Report on sediment modeling to support development of 2011 hydrograph

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and
Paul E. Grams, USGS, GCMRC (presenting)

USGS

Report on scenarios modeled for 2011 hydrograph:

Wright, S.A., and Grams, P.E., 2010, Evaluation of Water Year 2011 Glen Canyon Dam flow release scenarios on downstream sand storage along the Colorado River in Arizona: U.S. Geological Survey Open-File Report 2010-1133, 19 p.

http://pubs.usgs.gov/of/2010/1133/OFR_2010-1133.pdf

Journal article on sand routing model:

Wright, S.A., Topping, D.J., Rubin, D.M., and Melis, T.S., in press. An approach for modeling sediment budgets in supply-limited rivers, *Water Resources Research*.

http://www.agu.org/journals/wr/papersinpress.shtml

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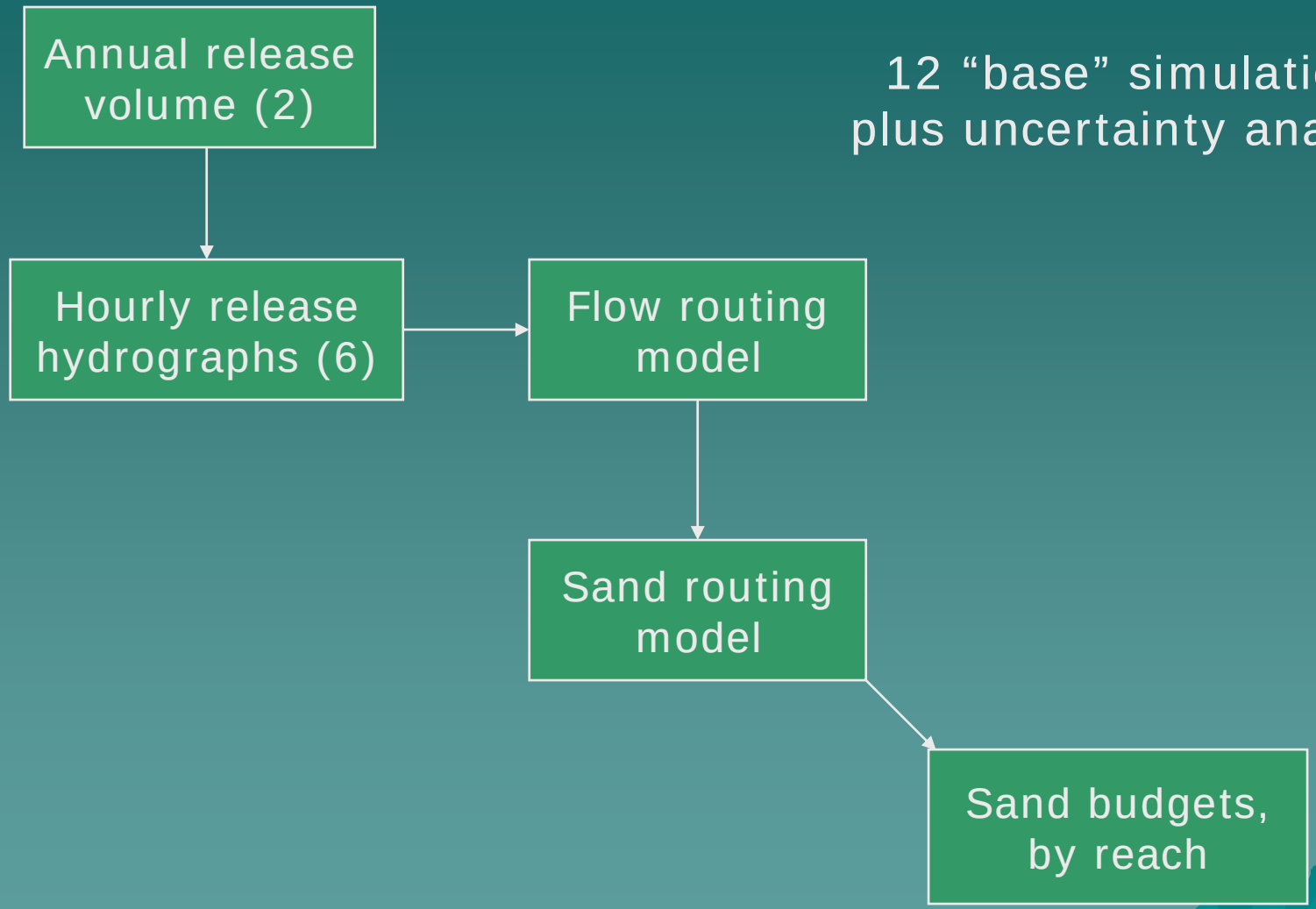
Approach



12 “base” simulations, plus uncertainty analyses

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Scenarios Modeled

2 annual volumes: 8.23 MAF and 11.0 (MAF, most probable from April 24-month study)

6 daily/monthly release patters:

1) Modified Low Fluctuating Flows (MLFF)
2) Steady Daily Flows (SDF) – No daily fluctuations, MLFF monthly volumes
3) Equal Monthly Volumes (EMV) – MLFF daily fluctuations, equal volume each month
4) Steady Year Round (SYR) – No daily or monthly fluctuations
5) Seasonally Adjusted Steady (SAS) – From the 1995 EIS
6) Increased Daily Range and Down Ramp (IDR) – Option "A Variation" from 2006 assessment

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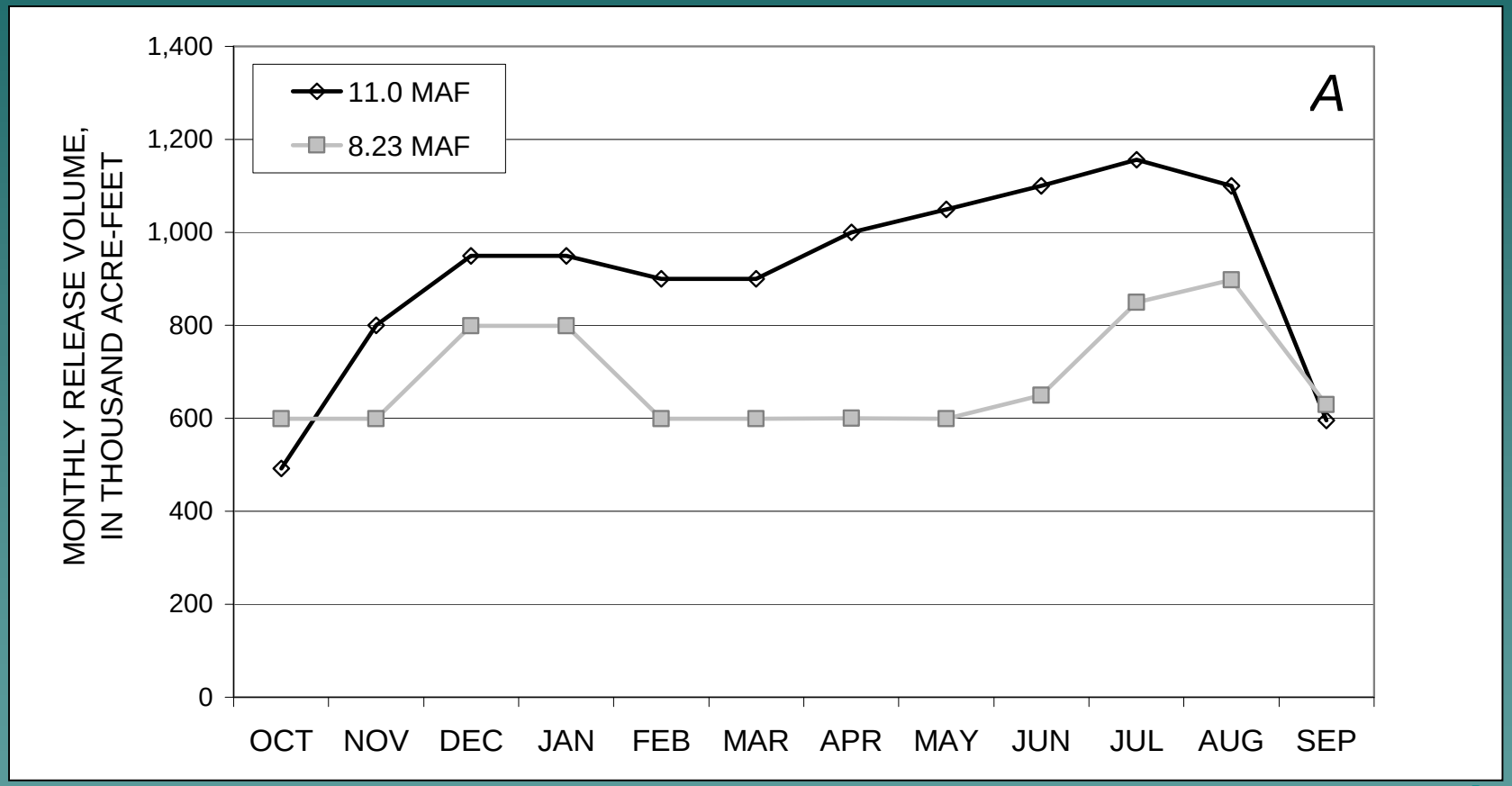
Annual and monthly volumes



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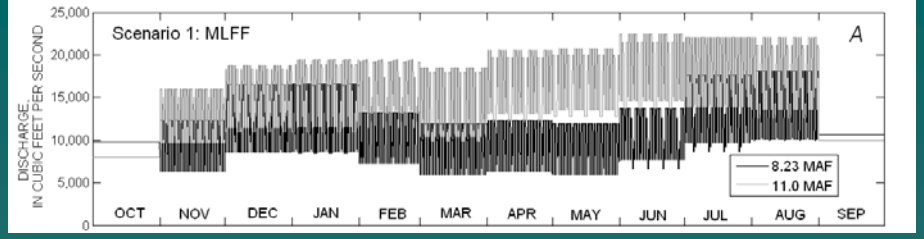
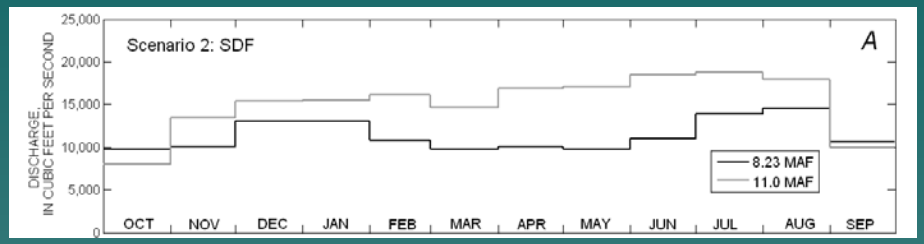
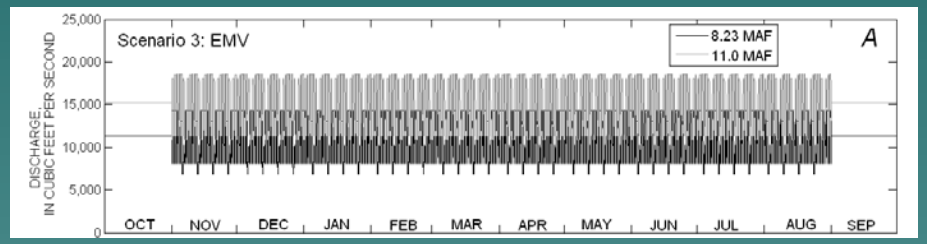


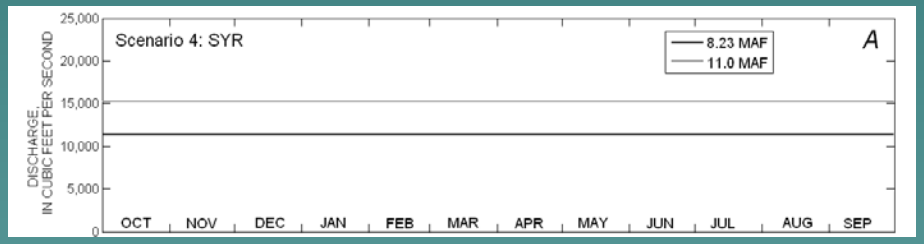
MLFF



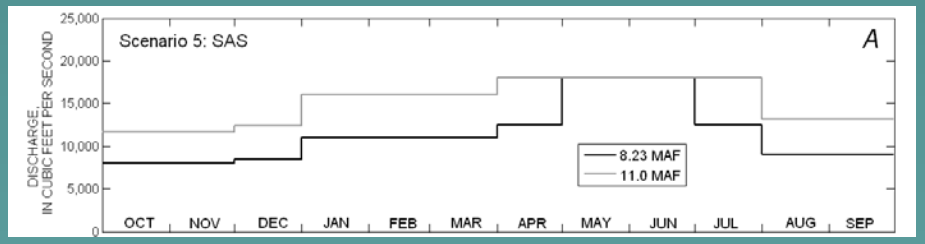
SDF



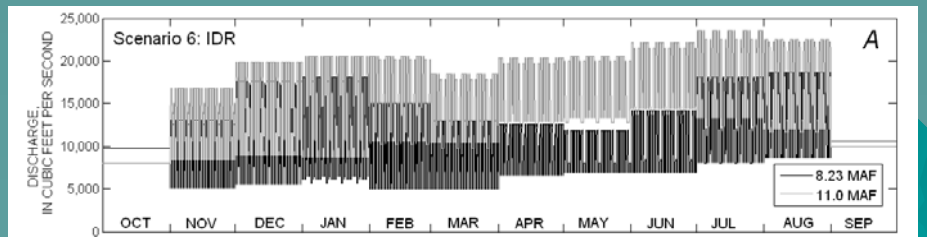
EMV



SYR



SAS



IDR

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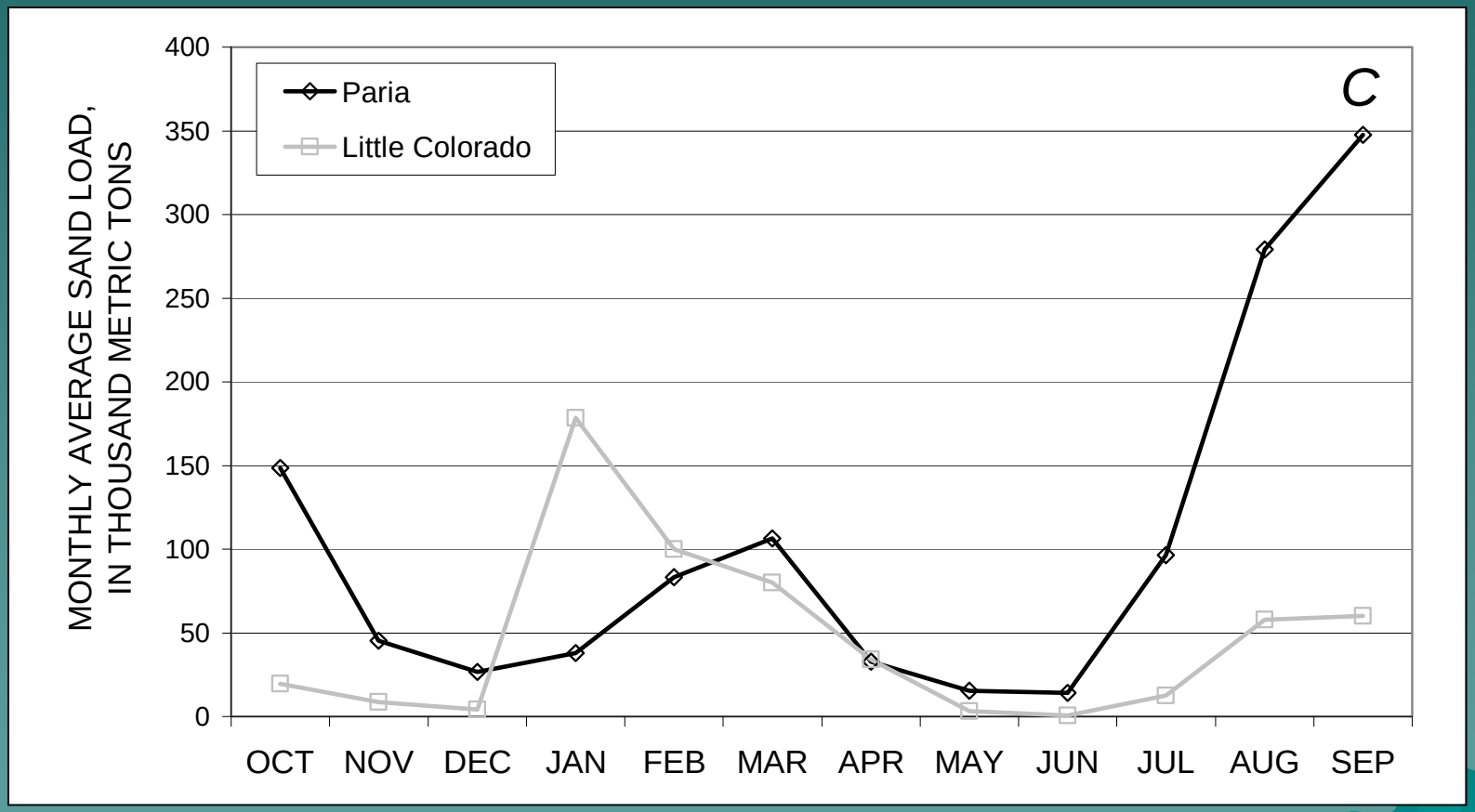
Tributary sand inputs

Averages for each month based on historical record



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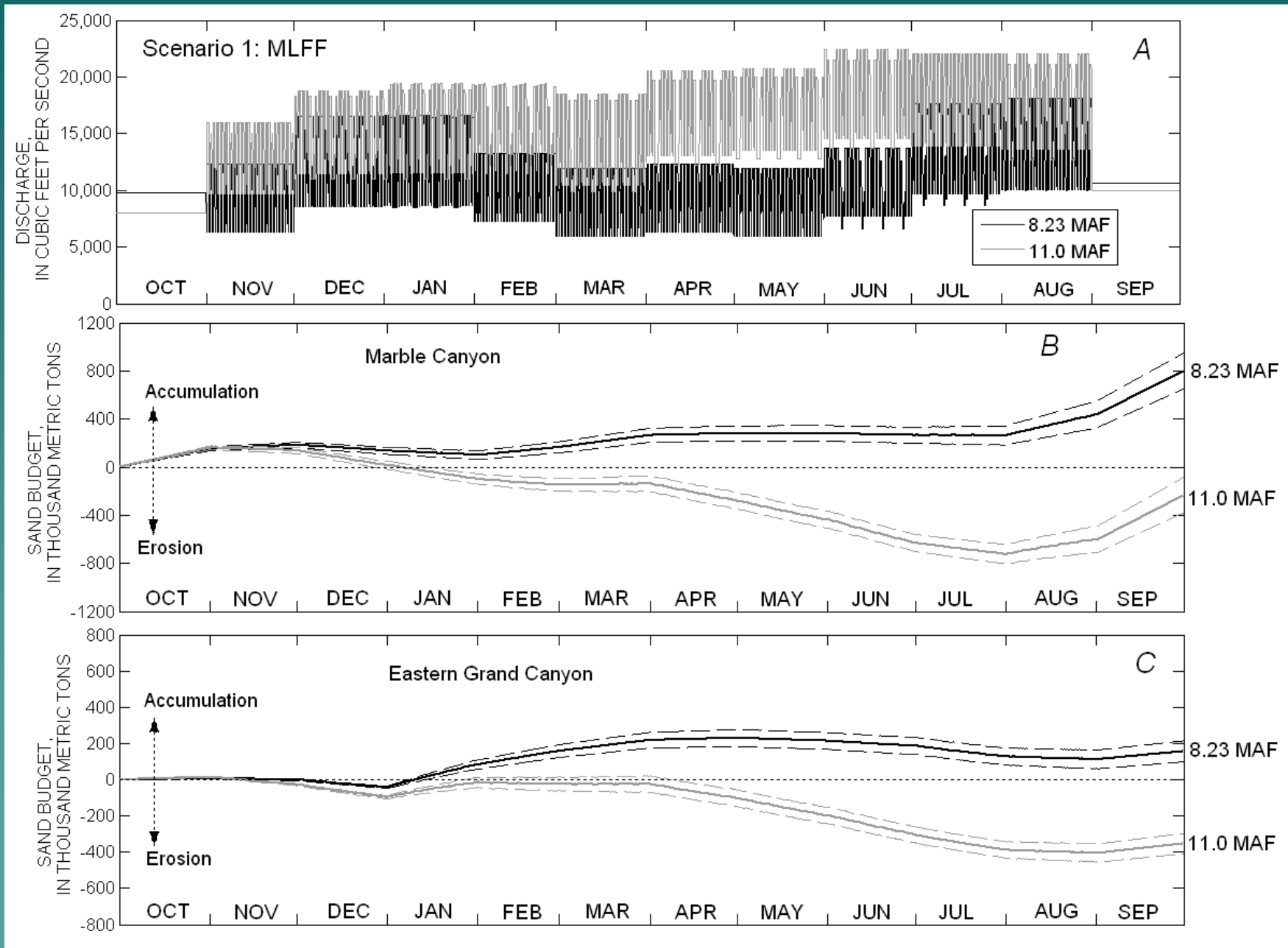
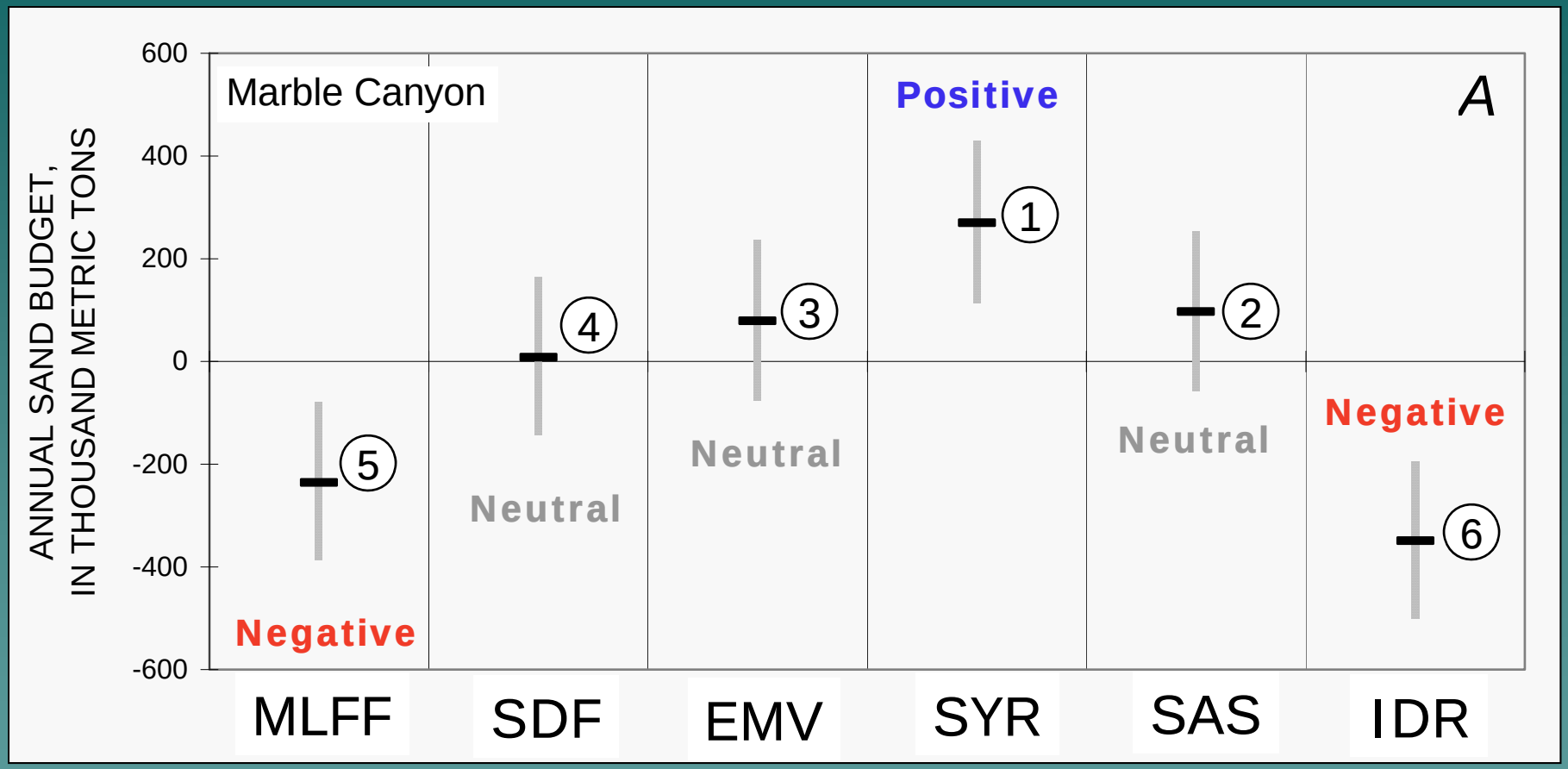
Example results plot



Marble Canyon, 11.0 MAF



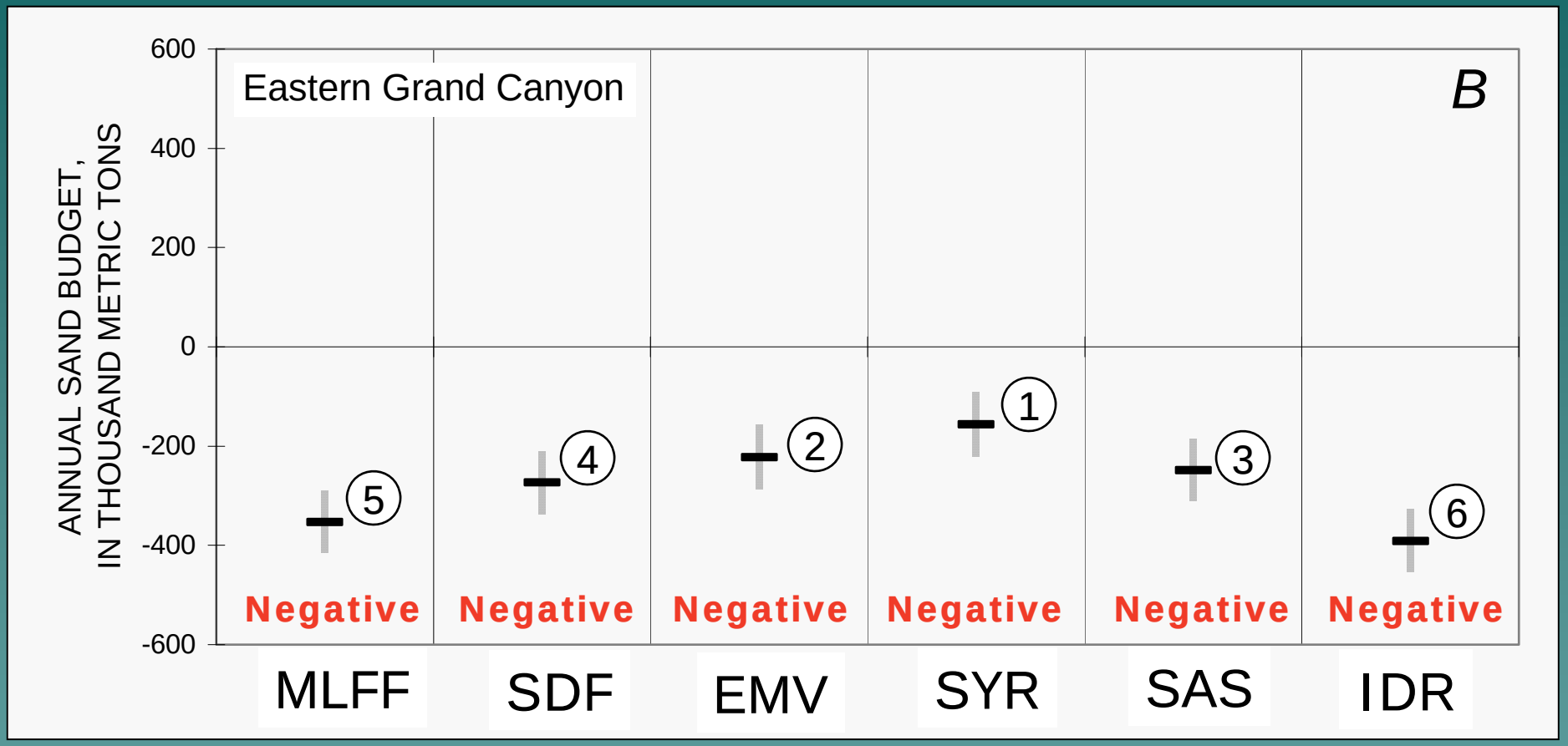
EXPLANATION

Base simulations

Uncertainty envelopes

620,000 metric ton difference from SYR to IDR

Eastern Grand Canyon, 11.0 MAF



EXPLANATION

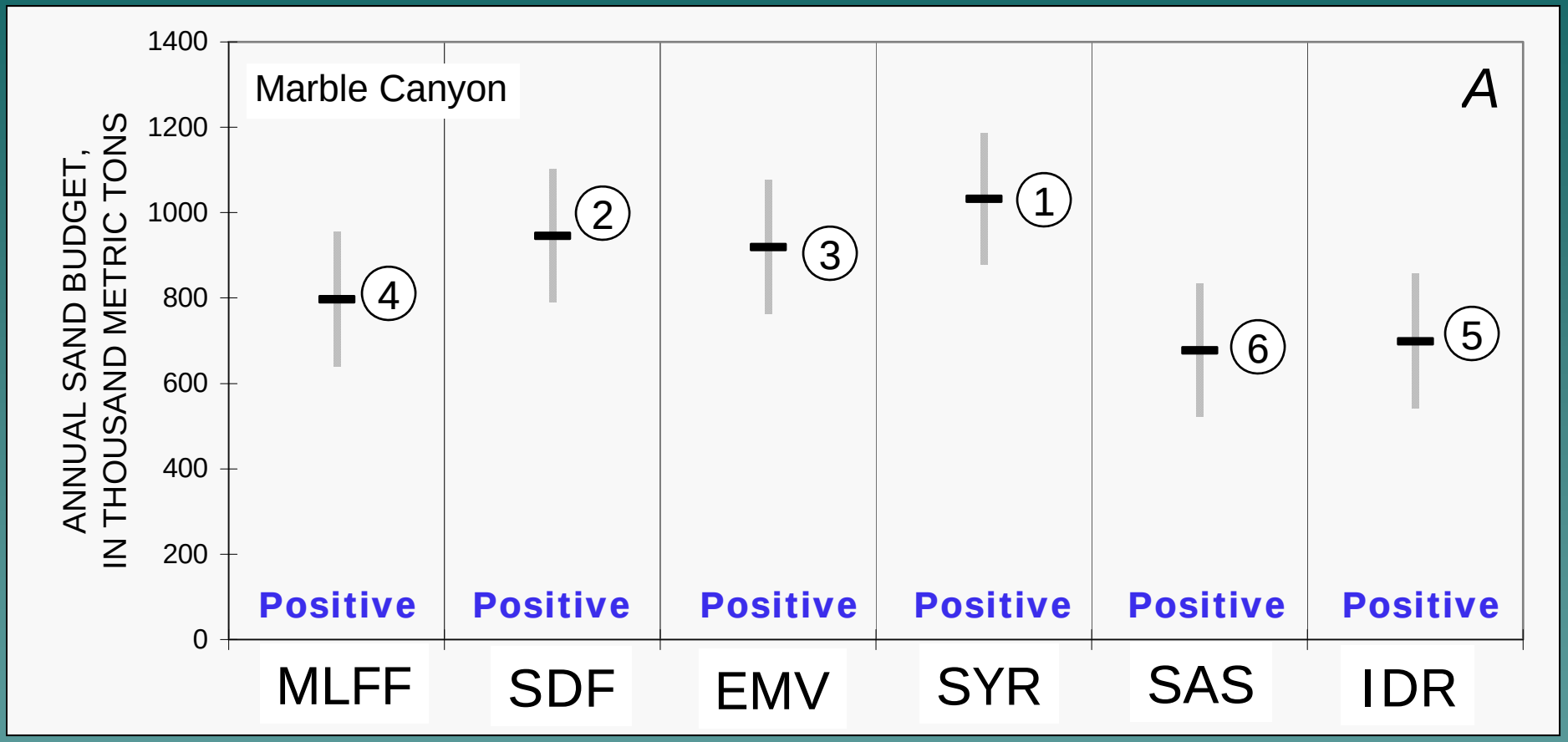
Base simulations

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

Marble Canyon, 8.23 MAF



EXPLANATION

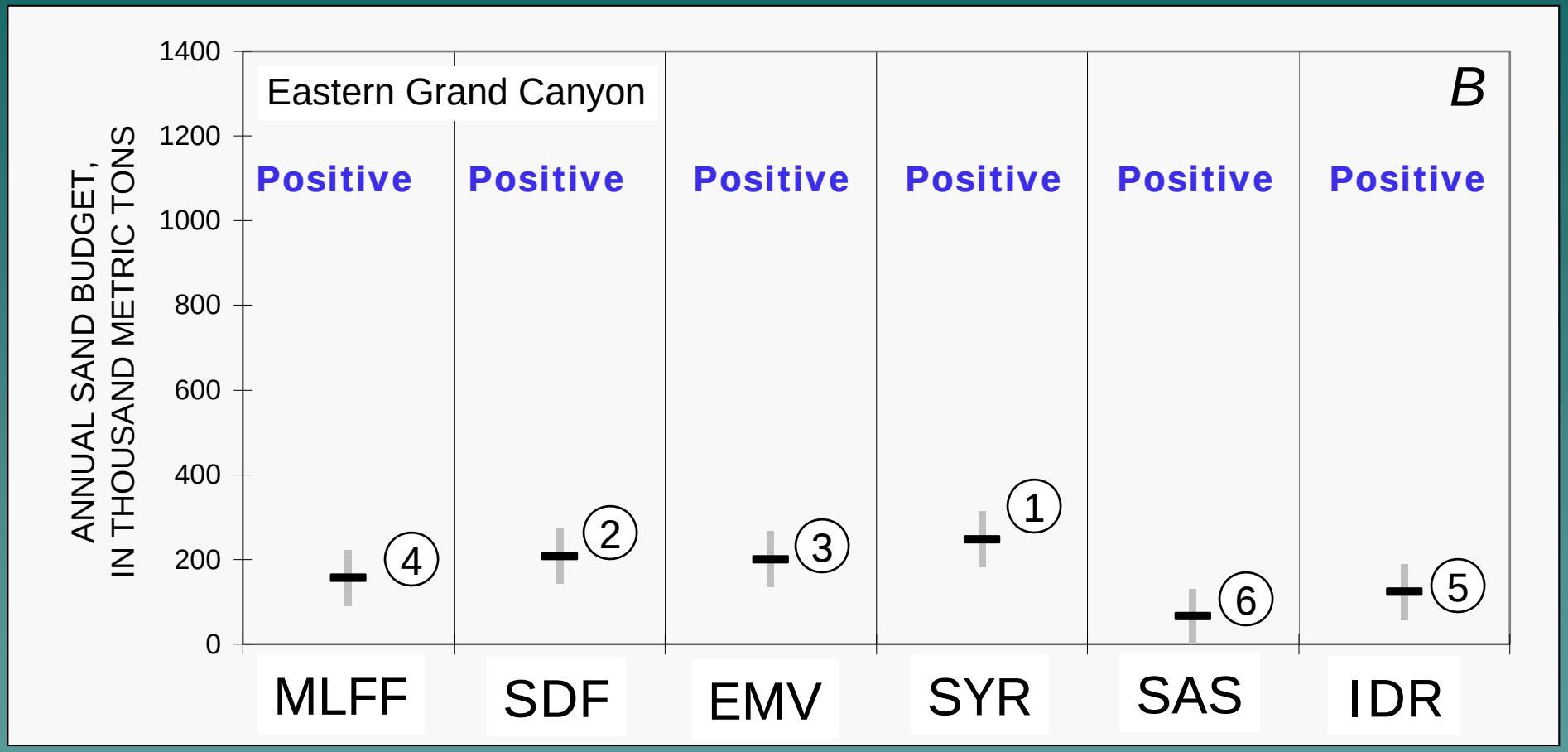
Base simulations

Uncertainty envelopes

Why all positive? Below average annual volume combined with average tributary inputs

350,000 metric ton difference from SYR to SAS

Eastern Grand Canyon, 8.23 MAF



EXPLANATION

Base simulations

Uncertainty envelopes

180,000 metric ton difference from SYR to SAS

Summary

Since we don't really know what the 2011 annual volume and tributary inputs will be, the results should be viewed in a relative sense (i.e. against each other)

SYR consistently ranks 1st in terms of sand retention and provides an upper bound for comparison

SDF and EMV yield similar results indicating more sand retention than MLFF. EMV is slightly better for 11.0 MAF while SDF is slightly better for 8.23 MAF.

SAS ranks high for 11.0 MAF (2/3 depending on reach), but ranks 6th for 8.23 MAF. This is because the maximum flow (18,000 cfs) is imposed and the same for both volumes.

IDR consistently ranks just below MLFF for sand retention

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