ADCP Measurement of Suspended Sediment in the Tidal Hudson River

Elizabeth Nystrom
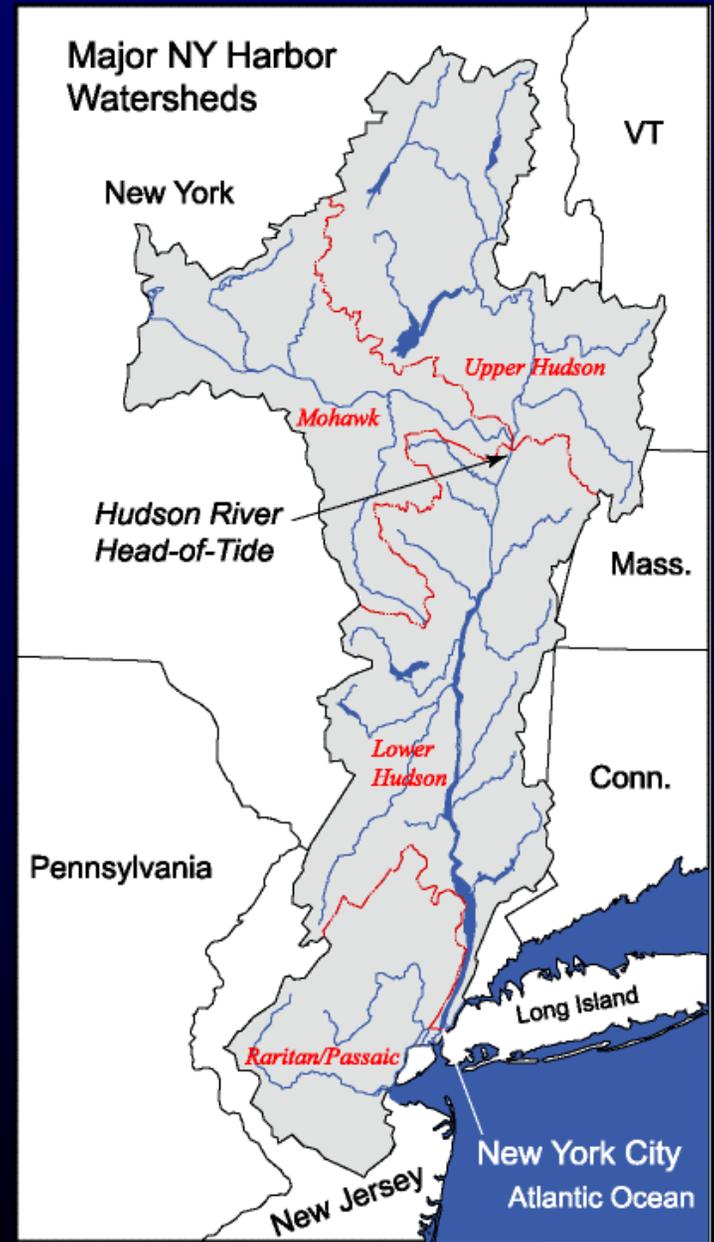
Gary Wall

New York District

Hudson River Basin
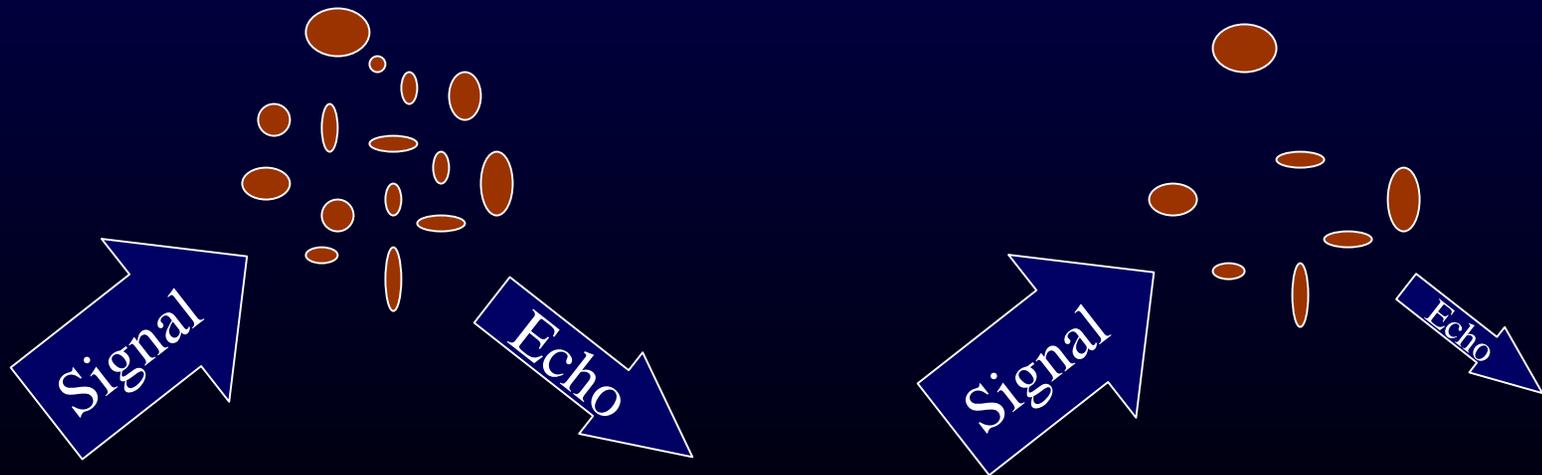

Major NY Harbor Watersheds

- $89 billion of cargo went through the port of NY/NJ in 2002
- River is tidal 153 miles to Federal Dam at Troy
- Can't use conventional methods to measure suspended sediment load

Acoustic Backscatter as a Surrogate for Suspended Sediment

- Relate the signal echo strength to concentration of suspended sediment

Uplooking ADCP

- 600 kHz Sentinel
- 1 ensemble every 15 min
- Transmit data over acoustic modem
- ~ 60 ft deep

ADCP

Acoustic Modem

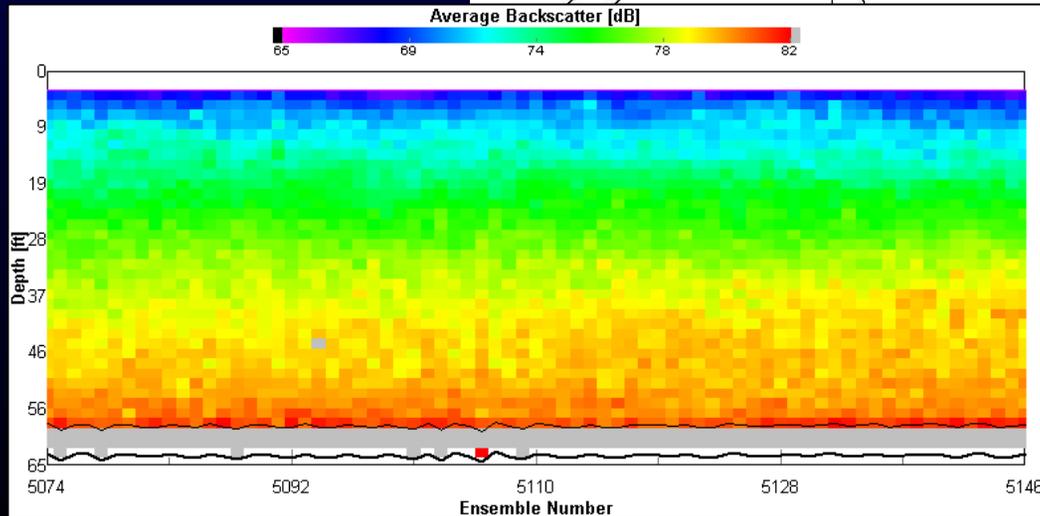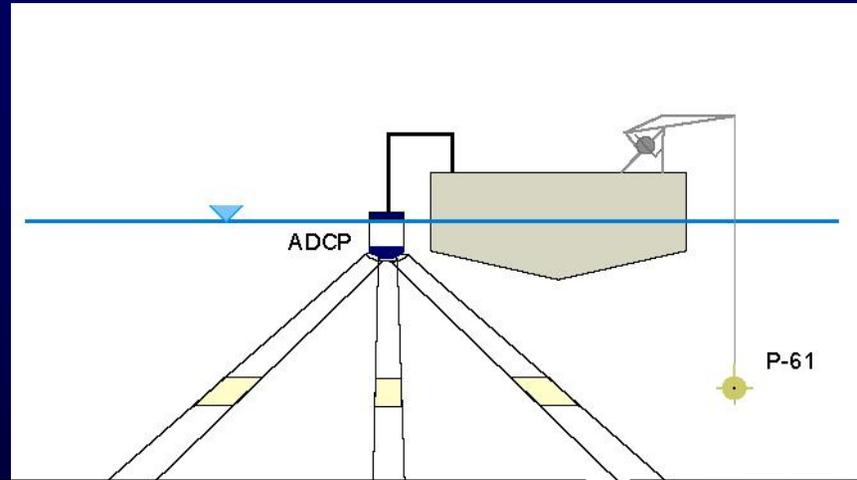# Load Computations

Suspended Sediment Load = SSC * Q

- Suspended Sediment Ratings
  - Acoustic Backscatter $\rightarrow$ Concentration
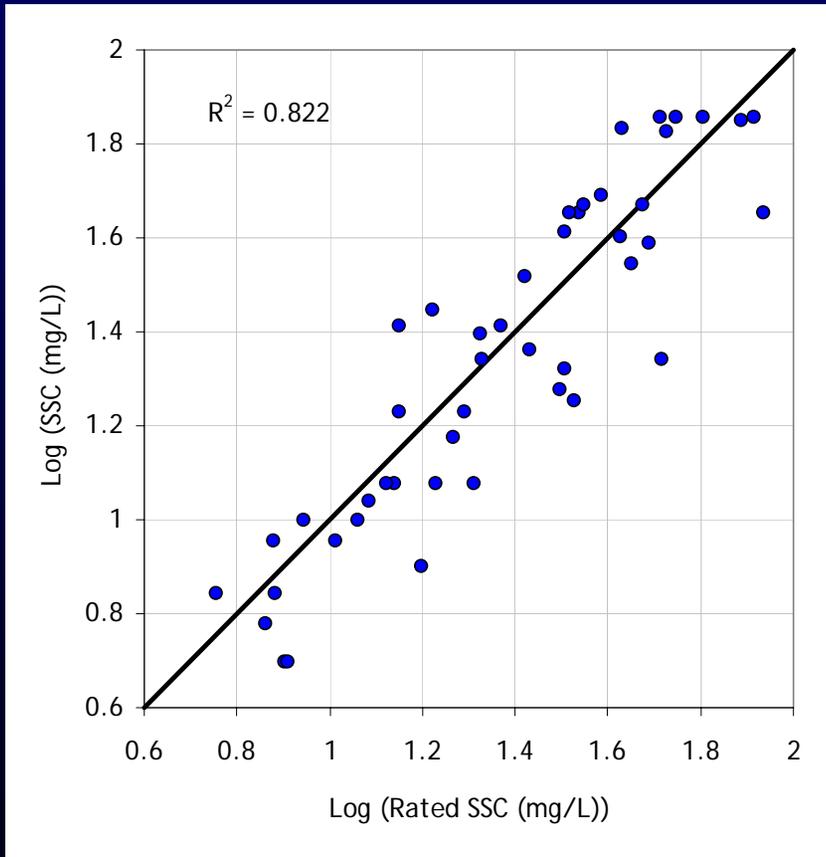 - Uplooker ABS $\rightarrow$ Cross Section ABS
- Discharge Rating
  - Uplooker Velocity & Wind Stress $\rightarrow$ Discharge

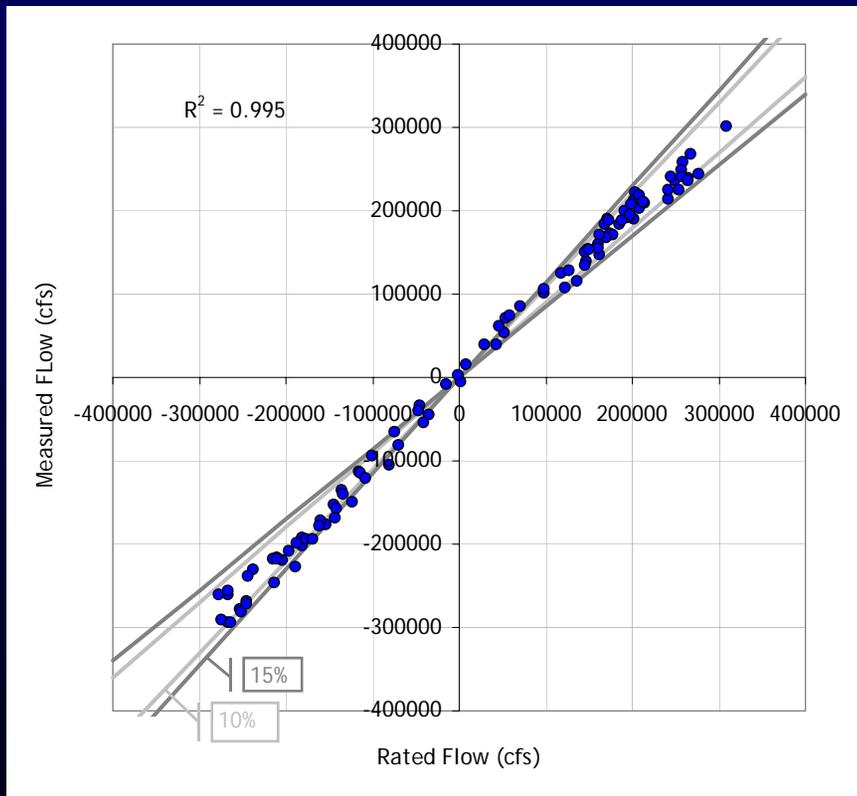# Backscatter – Concentration Rating Development

Backscatter-Concentration Rating

- Typical tidal range of ABS: ~15 dB

- Observed range of ABS: 65 – 100 dB

- Typical concentration: 25-100 mg/L

- Max concentration: ~200 mg/L

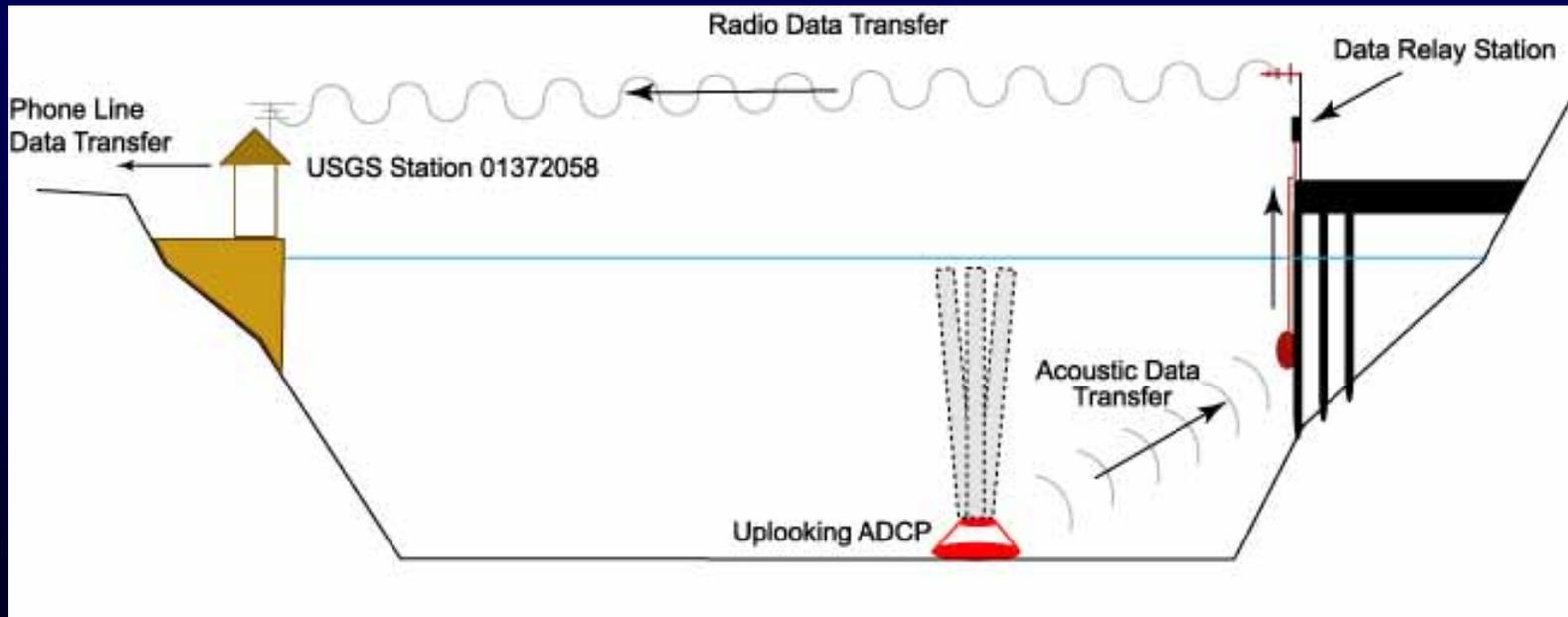$$SSC = 10^{(0.035 * ABS - 0.01 * Temp - 1.21)} * 1.055$$

Discharge Rating

- Typical tidal range ± 300,000 cfs
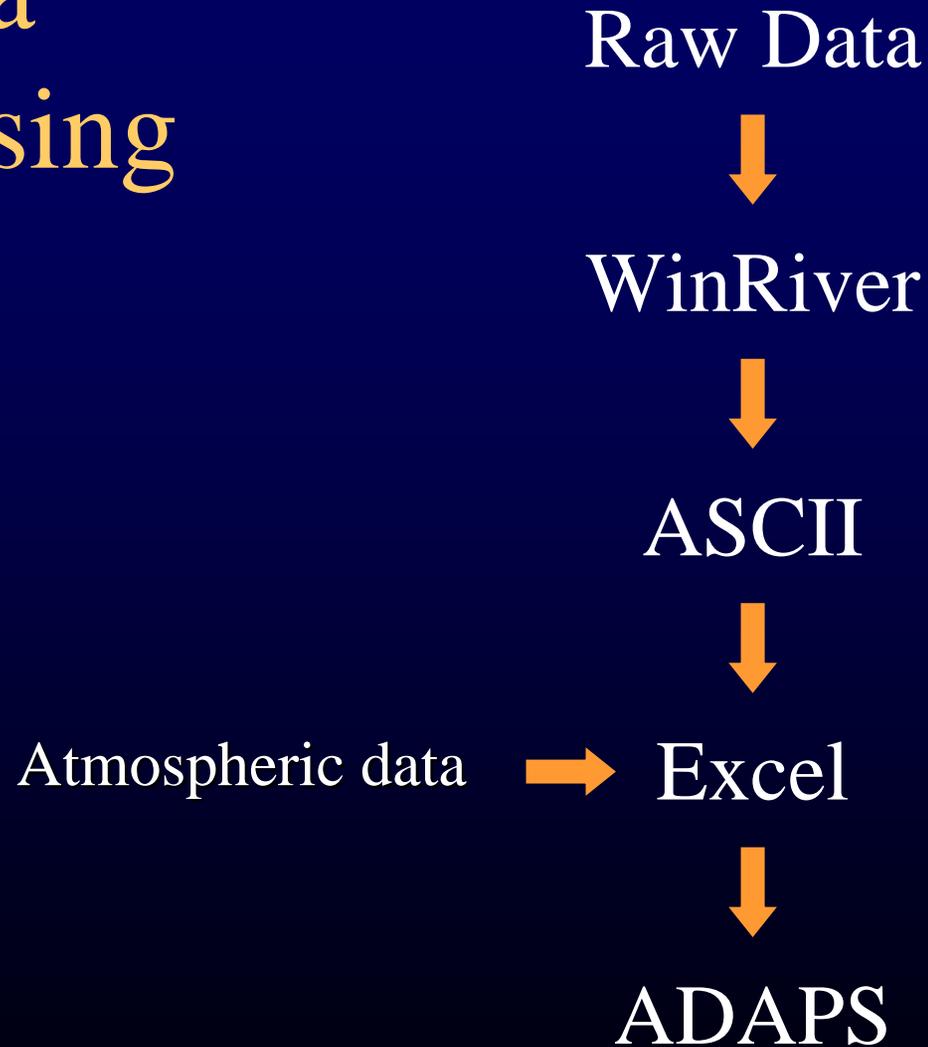- Peak flows: -345,000 & 380,000
- Max net flow: ~125,000
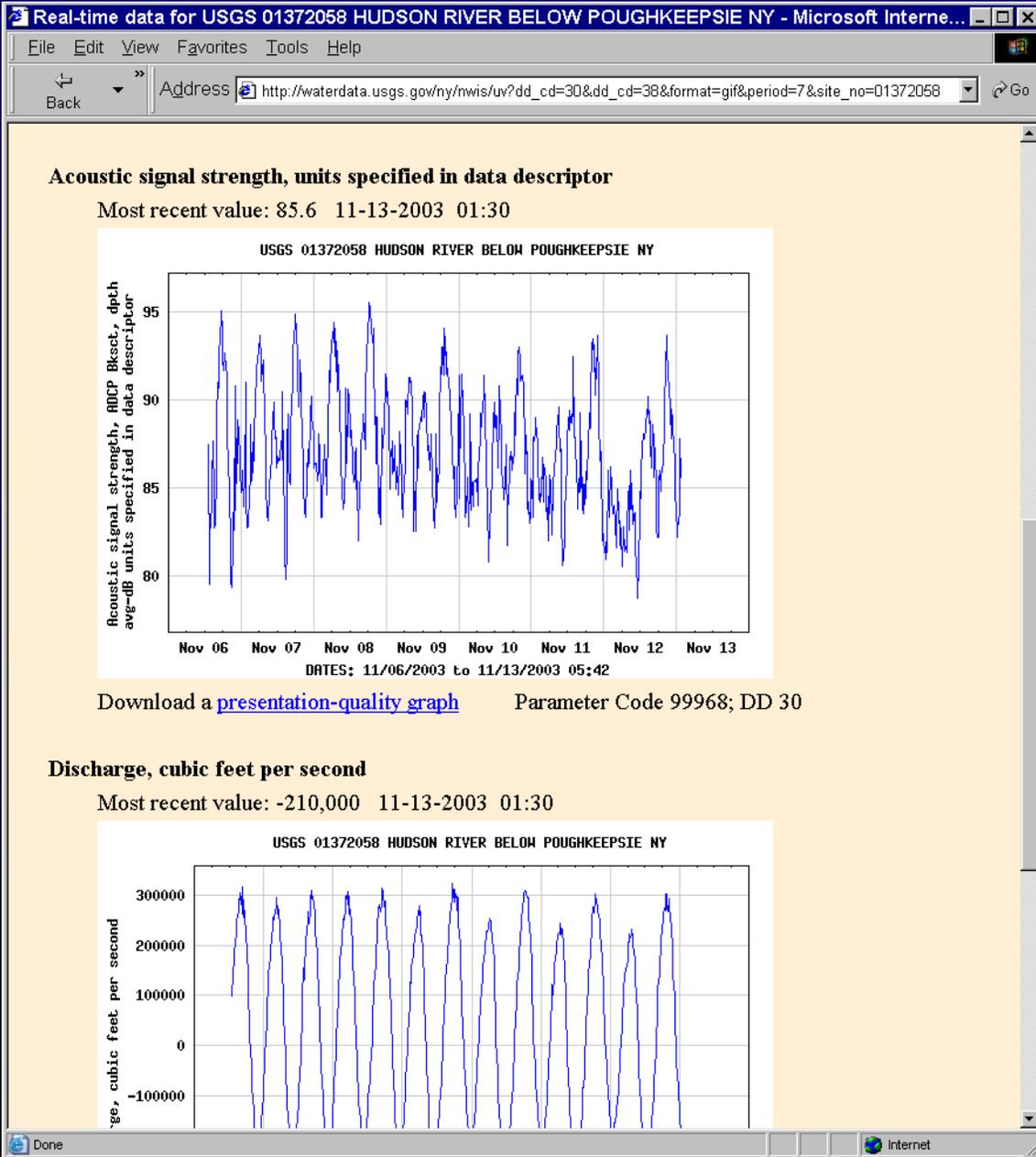
$$Q = 130,883 * Vel + 443.7 * Wind\ Stress - 14,244$$

Data Transfer

(not to scale)

Data Processing

Raw Data

↓

WinRiver

↓

ASCII

↓

Atmospheric data → Excel

↓

ADAPS

Near Real Time Data

- Velocity, backscatter and discharge data
- Updated daily

Questions?

For more information:

Poster session later today

Project web page:
http://ny.water.usgs.gov/projects/poused/