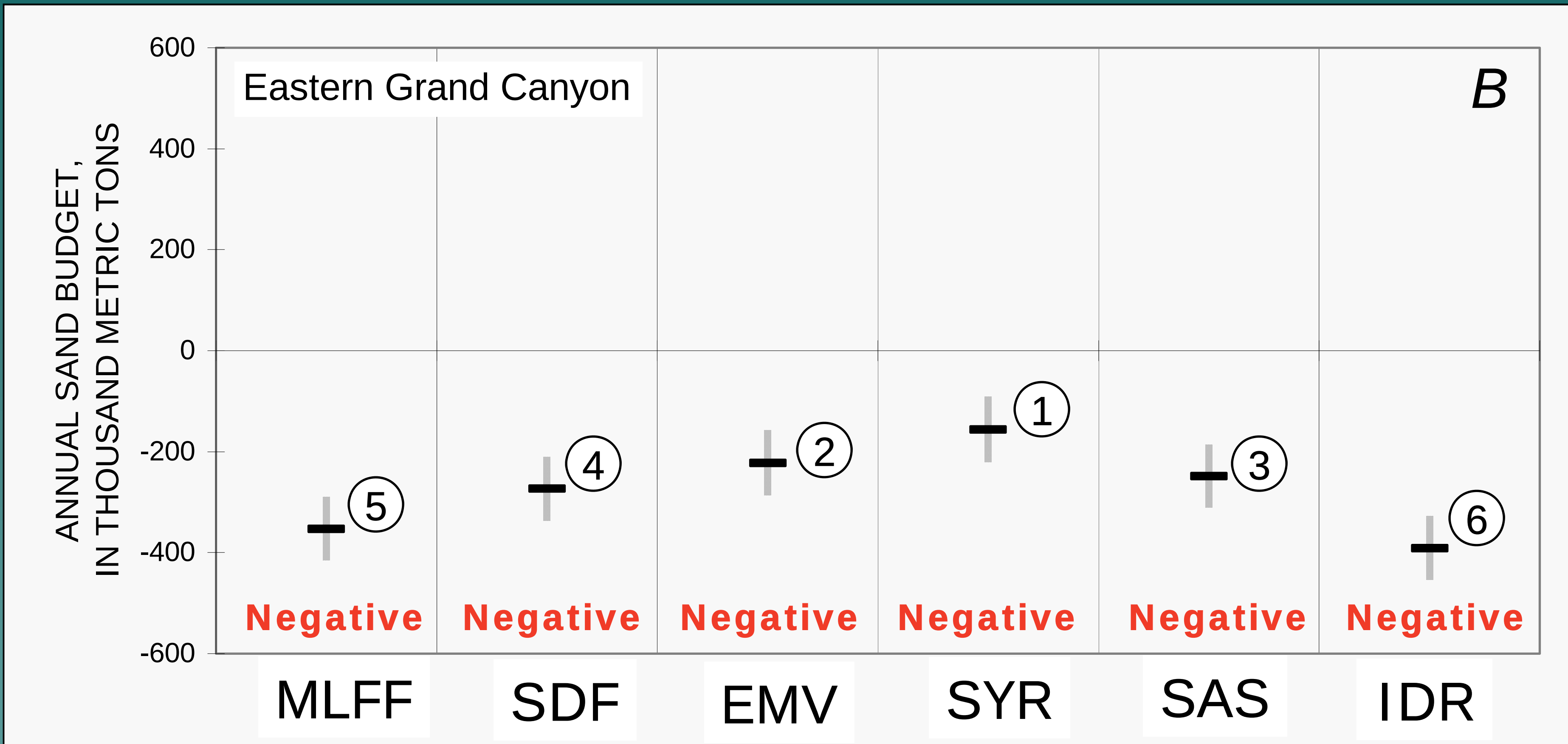
Marble Canyon, 11.0 MAF



620,000 metric ton difference from SYR to IDR

Eastern Grand Canyon, 11.0 MAF



EXPLANATION

Base simulations

Uncertainty envelopes

Why all negative? LCR inputs are less than Paria, timing of inputs late in simulations

230,000 metric ton difference from SYR to IDR