Circulation and Sediment/Contaminant Transport in the Newark Bay/Kills Complex.

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2,3,7,8-TCDD in Surface Sediments
Issues
1) River Flow
2) Tides
3) Meteorology

Estuarine Dynamics

Sediment Transport

Contaminants & Sediment

Dissolved Phase

Contaminant Transport

Suspended Phase
Study Site

- **Moorings**: ADP's, C-T, Pressure, OBS, LISST
- **Tide Gauges**

New Jersey

Arthur Kill

Kill van Kull

Newark Bay

Perth Amboy

Manhattan
In estuaries heavy salty sea-water slumps underneath the lighter seaward-flowing riverine water. This results in converging near bottom flows that accumulate suspended material near the head of the salt wedge.
Effects of Currents and the Location of a Source of Contaminants

Run 1
Steady Flow (10 cm/s)

Run 2
mean flow 10 cm/s + 75 cm/s tide

Run 3
Converging mean flow + tide

Run 4
Converging mean flow + tide

*Ah=50 m²/s in all simulations
Crosses show locations of CTD casts taken during ebbing tides on March 14, 2001.

Turbidity Maximum in the Arthur Kill

CTD/ADCP Section
Color - Velocity
Black - Salt
Red - OBS
Schematic of the Bottom Mean Flow

New Jersey

Daily movement at 5 cm/s

... may reflect sediment/contaminant transport
Tidal Effects
$T_c =$ Critical threshold for sediment resuspension
Sediment Resuspension = (U_{excess})^2
Evidence of Flood tide resuspension in Newark Bay

....But meteorologically forced resuspension in the Arthur Kill
Average backscatter on the flood (blue) & ebb (green) tide
Schematic of Tidally Driven Sediment Transport

Mean Tidal excursion in Kills

Tends to Augment Mean flow sediment transport.

Pattern Enhanced during high river flow
Meteorological Effects
Dec 2000

Meteorologically forced flow-through flushing event in the KVK and Arthur Kill
Two modes of meteorologically forced flows in the Kills

Emptying/filling mode
Day 81

Flow through Mode
Day 63
Flow pattern following passage of low...may reflect transport associated with episodic events
Summary and Preliminary Conclusions

1) Tidally Mean Flows
   • Persistent 2-layer at Newark Bay
   • Influenced by meteorological forcing in the Kills
   • Weak in the KVK

2) Tidal period motion traps sediment in Newark Bay
   • Enhanced with river discharge
   • Tends to augment mean flow
   • Important in KVK

3) Turbidity maximum in Arthur Kill

4) Meteorological effects significant in Kills