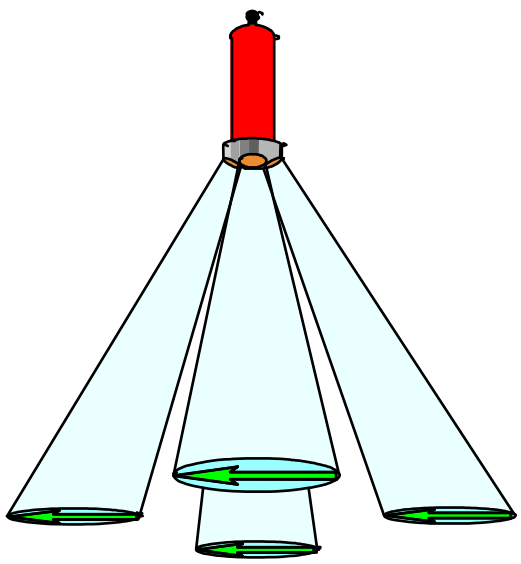
Velocity Mapping with ADCPs

Limitations and Considerations

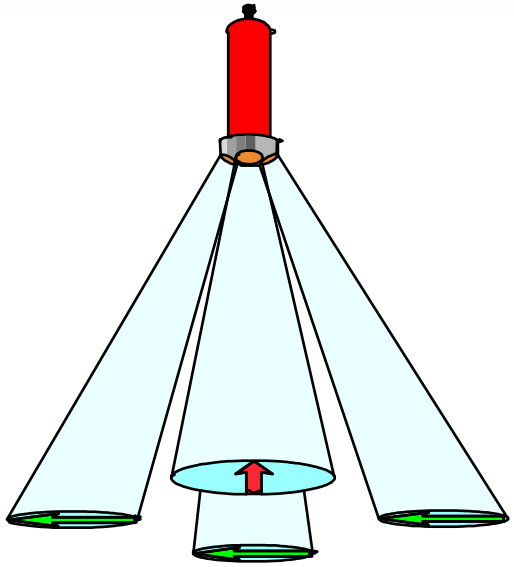
Hydro Acoustics
USGS

Things to Consider

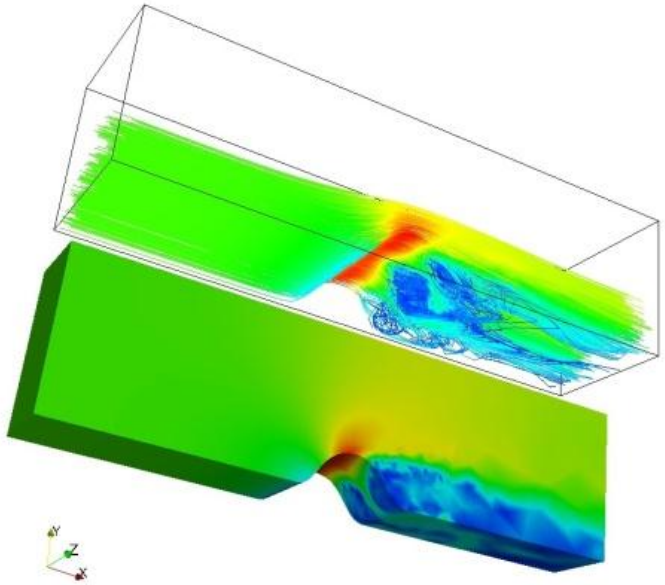
- **The ADCP assumes a homogeneous flow when computing velocity components from beam velocities**



HOMOGENEOUS



NONHOMOGENEOUS



DNS from
Hoffman & Johnson
2009

Things to Consider

- The assumption of flow homogeneity is likely violated more often than we think
  - especially in areas of interest for velocity mapping
- Can be assessed (to some degree) by looking at the error velocity

The Million Dollar Question:

How well are we representing the flow field with measurements from an ADCP?

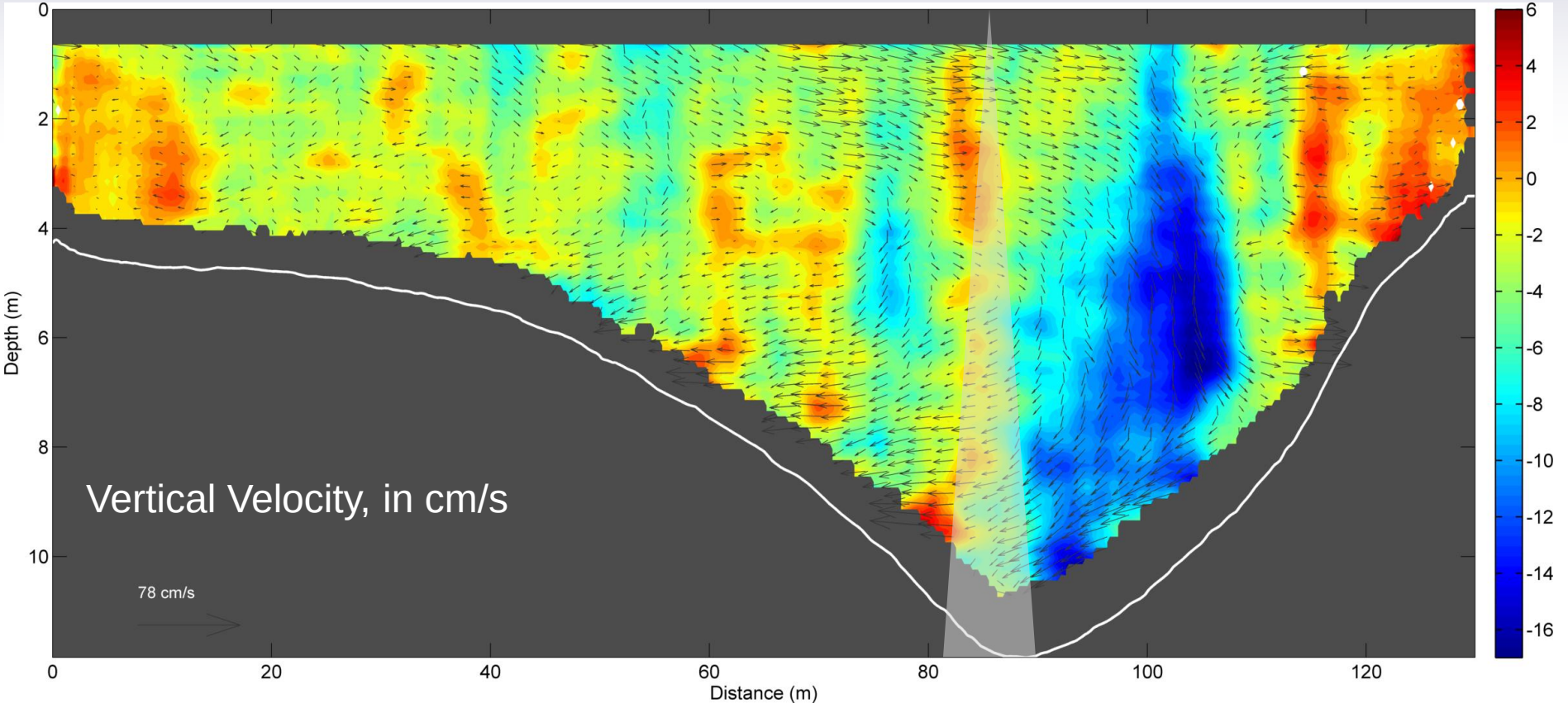
Further Questions

- What scales of the flow are accurately represented and what scales are lost?
- What are we gaining/losing when we apply spatial averaging?
- How does temporal averaging (or transect averaging) affect the results?

Results should depend on distance from the instrument and flow depth (due to diverging beams)

Resolution of Flow Structure:

Wabash River



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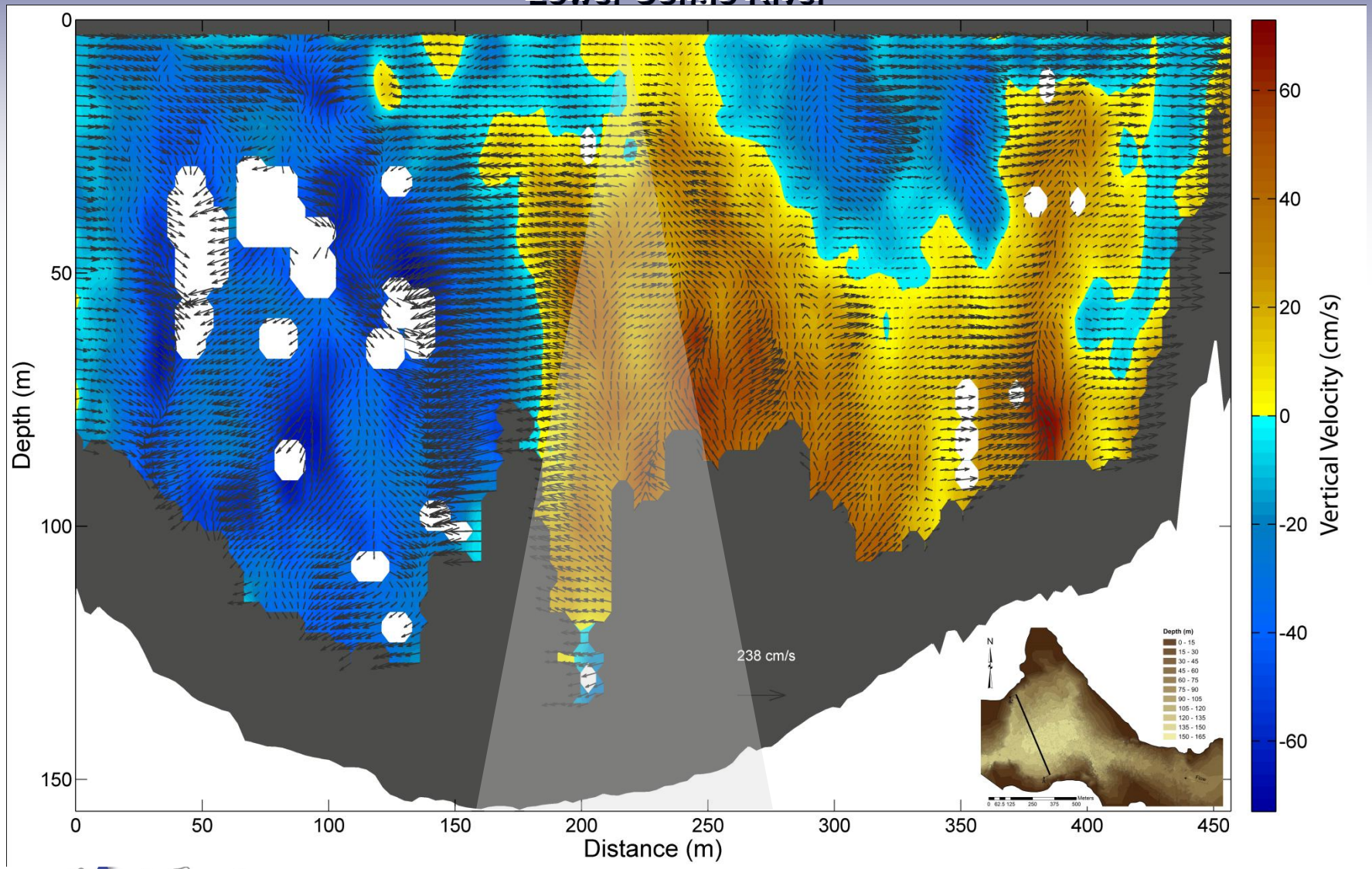
Resolution of Flow Structure:

Lower Congo River



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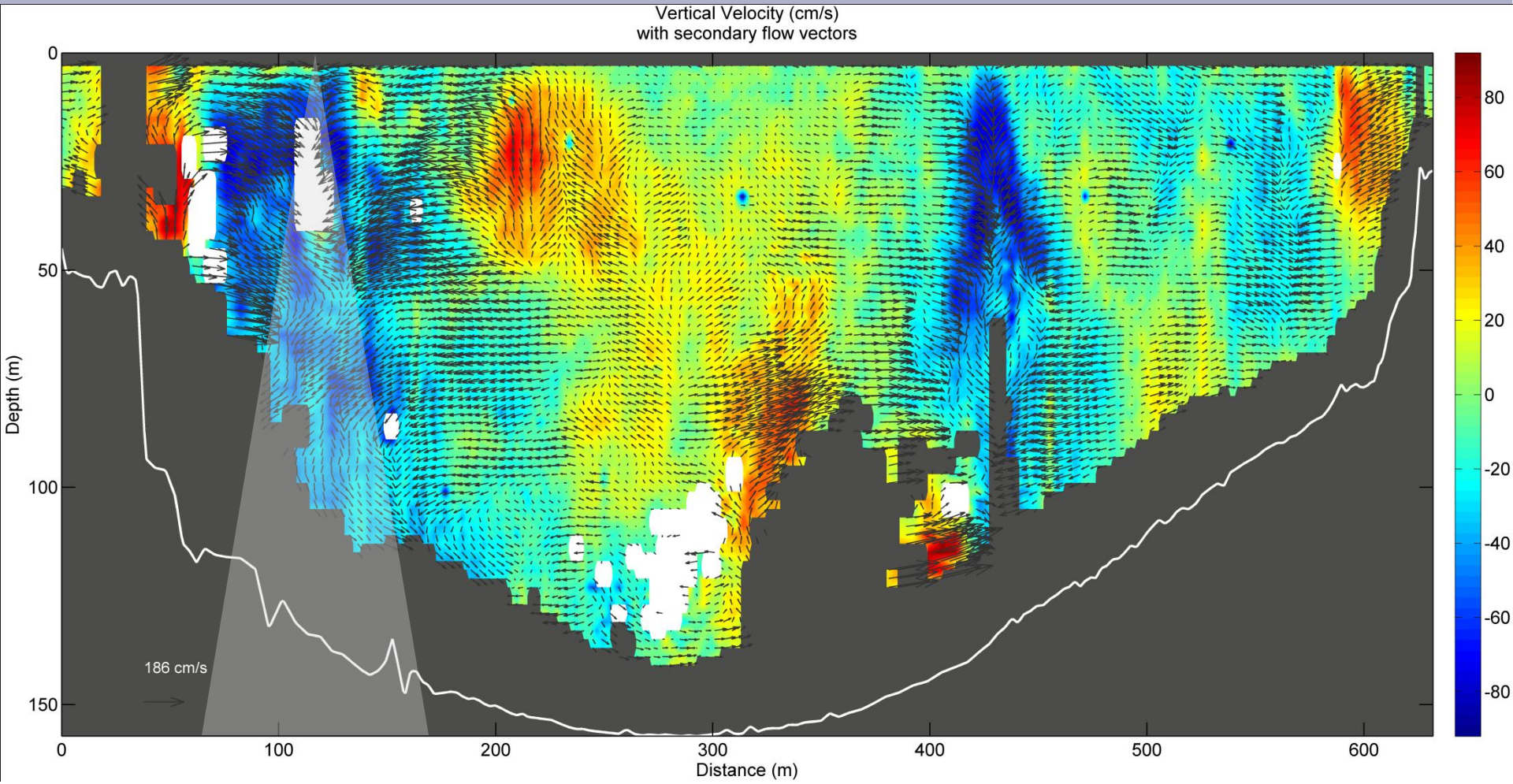
Resolution of Flow Structure:

Lower Congo River



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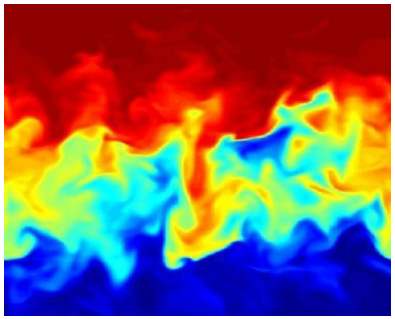
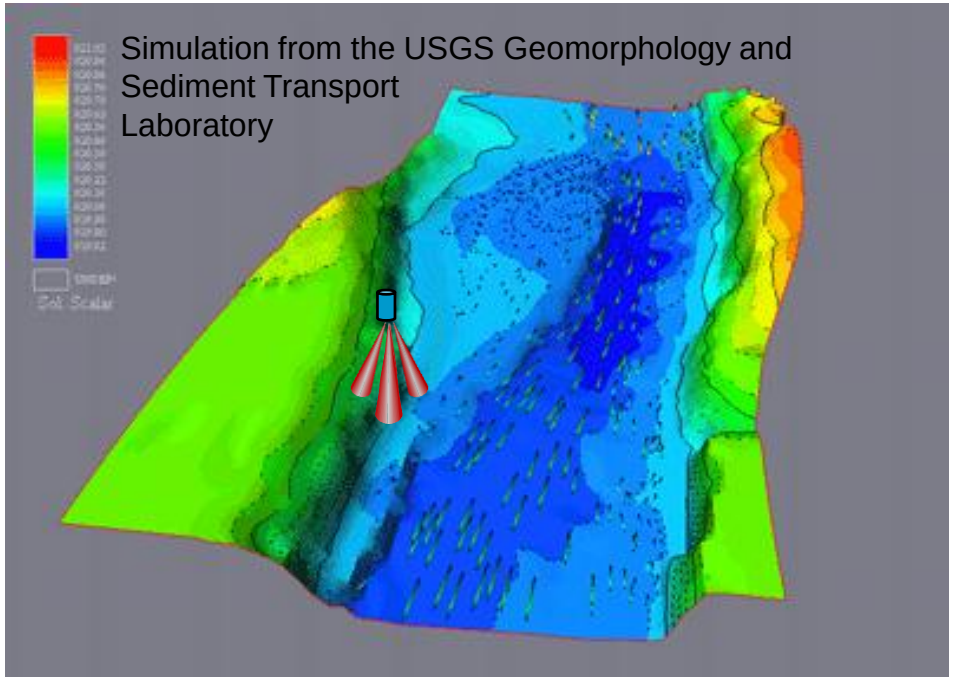
Validation

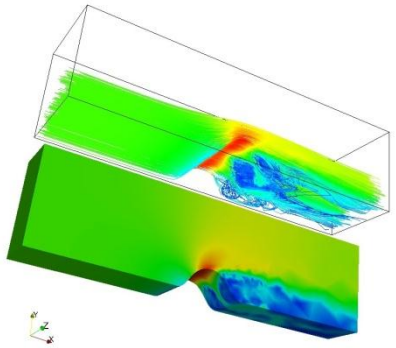
Typically, models are calibrated and validated using field or gage data

Can we use computational data to validate our ADCP-derived velocity distributions?



DNS from
de Bruyn Kops
and Riley 2001





DNS from
Hoffman & Johnson
2009

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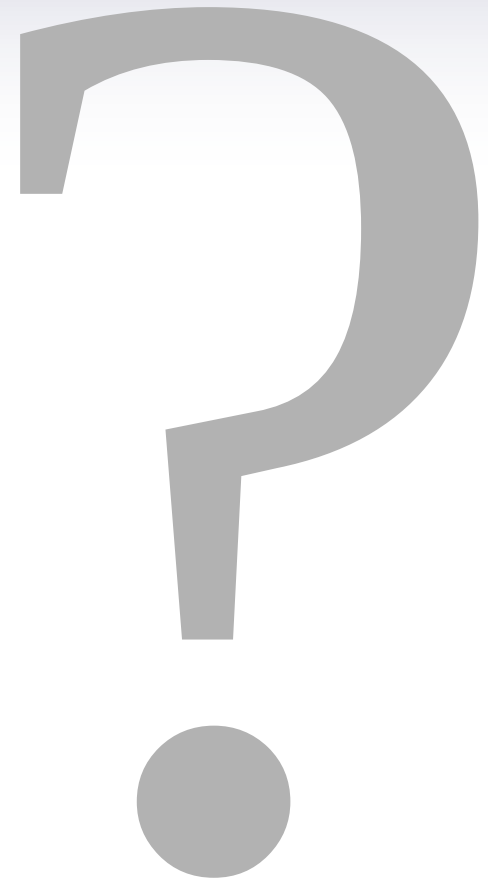
Additional Issues/Considerations

- Vertical velocity bias
- Flow disturbance (instrument and boat)
- Temporal variability can translate to spatial variability
  - Reachwise surveys can take time and flow may not remain steady
  - Flow fluctuations may be present especially at sites where velocity mapping may be needed (near structures, bends, confluences, bifurcations, etc.)

Questions?



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