Results from modeling of sand deposition as a function of discharge and sandbar surveys: How effective are powerplant flows at making new sand deposits?

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Replenish sand bars with high dam releases

- How high? Are power-plant capacity releases sufficient?
- How long?

Modeling

Compute deposition over range of sand supplies and water discharges

Photos from NAU
Sandbar Studies

2d model of flow, sand transport, and bed evolution

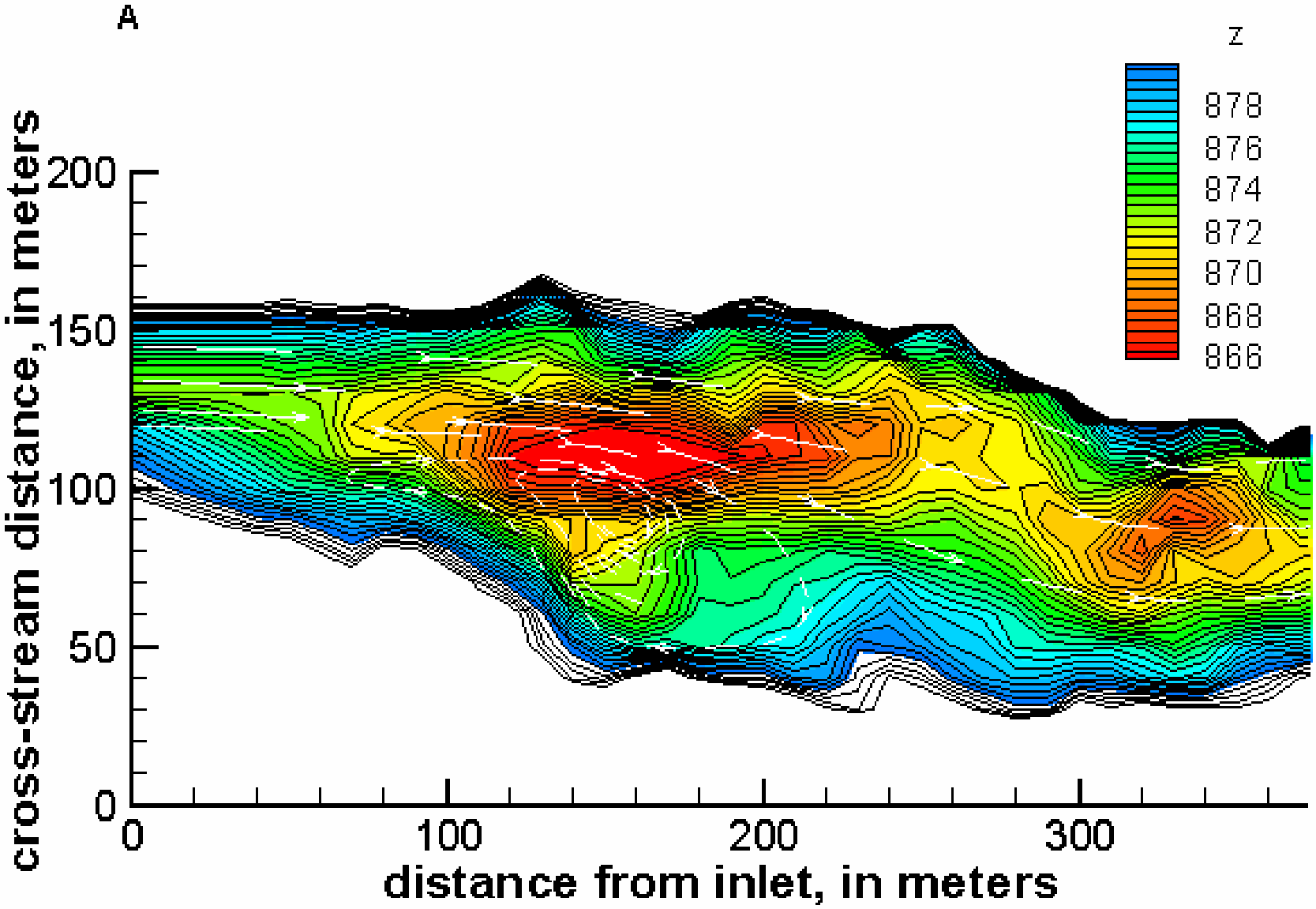
-- calculate vertically averaged flow field

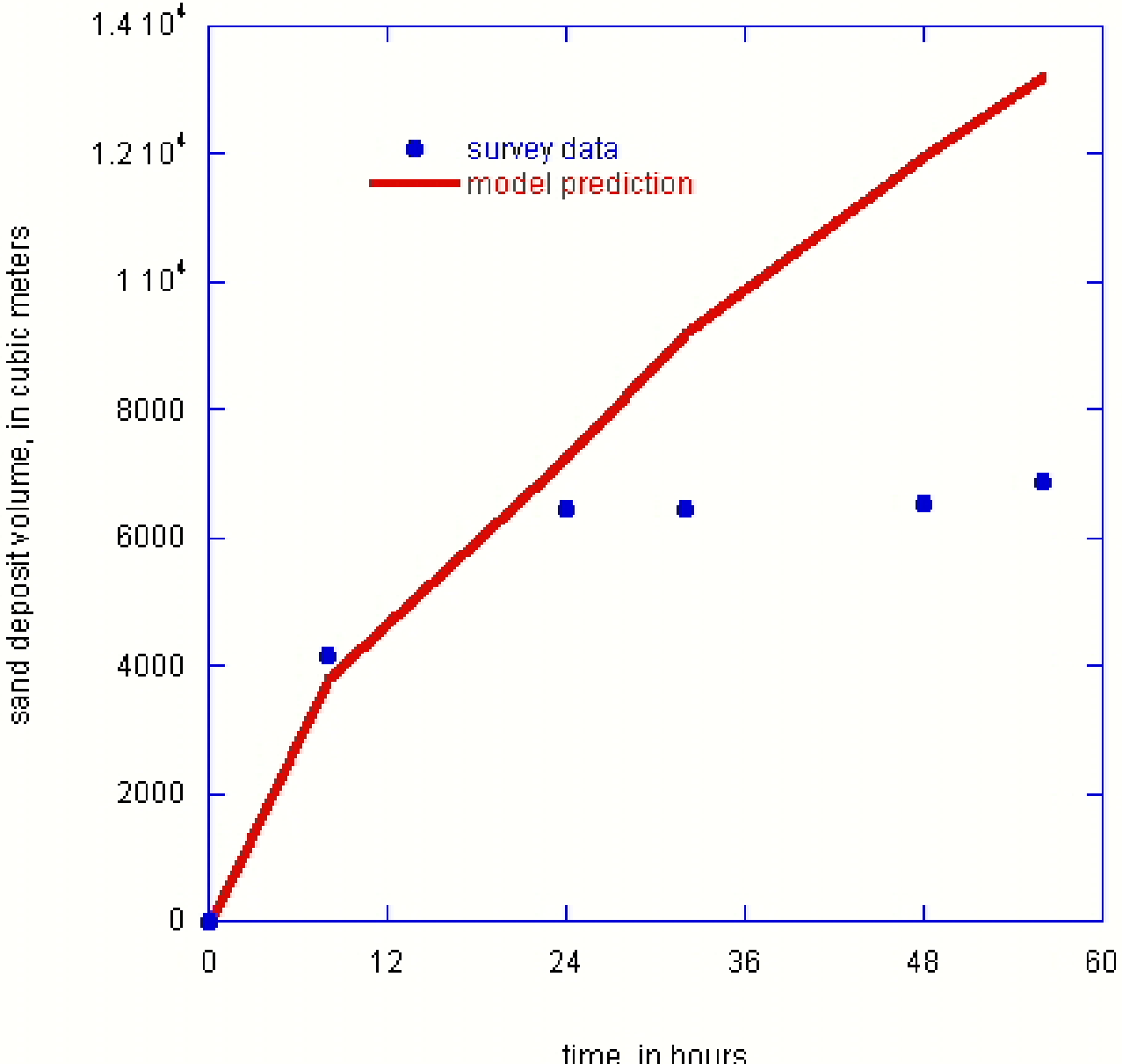
-- calculate 3d suspended sand field

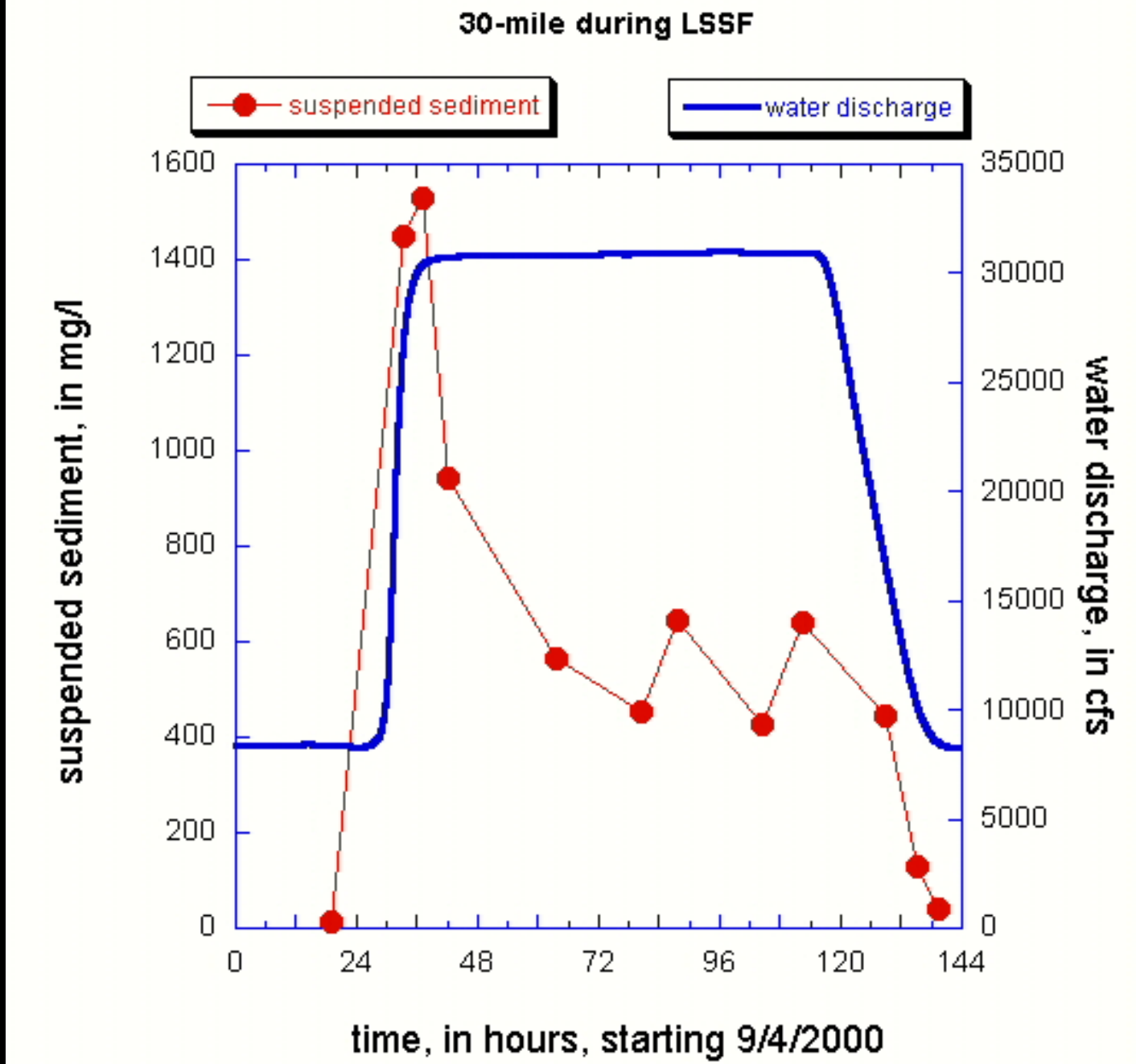
-- calculate local sand discharge

-- calculate change in bed elevation over a small time step

30-mile; t = 0

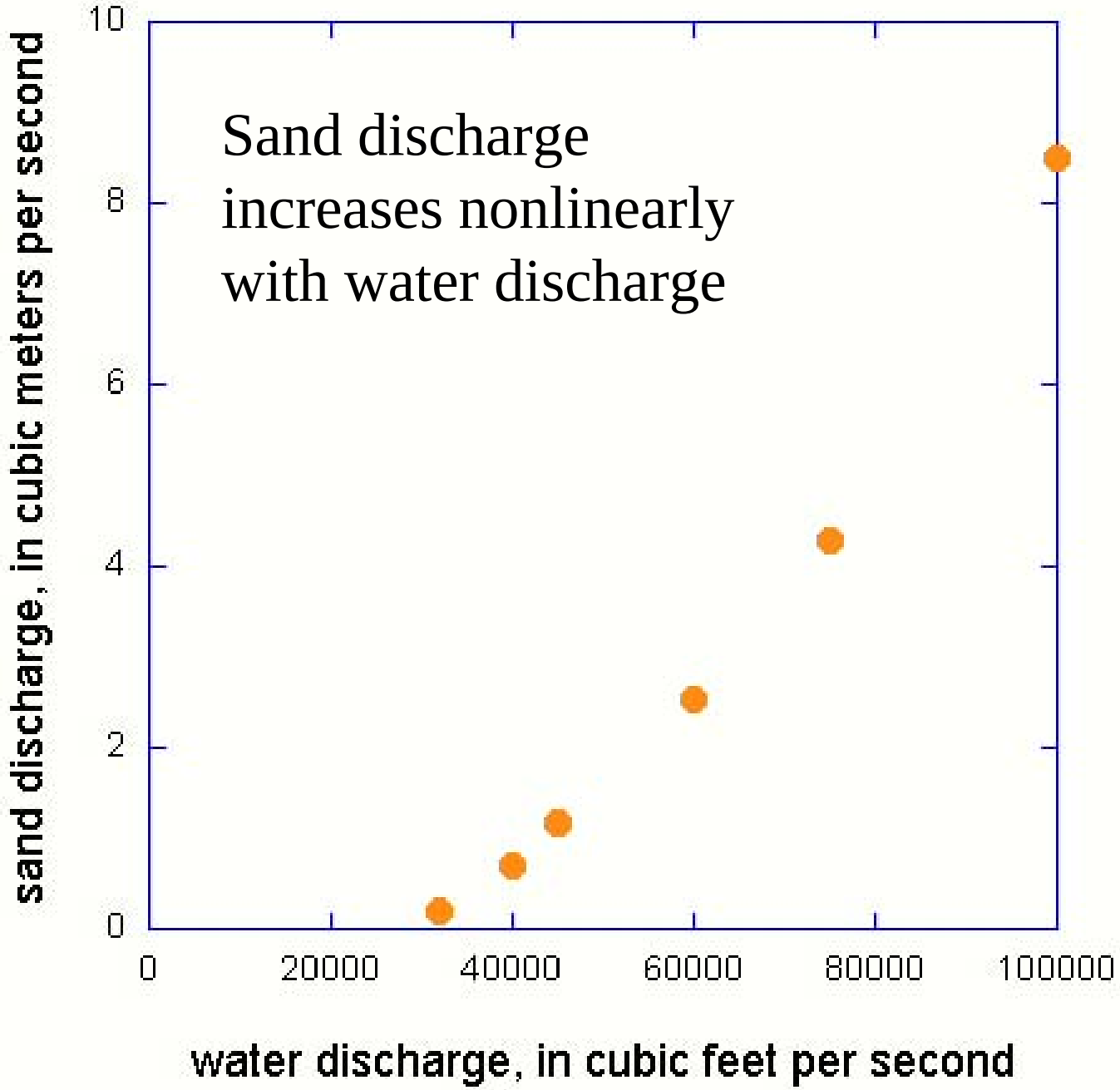

A
z
878
876
874
872
870
868
866
cross-stream distance, in meters
200
150
100
50
0
0
100
200
300
distance from inlet, in meters


1.4 10^4
1.2 10^4
1 10^4
8000
6000
4000
2000
0
sand deposit volume, in cubic meters
survey data
model prediction
0
12
24
36
48
60
time, in hours

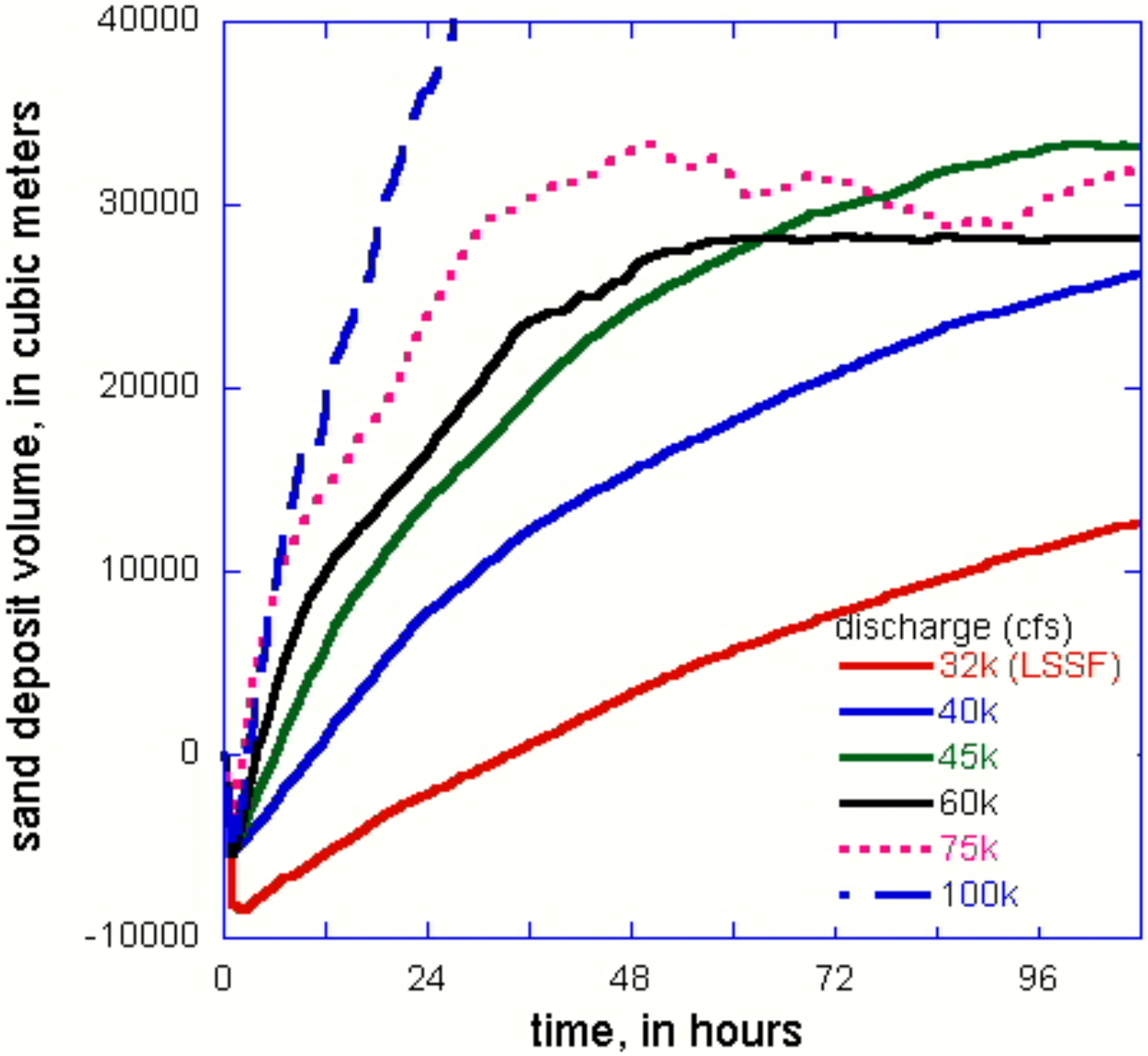

30-mile during LSSF
suspended sediment
water discharge
suspended sediment, in mg/l
water discharge, in cfs
time, in hours, starting 9/4/2000
0
200
400
600
800
1000
1200
1400
1600
0
5000
10000
15000
20000
25000
30000
35000
0
24
48
72
96
120
144

Integrate over LSSF spike flow to get total volume of sand transported.

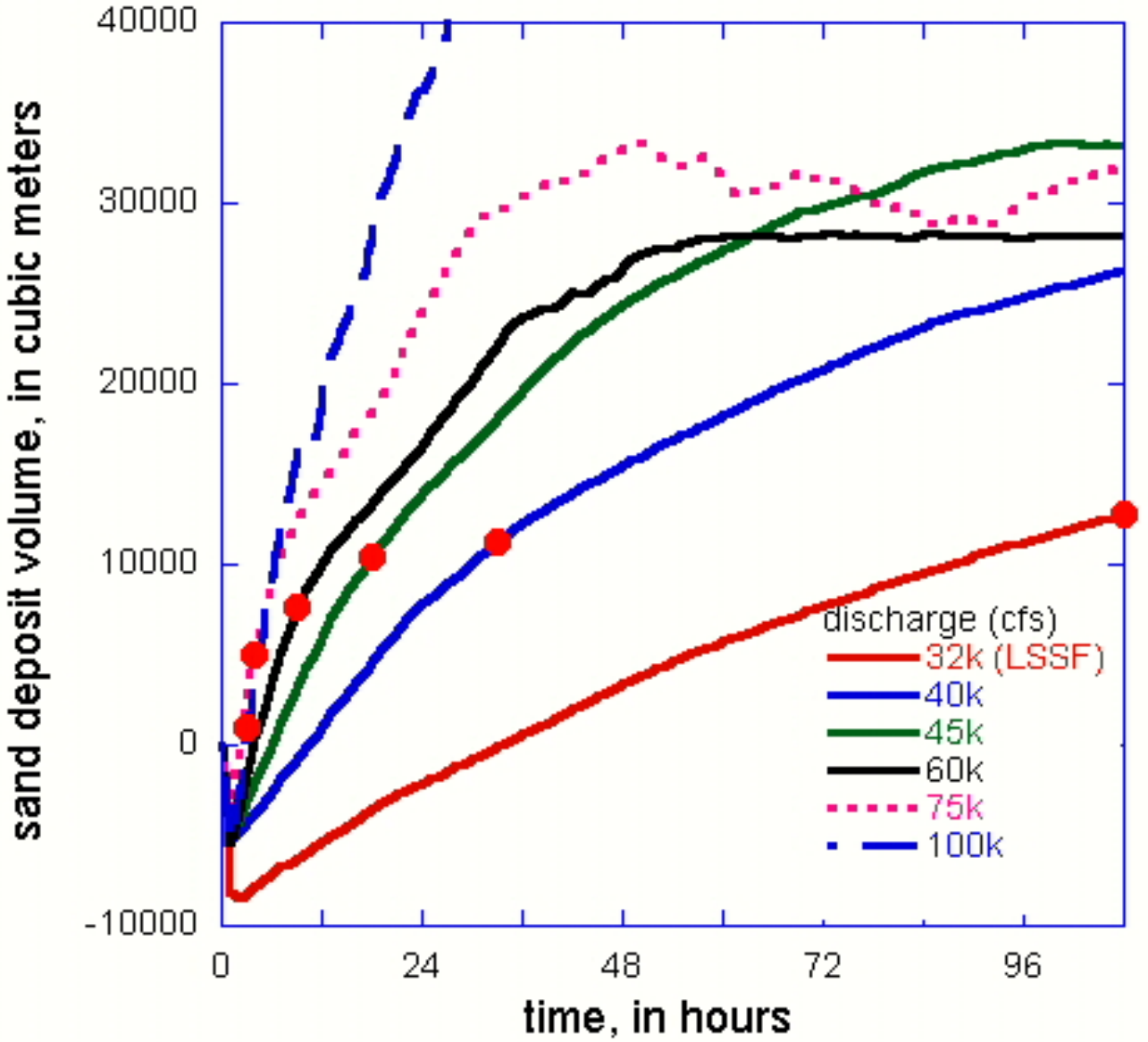
T_v = time required for total volume of sand to be transported


Sand discharge
increases nonlinearly
with water discharge
sand discharge, in cubic meters per second
water discharge, in cubic feet per second
0
2
4
6
8
10
0
20000
40000
60000
80000
100000

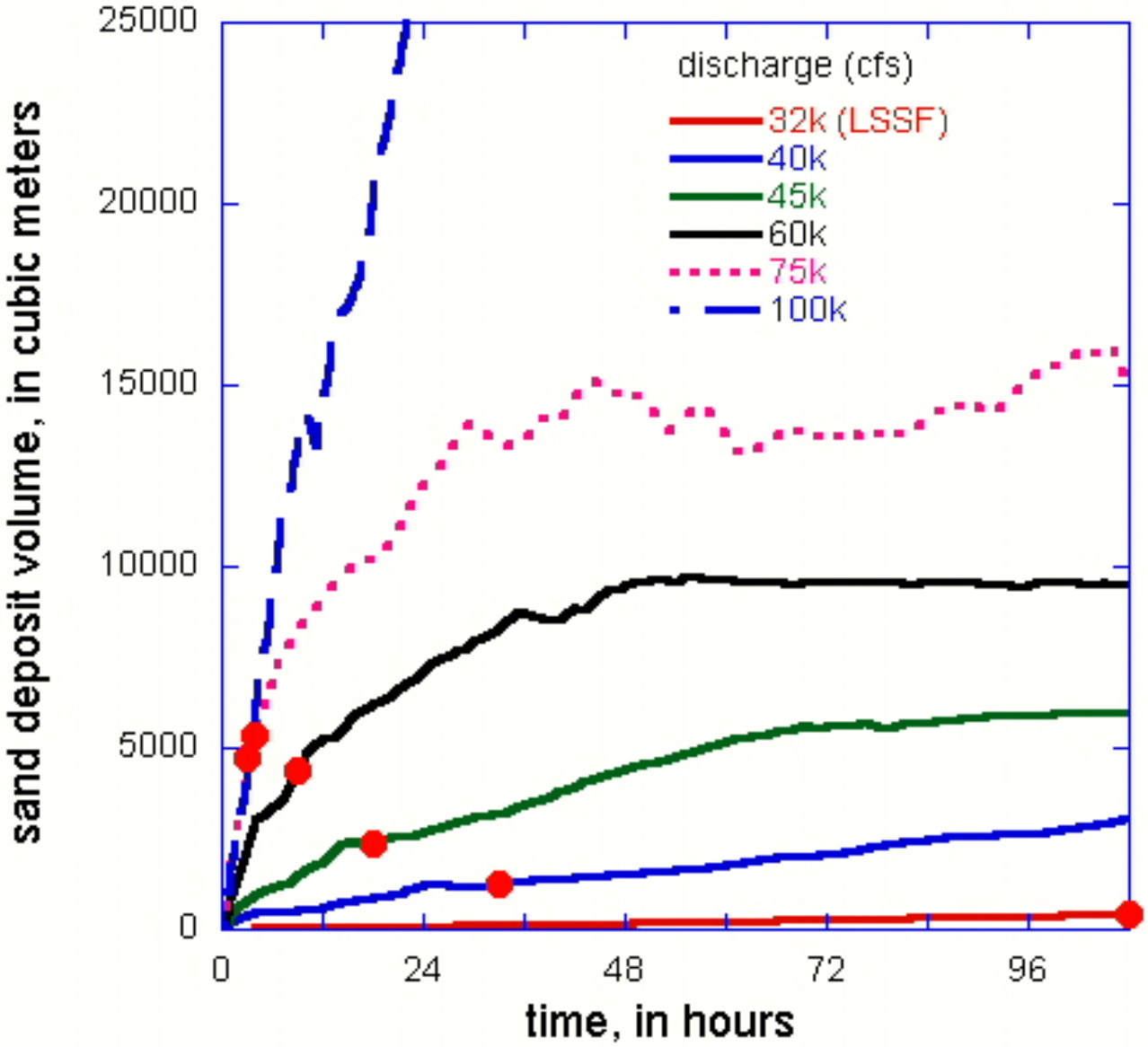
Net change in sand deposit volume



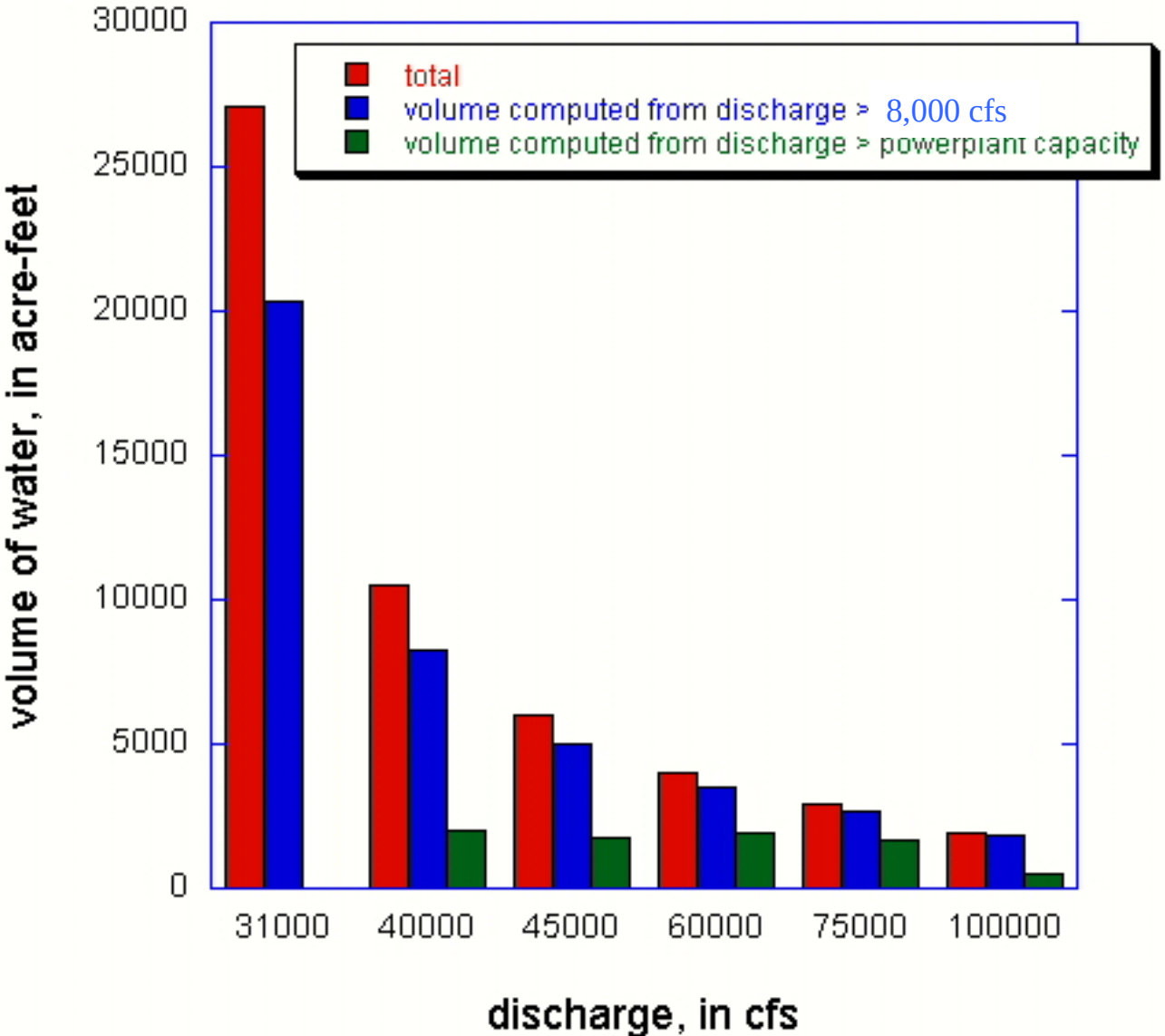
Net change in sand deposit volume



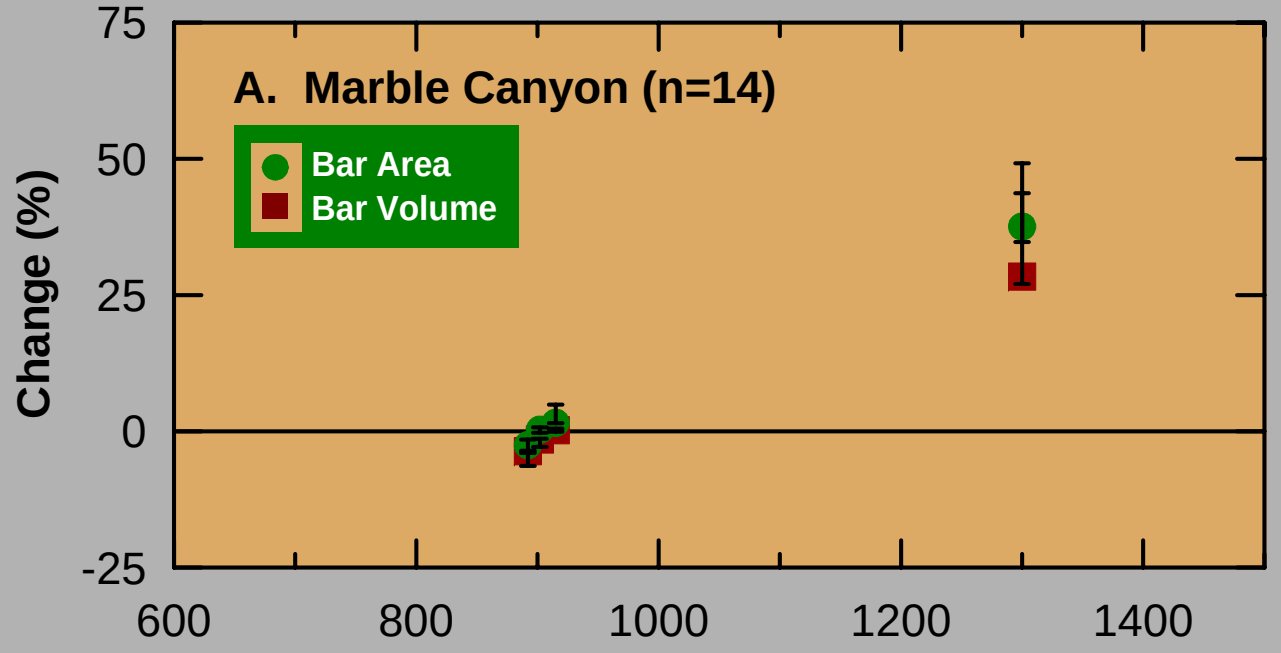
Net change in sand volume above 25k cfs stage

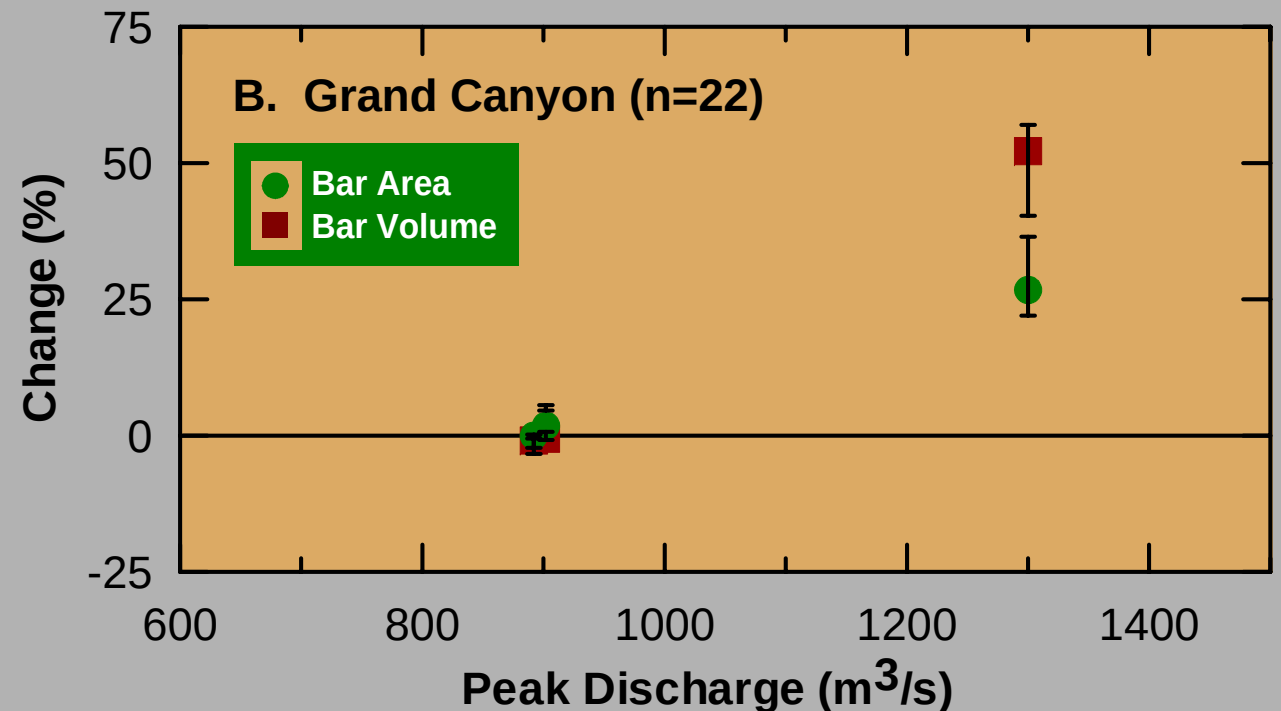


Volume of water required to transport volume of sand transported during the LSSF at 30-mile



NAU
survey data





Additional considerations

- Distribution of sand within recirculation zone
- Possible increase in likelihood of slumping at highest deposition rates
- Rates of change of discharge increase with highest discharges

Conclusions

Power-plant capacity flows are ineffective at building sand deposits

Discharges around 45,000 to 60,000 cfs make best use of sand and water