Planning Velocity Field Surveys with ADCPs

First and Foremost

1. Define the objectives for the study
2. Define the data required to meet your objectives (make a data wish list)
3. Determine what instruments you need to obtain the required data
4. Decide how you will process and visualize the data

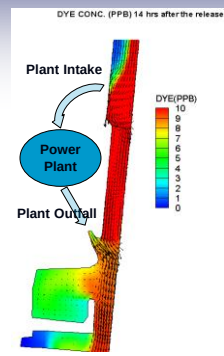
Example

Objective:

Determine the impact of cooling water use by a coal-fired power plant on the discharge and velocity distribution in an urban canal.

What data are required?

What instruments are needed?



Types of Measurements

- Transects
  - Cross-sections
    - Discharge & velocity distribution
    - Secondary flow through bends/confluences
  - Longitudinal
    - Flow over a set of dunes
    - Characterization of velocity magnitude through a reach (quick assessment)
- Sweep
  - Dense coverage, serpentine path
- Stationary (at-a-point)
  - Time-series analysis (turbulence, mixing)

Navigation

- Use navigation software when available
- Plan your survey before you get in the field (modify in the field if necessary)
- Examples: Hypack, Fugawi, HotMaps (for use with echosounders with GPS), Google Earth (with GPS and data link), ArcGIS10
- Can't overlook the importance of good navigation and proper planning

Laying Out Plan Lines

- Tips
  1. Create more plan lines than needed (allows flexibility in the field)
  2. Sample in both space and time

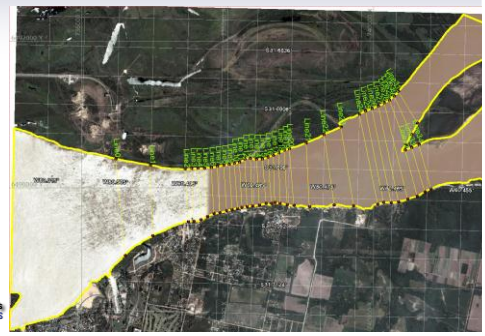
     (use a combination of transects, longitudinal, and stationary measurements)

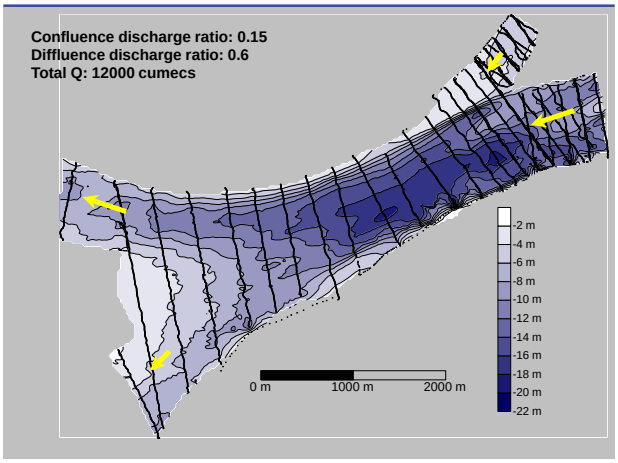
Class Exercise

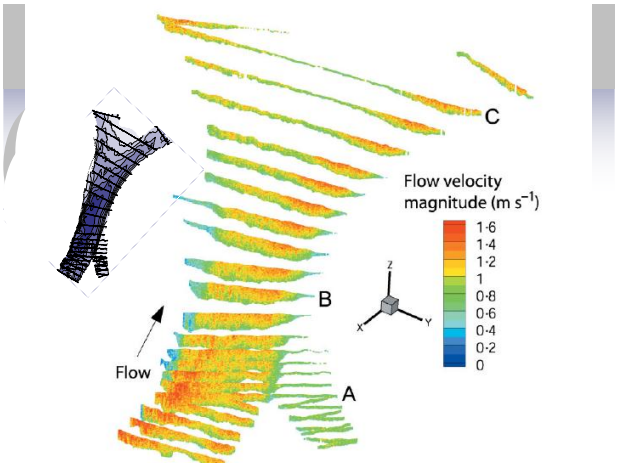
- WHERE to MEASURE
  - Around a bend

Class Exercise

- WHERE to MEASURE
  - At a confluence/bifurcation



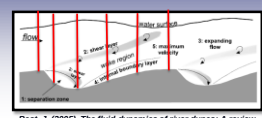




More Confluences/Bifurcations

Class Exercise

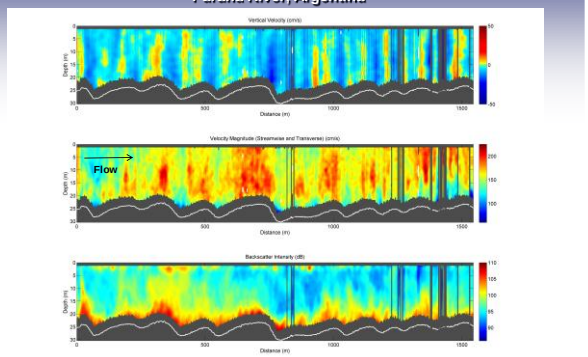
- **WHERE to MEASURE**
  - **Through a dune field**



Best, J. (2005), The fluid dynamics of river dunes: A review and some future research directions, J. Geophys. Res.

Dune Field

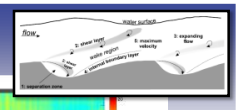
Parana River, Argentina

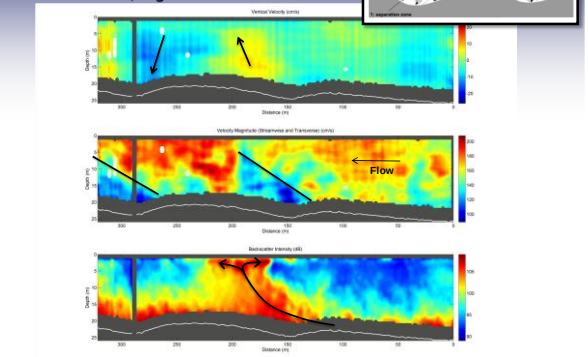


HydroAcoustics USGS

Dune Field

Parana River, Argentina





HydroAcoustics USGS

Class Exercise

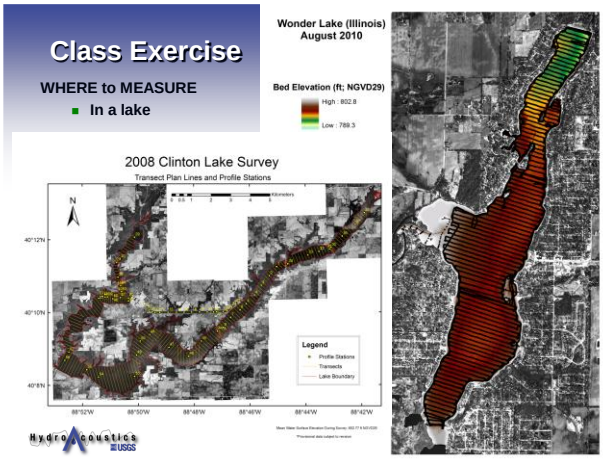
- WHERE to MEASURE
  - Near a structure

HydroAcoustics USGS

Class Exercise

WHERE to MEASURE

- In a lake

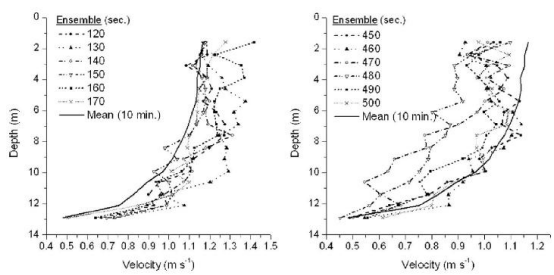


Scales and Location

- Need to consider…
  - Time
  - Space
- WHERE TO MEASURE and WHAT to AVERAGE!
- Interested in turbulent structures?
  - Don't average out the structures

Averaging in Time

- How long to average?



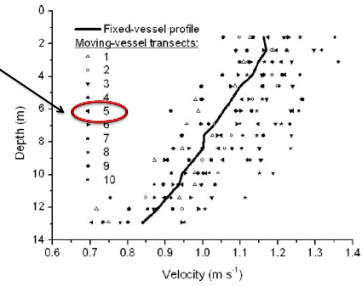
Averaging in Space

- How many transects to average at a section to get a stable time-averaged map of the flow field????

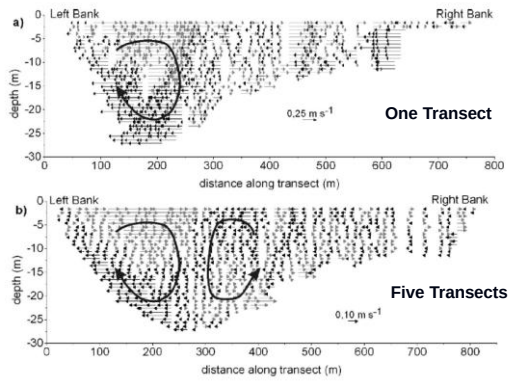
Recommendation from Szupani et al. 2007

However, limited data from one site

We recommend always collecting reciprocal pairs for assessment of directional bias

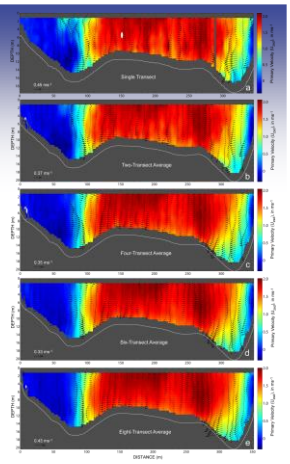


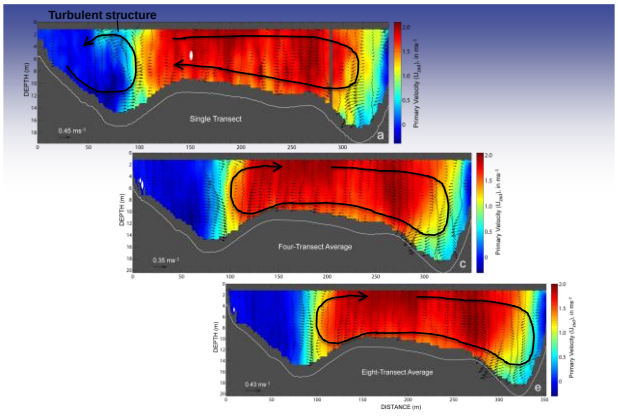
Secondary Flows



Recommendations Revisited

VMT provides tools to allow us to revisit these recommendations using a range of flows and data sets

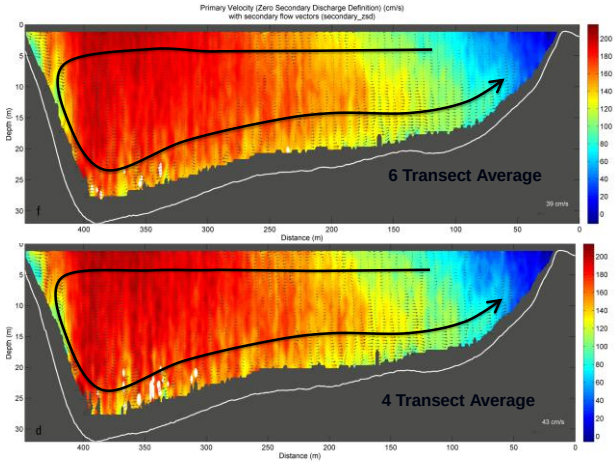




Conclusions

- Have well defined objectives prior to heading to the field
- Consider temporal and spatial scales and averaging during planning
- Be clear what averaging is needed BEFORE the survey

Questions?


Primary Velocity (Zero Secondary Discharge Definition) (cm/s)
with secondary flow vectors (secondary_ztid)
Depth (m)
Distance (m)
6 Transect Average
f
39 cm/s
4 Transect Average
d
43 cm/s