April 2008 Grand Canyon Sediment Update

David Topping, Ron Griffiths, Tom Sabol,
Nick Voichick, Bob Tusso, Ted Melis,
Paul Grams, and many others at the USGS

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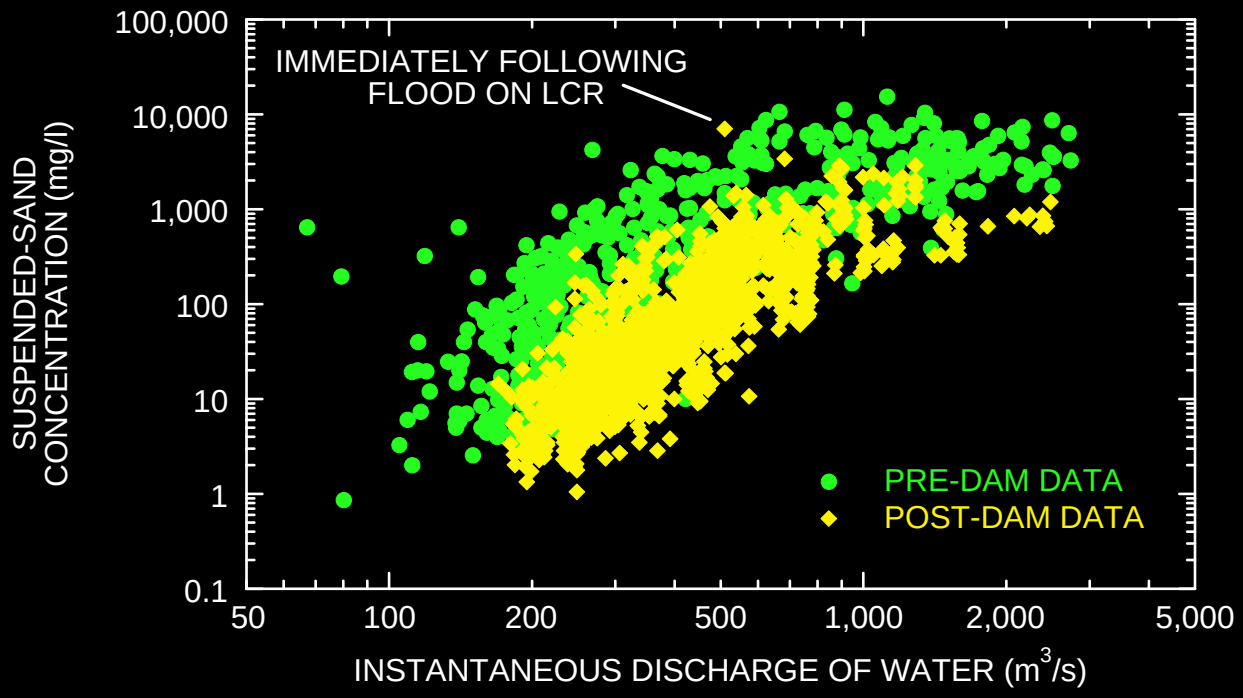
Large discharge-independent changes in suspended-sediment concentration and grain size over short (i.e., < hourly) timescales



Three orders of magnitude range in sand concentration at any given water discharge.

Implication...high resolution direct measurements of sand concentration are required.

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Preliminary results – subject to review and revision

Since 1999, we have been studying abnormal water years

- Knowing sand inputs is not enough to conduct future BHBFs, levels of sand retention in key reaches must be known!
- Only a 20% increase in downstream water delivery will result in a minimum factor of 2 increase in sand export (details depend on monthly water distribution and grain size)
- This return to a more “normal” flow scenario will negate any of the sand retention we have observed during “abnormal” 8.23 maf water years
- Demonstrable retention of tributary sand in the Colorado River under “normal” water years is < 2 months (Topping et al., *WRR*, 2000; Rubin et al., *EOS*, 2002; Wright et al., *USGS-Circ.*, 2005)
- Flows may be increasing above 8.23 maf this year for the first time since 1999!

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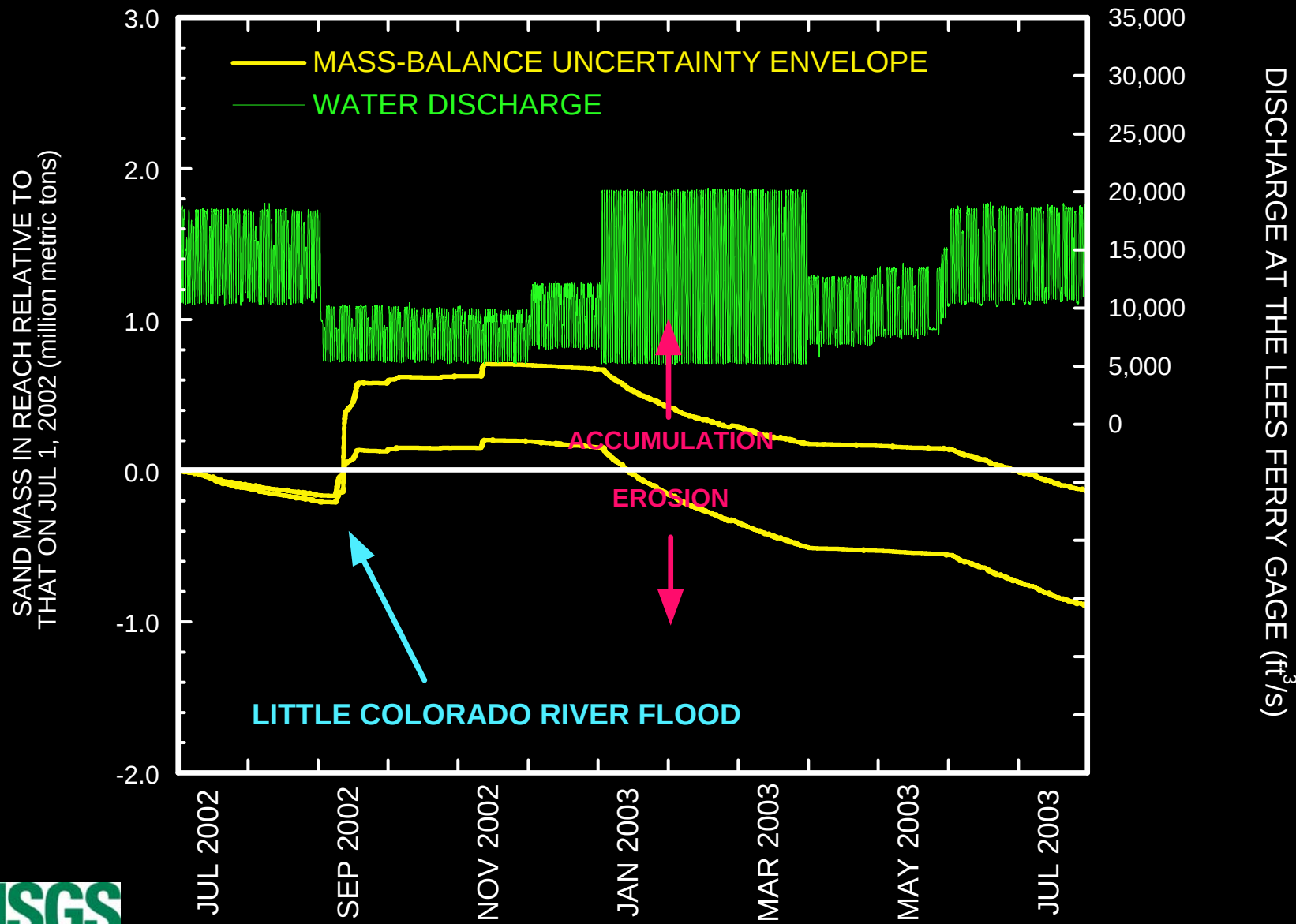
SEDIMENT-YEAR 2003 MASS-BALANCE SAND BUDGET BETWEEN LEES FERRY AND THE GRAND CANYON GAGE



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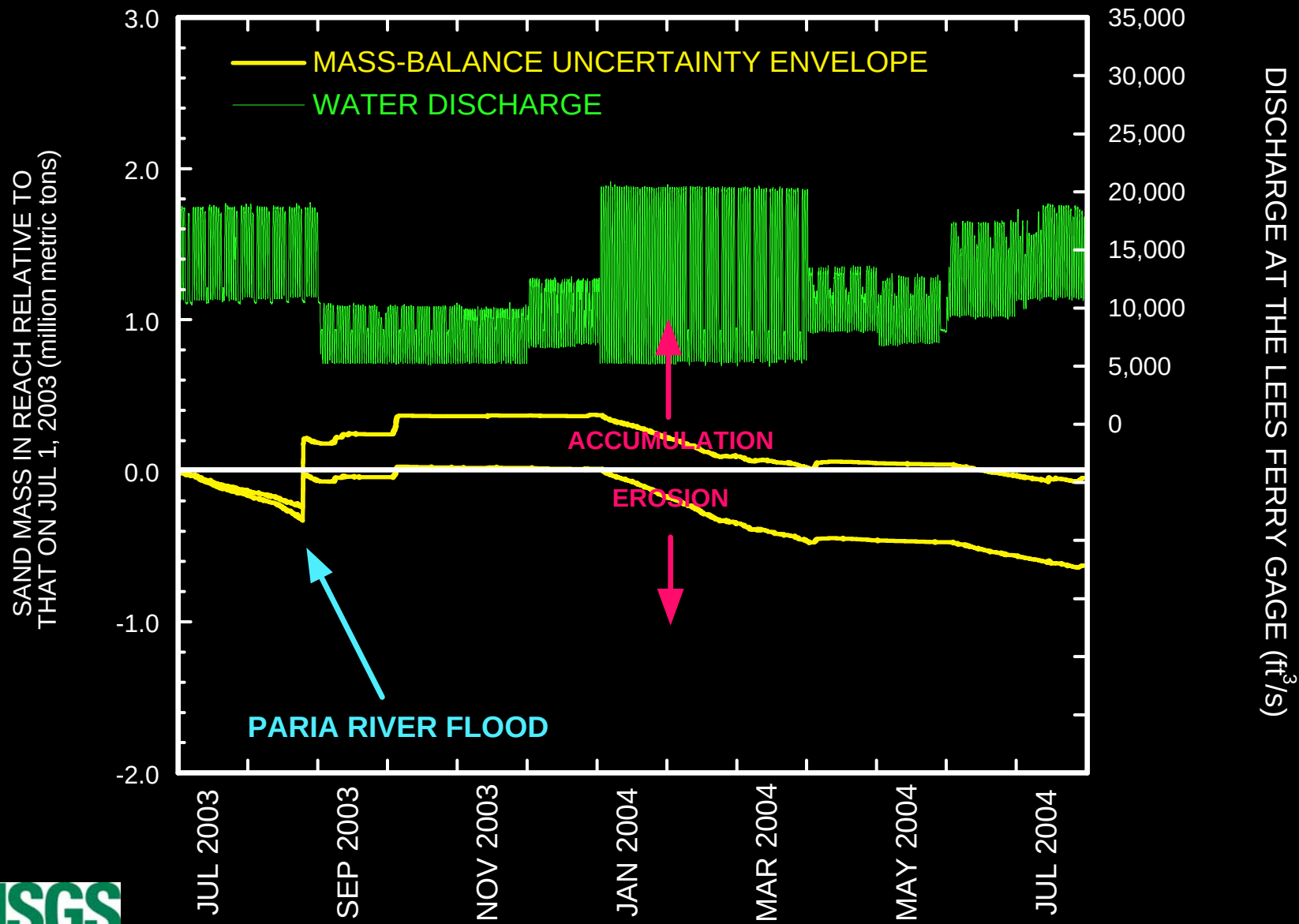

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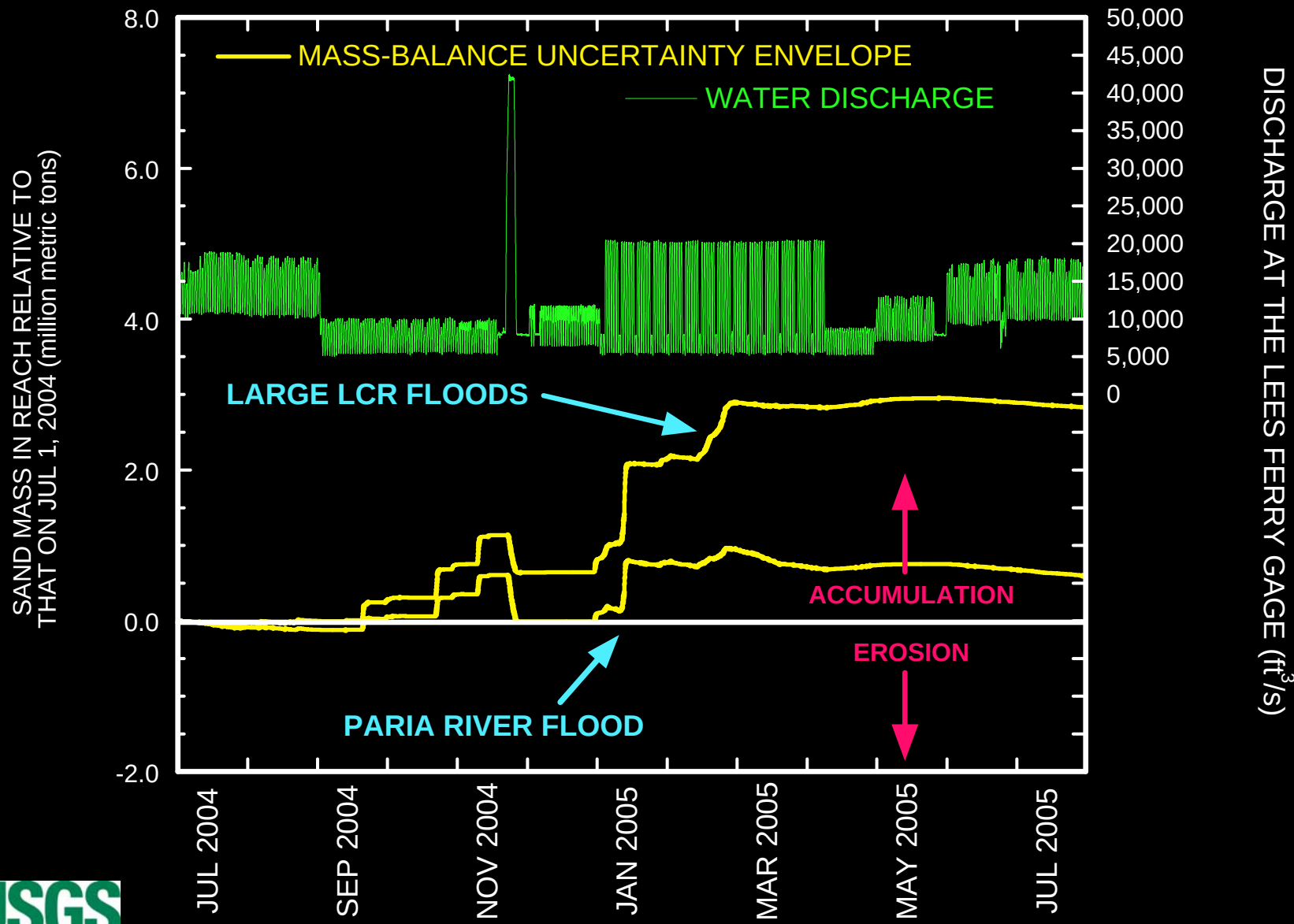

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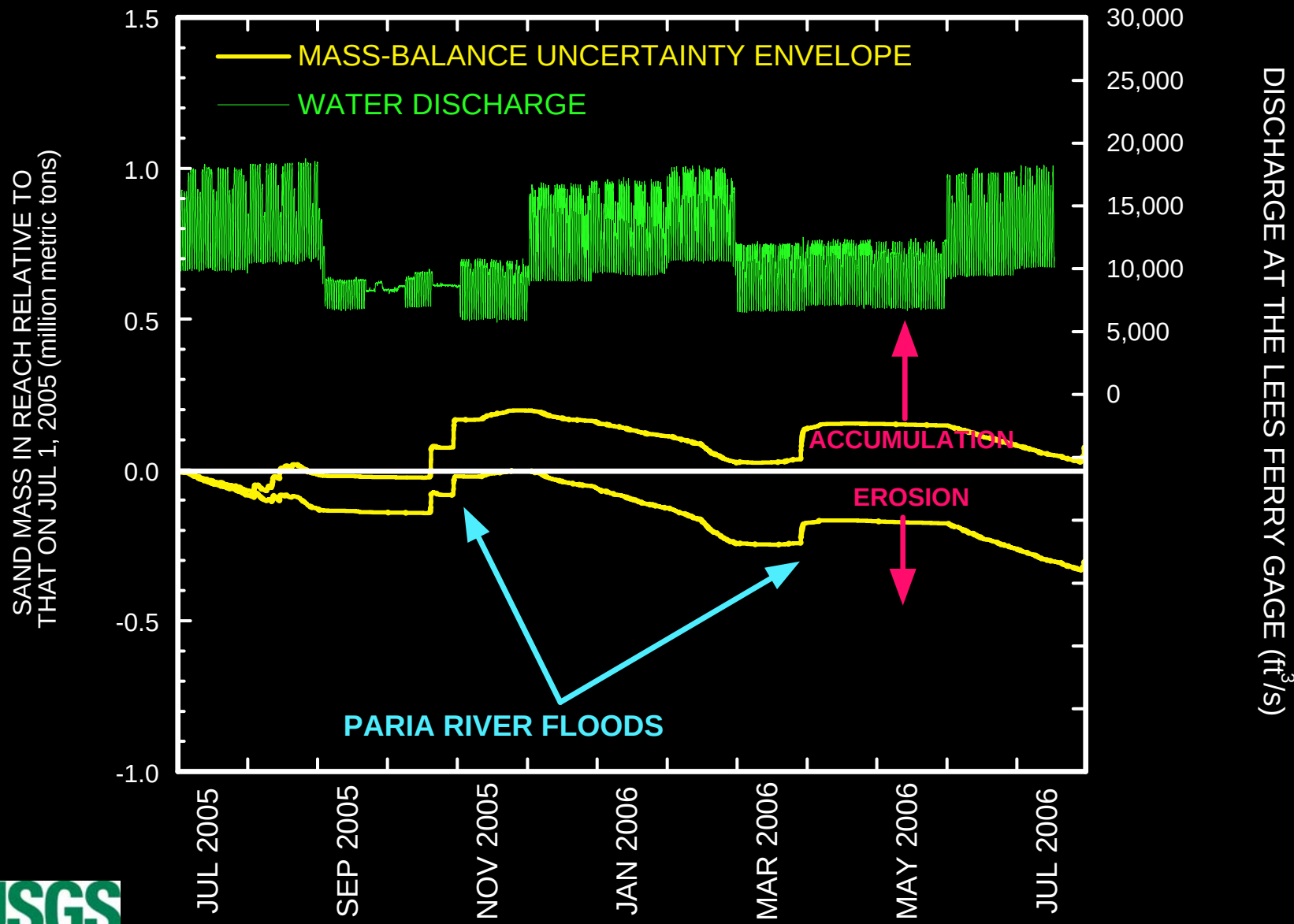

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Antecedent reach-by-reach sand-supply conditions prior to the 2008 HFE

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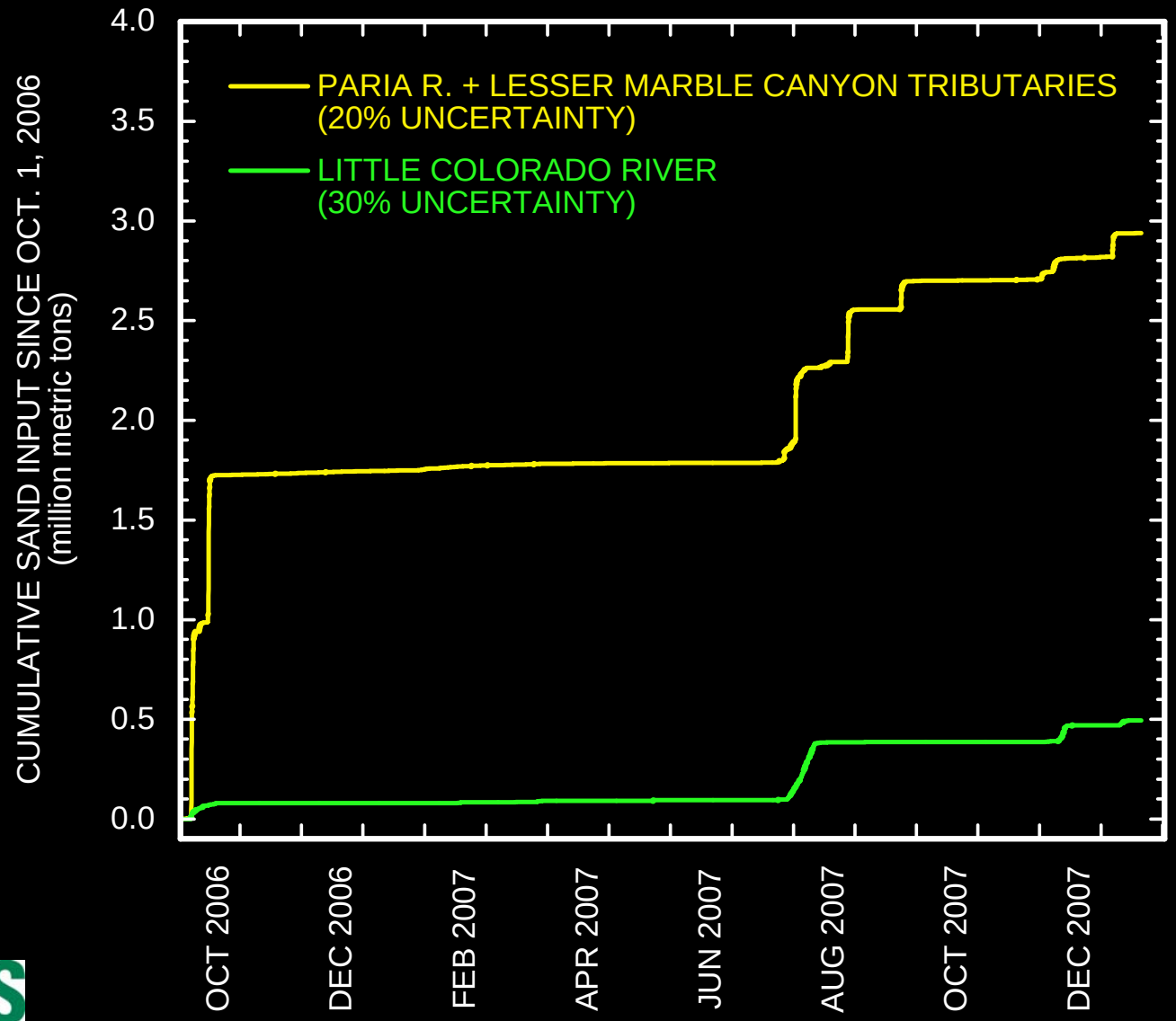
Preliminary results – subject to review and revision

TRIBUTARY SAND INPUT BETWEEN THE LEES FERRY AND GRAND CANYON GAGES OCTOBER 2006 - JANUARY 2008



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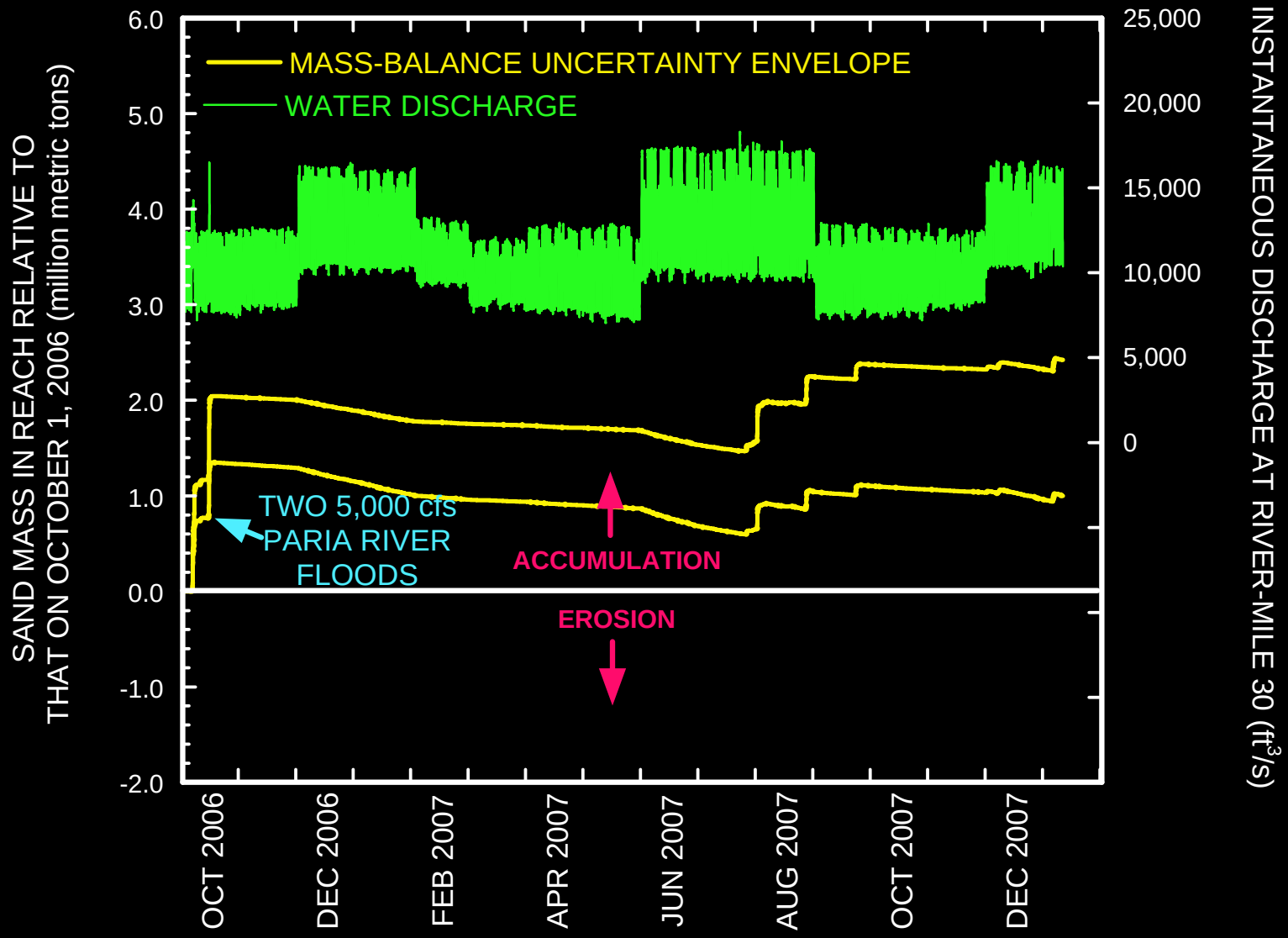
Preliminary results – subject to review and revision

OCT 2006 - JAN 2008 MASS-BALANCE SAND BUDGET FOR UPPER MARBLE CANYON (river-miles 1-30)



Demonstrable > 1 million metric tons sand accumulation

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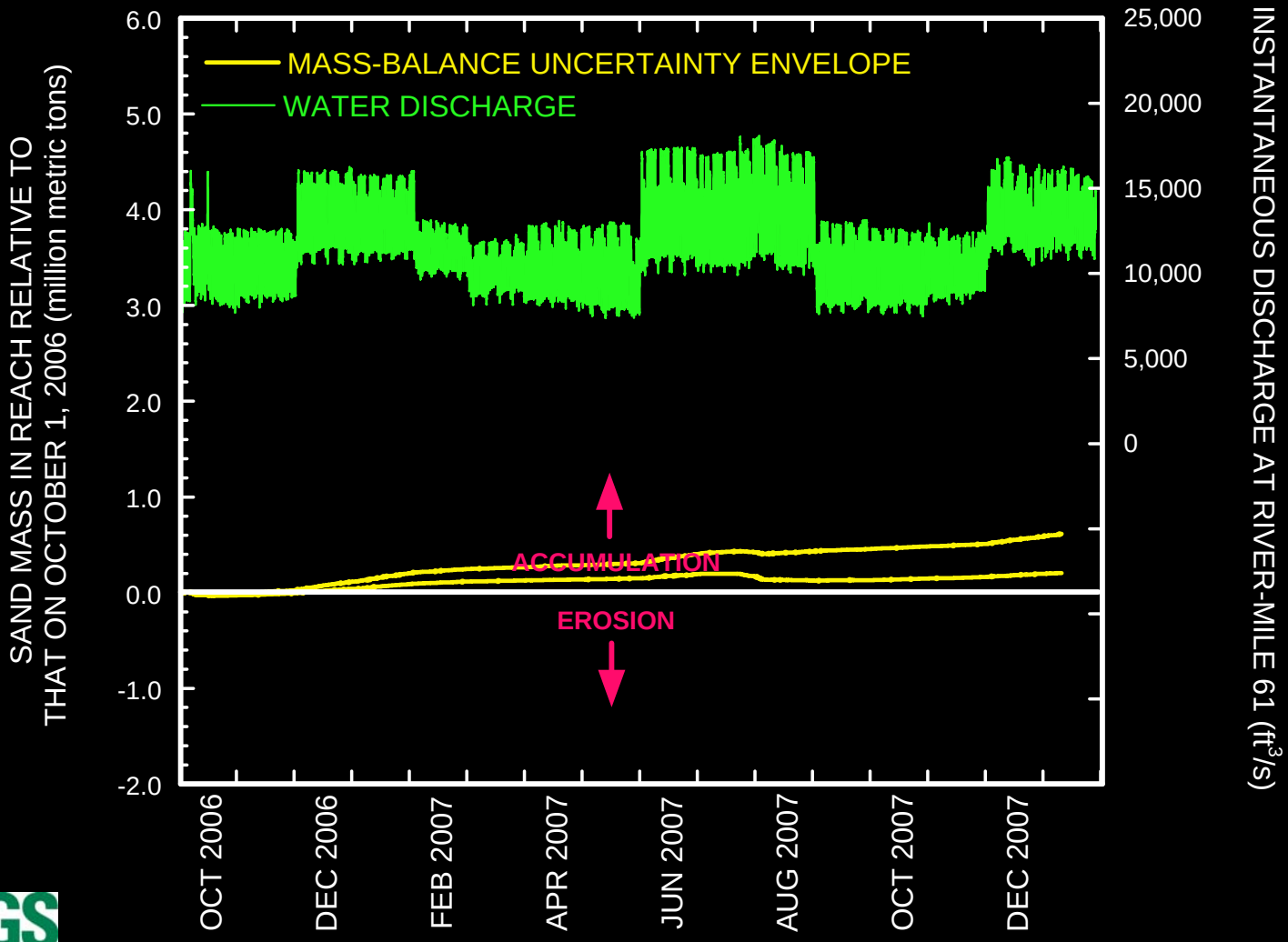
OCT 2006 - JAN 2008 MASS-BALANCE SAND BUDGET FOR LOWER MARBLE CANYON (river-miles 30-62)

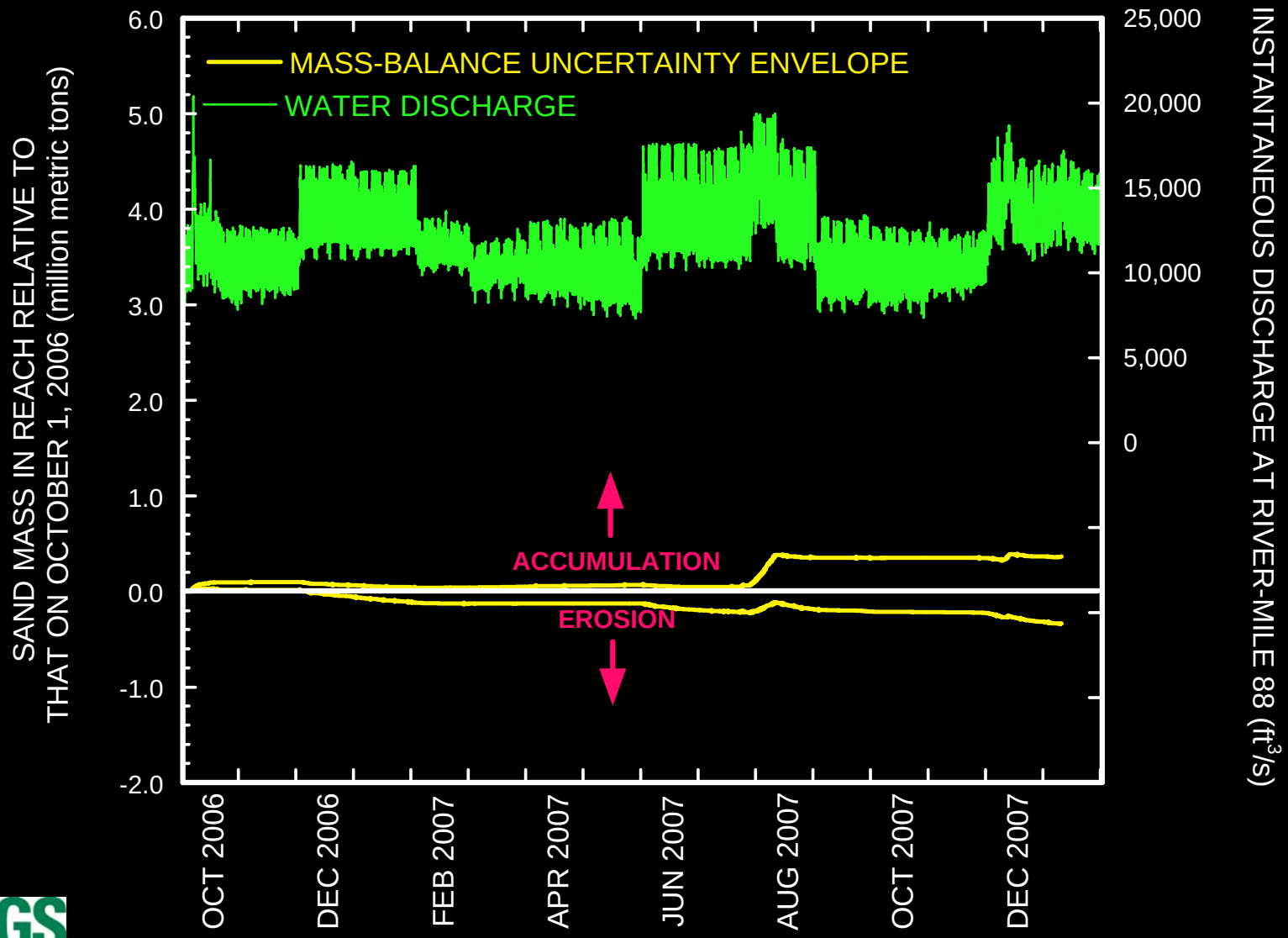


Demonstrable > 200,000 metric tons sand accumulation

This reach was likely the major supplier of sand measured in transport downstream at the Grand Canyon gage (RM 88) during the 2008 HFE

Preliminary results – subject to review and revision

OCT 2006 - JAN 2008 MASS-BALANCE SAND BUDGET FOR EASTERN GRAND CANYON (river-miles 62-88)



NO DEMONSTRABLE SAND ACCUMULATION!

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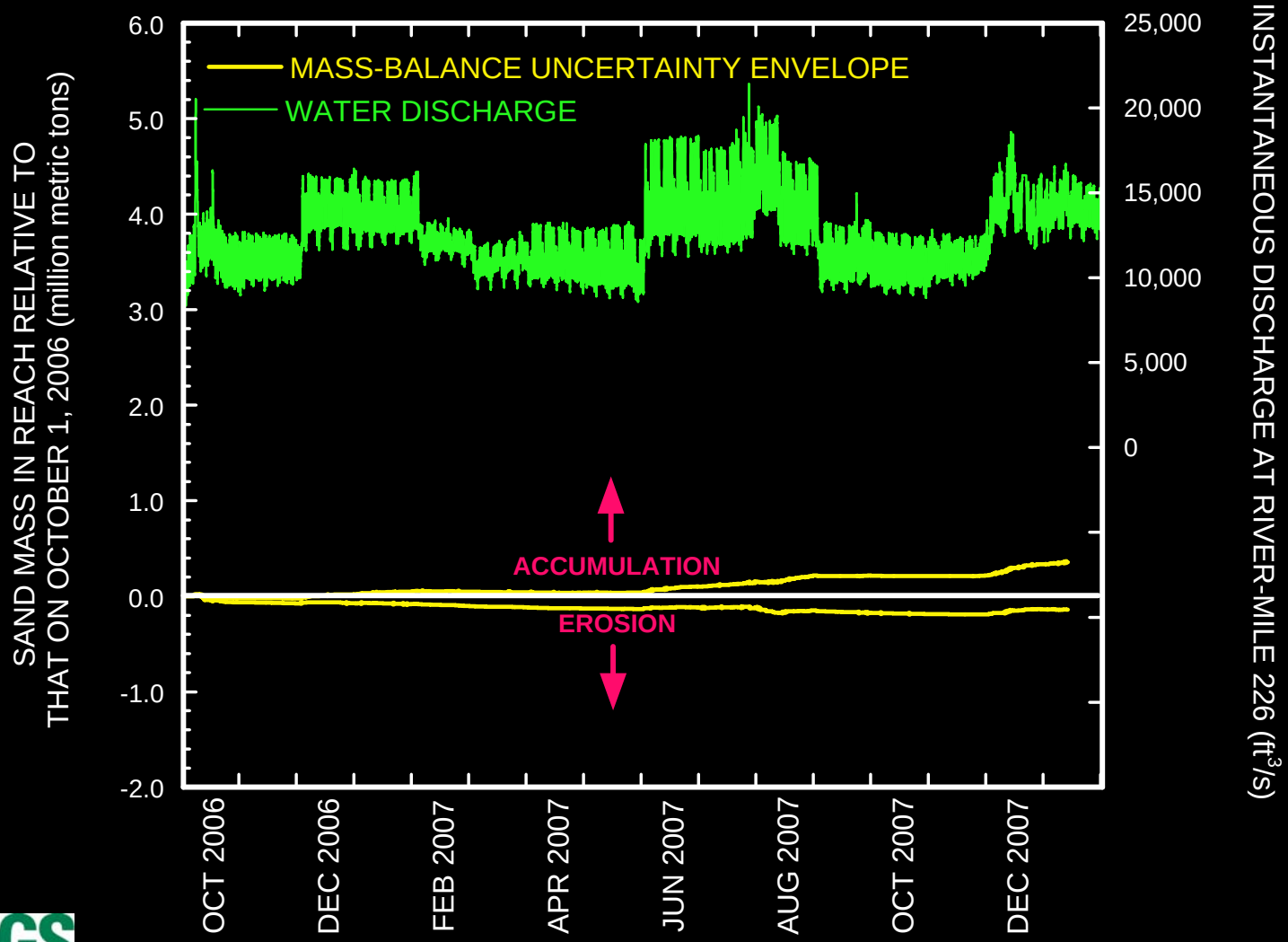
OCT 2006 - JAN 2008 MASS-BALANCE SAND BUDGET FOR CENTRAL & WESTERN GRAND CANYON (river-miles 88-226)



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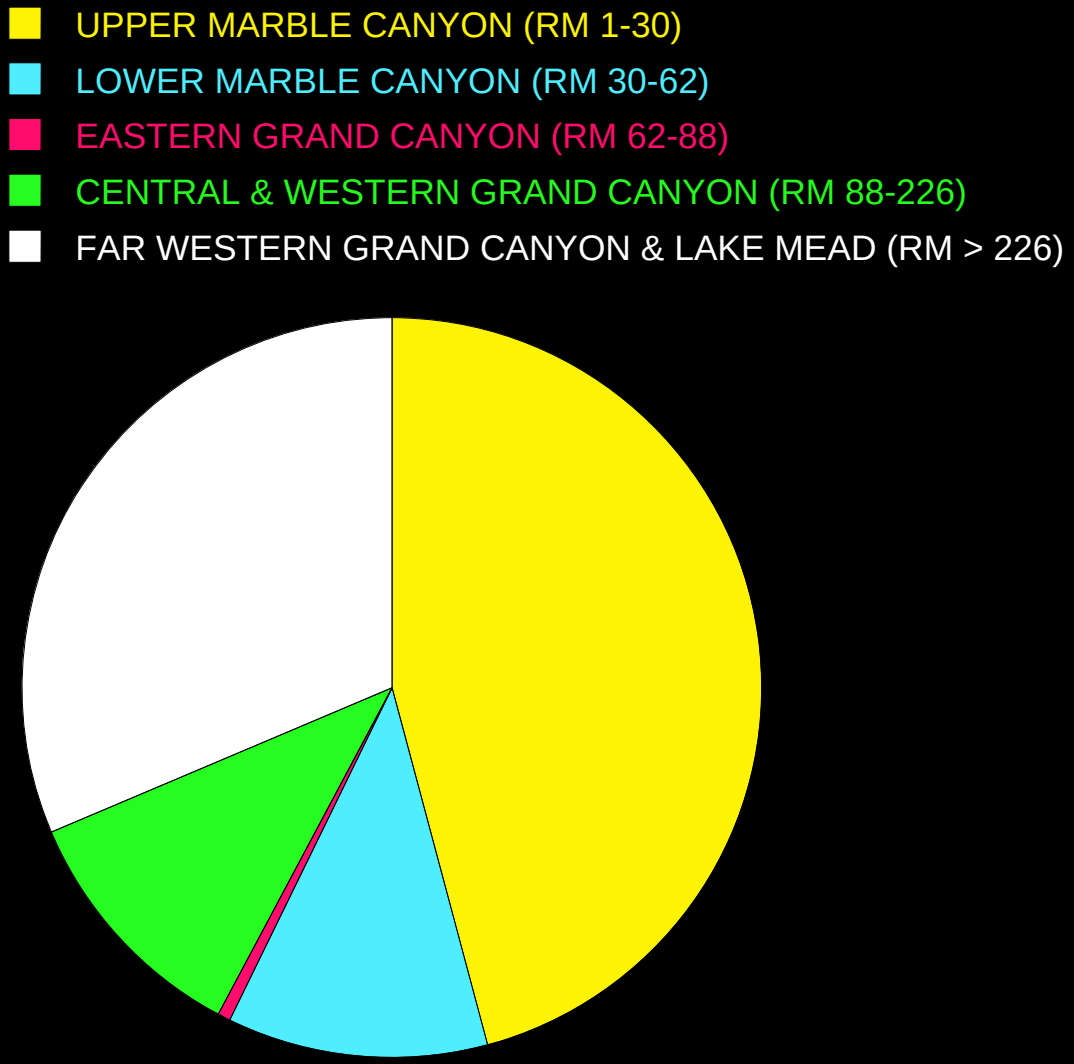
NO DEMONSTRABLE SAND ACCUMULATION!

ANY SAND ACCUMULATION FROM LOCAL TRIBUTARY INPUTS ONLY.
THIS IS LIKELY <300,000 metric tons of sand.

Preliminary results – subject to review and revision

On January 20, 2008, where was the sand supplied by tributaries since October 1, 2006?



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