An experimental study on the displacement of large wood in river channels

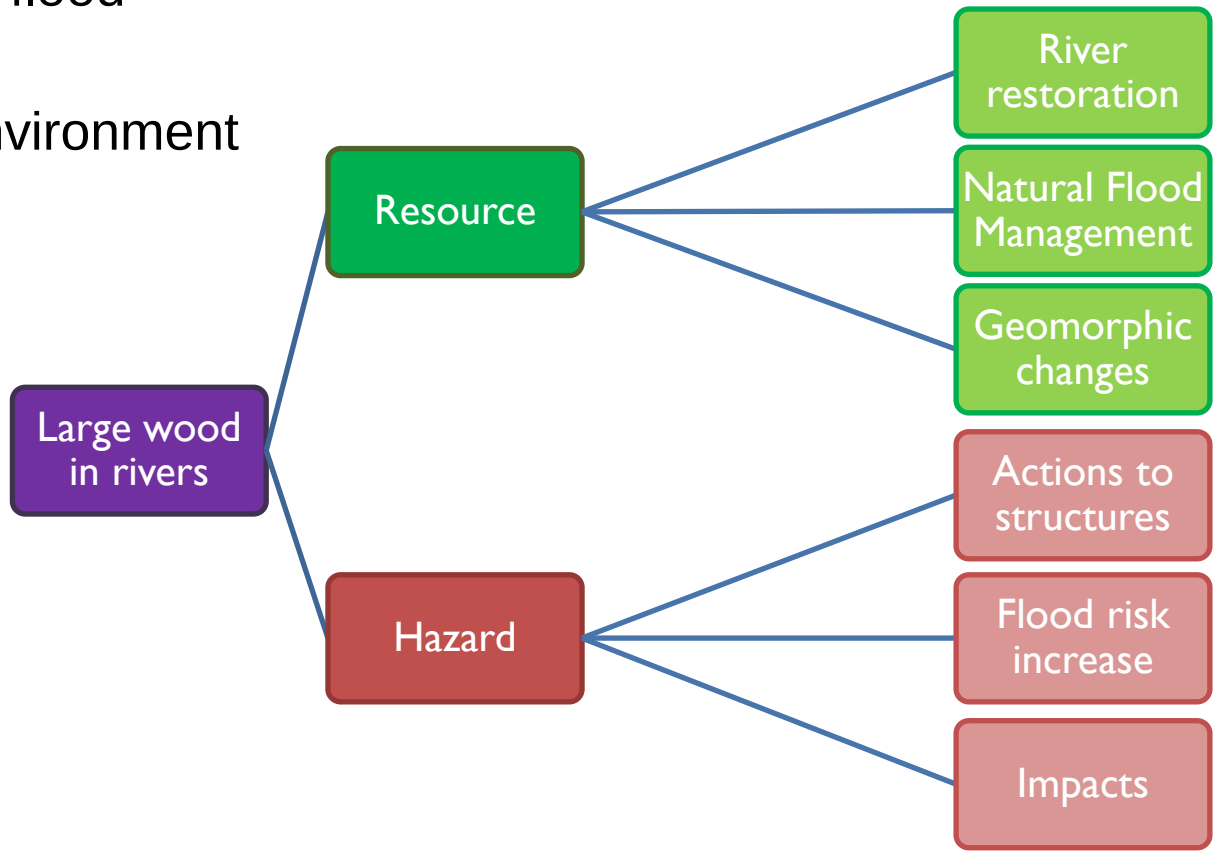
Dr Diego Panici
Dr Georgina L. Bennett

25th May 2022

Natural Environment Research Council
SENSUM

Large wood in rivers

- Useful for aquatic environment and flood management
- Harmful to human lives and built environment



Large wood in rivers

- **Benefits**
  - Restoration of fish and aquatic life habitat
  - Flood mitigation measures (e.g. flood peak delay, out of bank flow)
  - Banks stabilisation
  - Introducing variability in the geomorphology of the river

An example of Large Woody Debris Dam in Yorkshire to encourage out of banks flow. Source: Environment Agency

Large wood in rivers

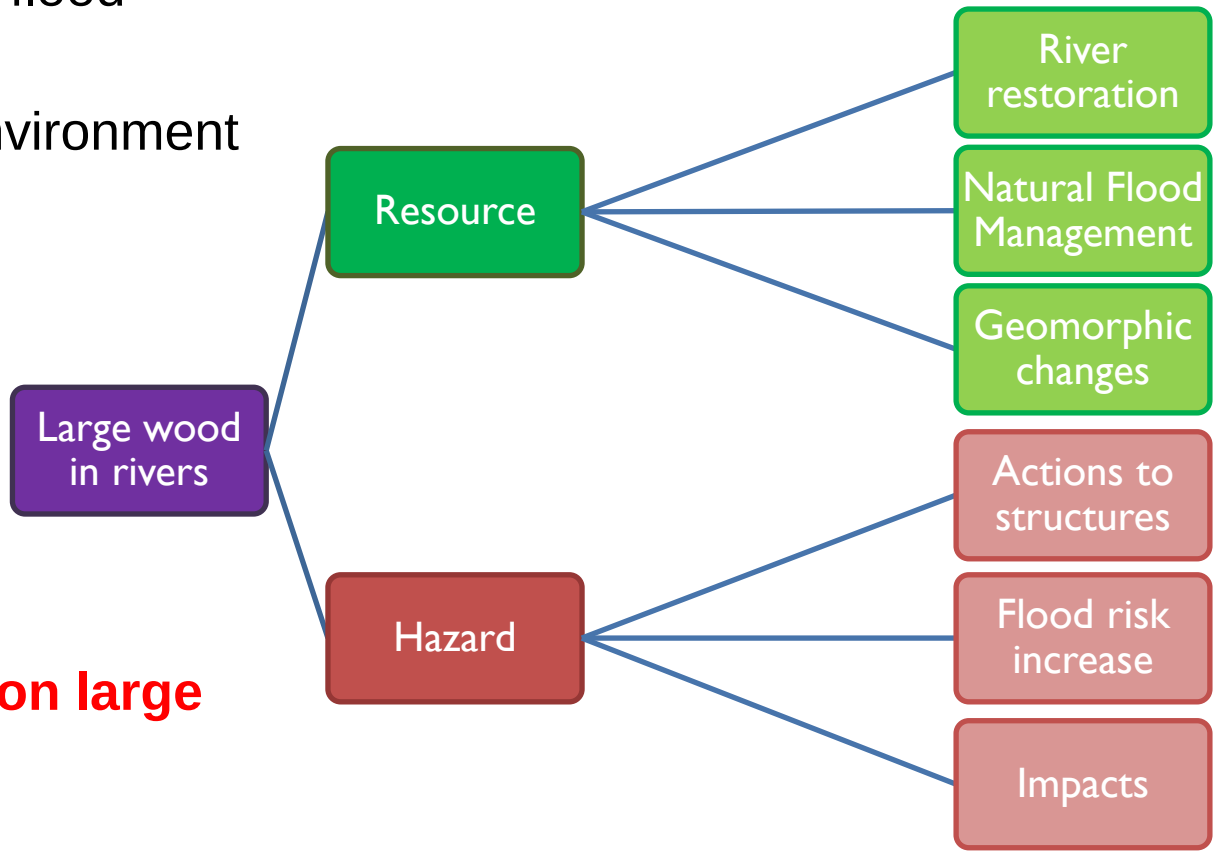
- **Risks**
  - Damage to bridges and structures from impact
  - Debris accumulations may cause increased scour and bridge collapse
  - Can block bridge or culvert openings and cause large afflux upstream

Bridge failure in Oklahoma, USA. Source: Bradley et al. (2005).

Large wood accumulation at Worcester bridge in February 2014, Worcester. Source: BBC.

Large wood in rivers

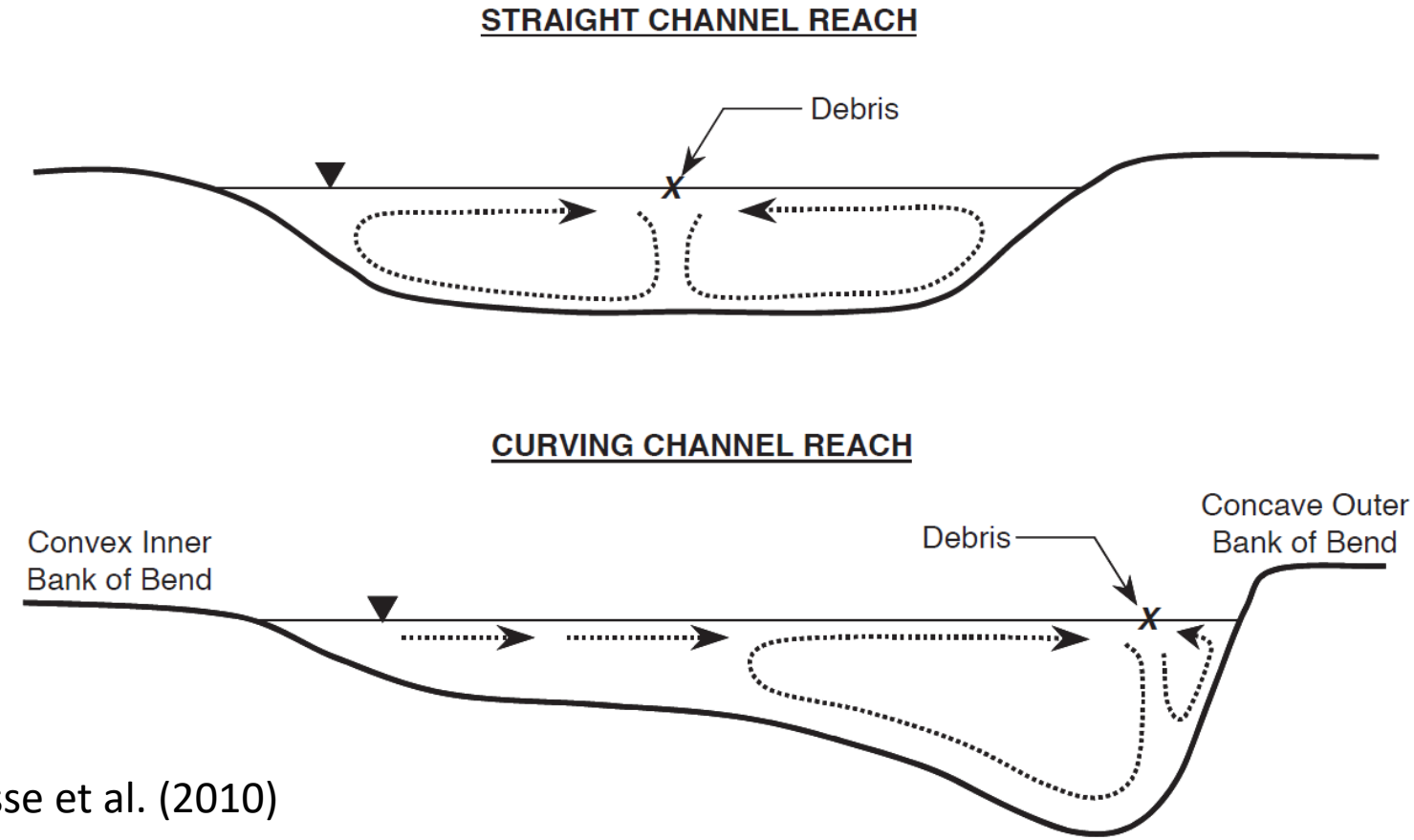
- Useful for aquatic environment and flood management
- Harmful to human lives and built environment



- **Processes depend substantially on large wood transport in rivers**

Large wood in rivers

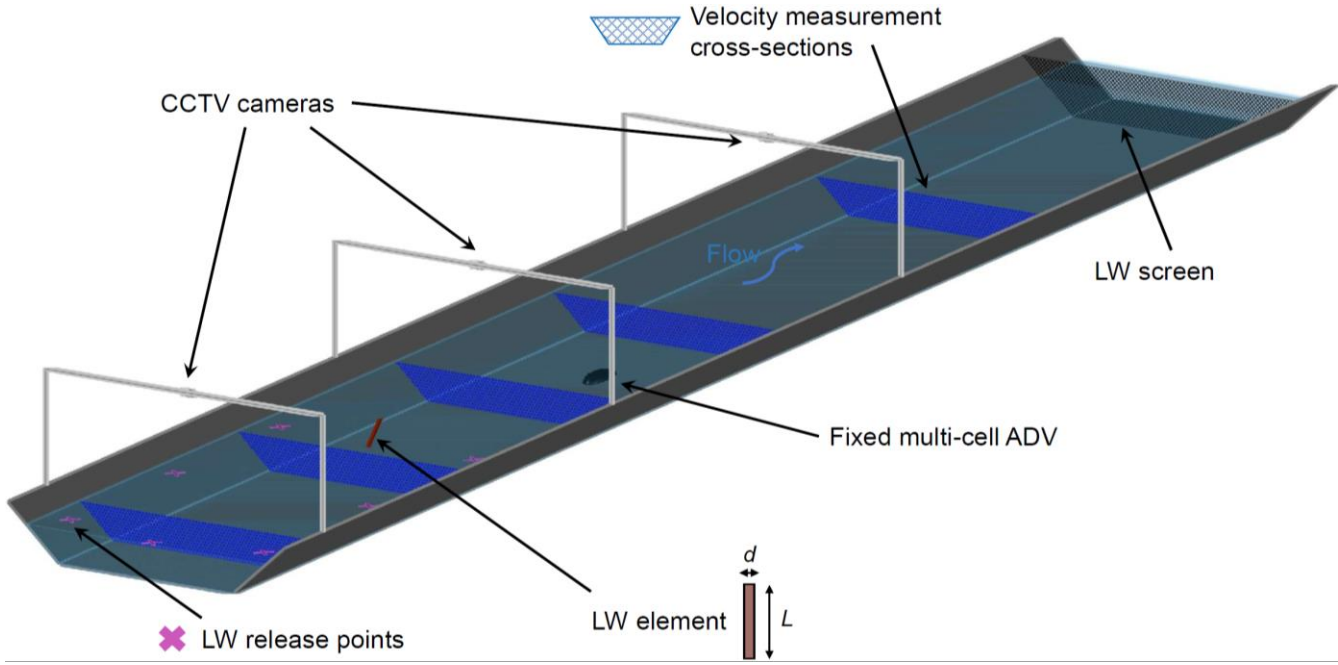
- Past (unproven) theory suggested that large wood (LW) travels at convergence points



Source: Lagasse et al. (2010)

Experiments

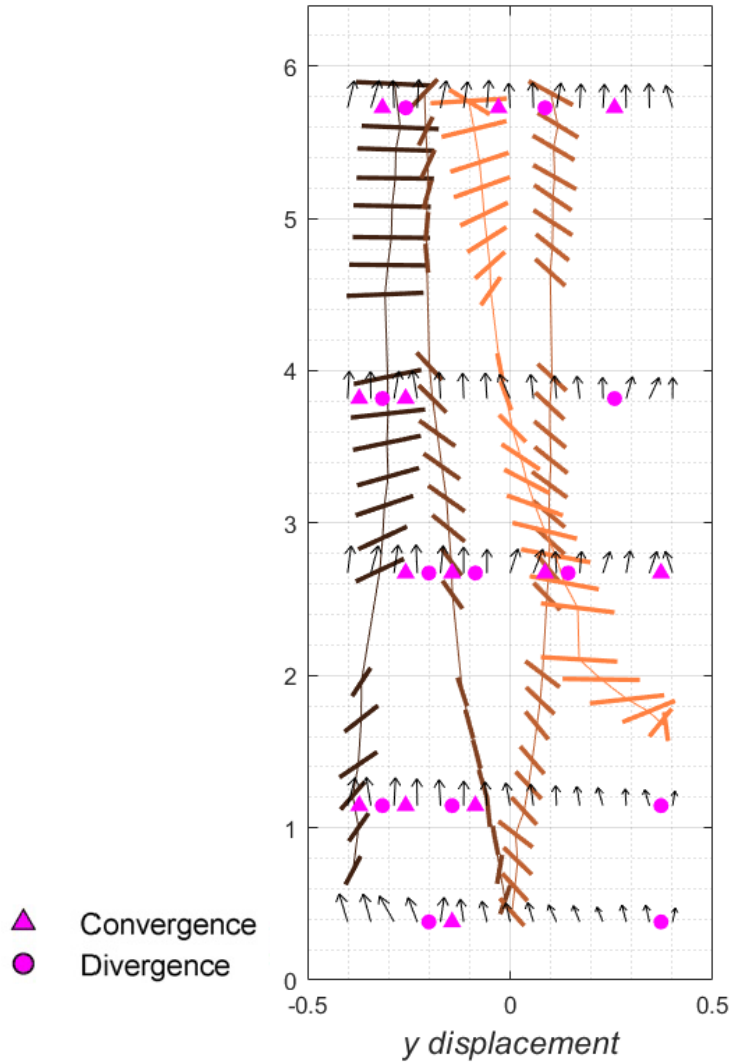
- Laboratory experiments at University of Southampton trapezoidal flume
  - Tracking LW trajectories
  - Comparing flow velocity with LW position
  - Natural sticks used to mimic full-scale LW
  - 7 different LW release points
  - 3 different flow conditions



Source: Panici (2021)

Results

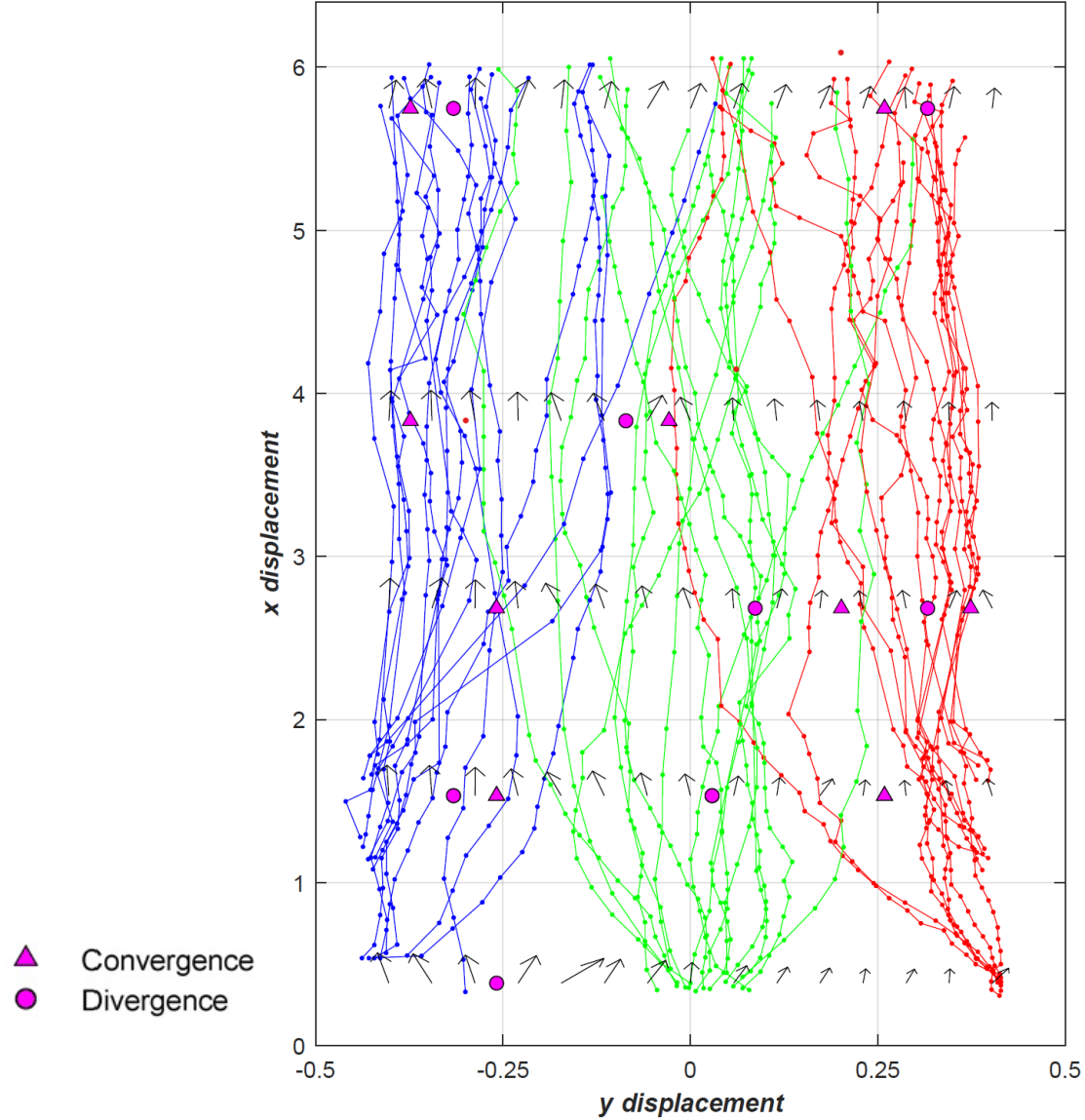
- LW motion involves combination of rotations, translation and displacement



Source: Panici (2021)

Results

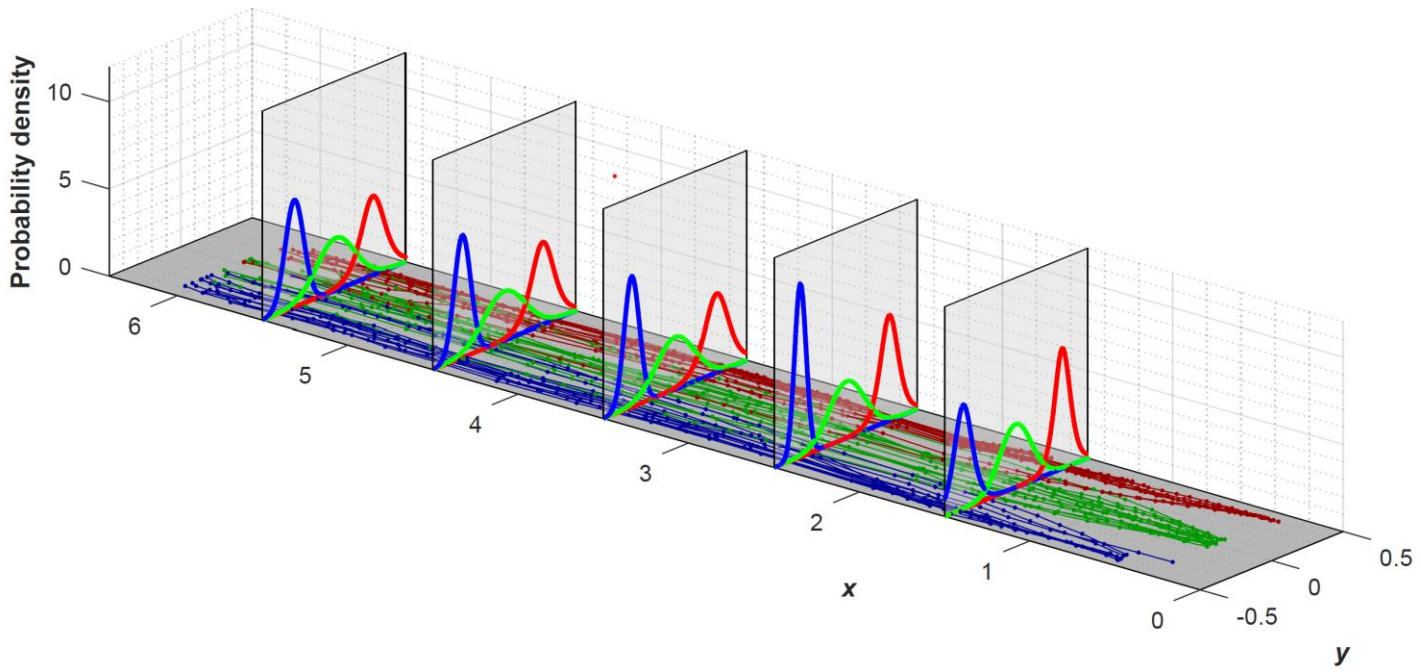
- LW motion involves combination of rotations, translation and displacement
- Little correlation between convergence points and LW motion
- Initial transient motion is important



Source: Panici (2021)

Results

- LW motion involves combination of rotations, translation and displacement
- Little correlation between convergence points and LW motion
- Initial transient motion is important
- Tendency to remain within well-defined areas of the channel after initial transient



Source: Panici (2021)

Conclusions

- Past theories on LW transport in rivers were not confirmed experimentally
- Types of motion include rotation and translation
- LW overall motion followed well-defined trajectories and remained within a limited portion of the channel
- An initial transient motion determines the LW position in the long term

Thank you!

d.panici@exeter.ac.uk
g.l.bennett@exeter.ac.uk