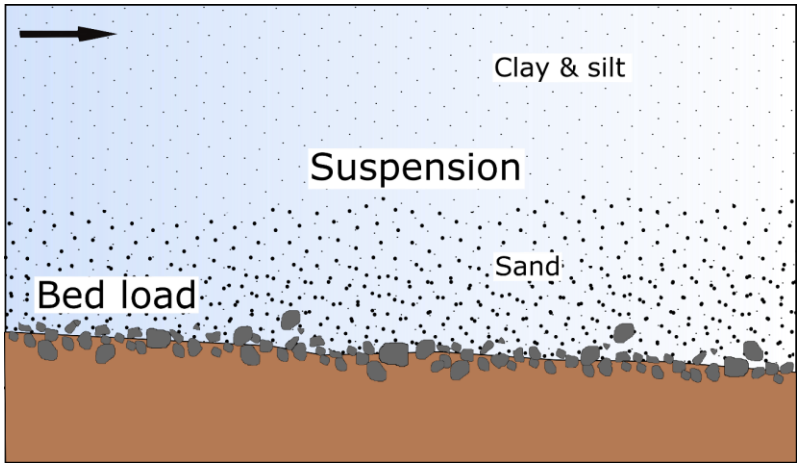
Establishing time series of concentration and grain size of suspended sand in rivers using an acoustic method

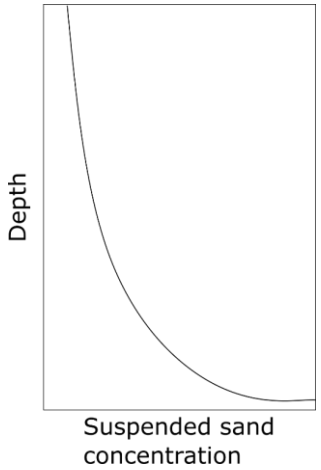
Jessica Laible[1], Benoît Camenen[1], Jérôme Le Coz[1], Guillaume Dramais[1], François Lauters[2], Gilles Pierrefeu[3]

1) RÉPUBLIQUE FRANÇAISE Liberté Égalité Fraternité INRAE 2) EDF 3) CNR

Sediment transport in rivers

- Transport by suspension or bedload
- Focus on suspension:
  - Bimodal distribution: fines and sand
  - Suspension: Concentration of sand-sized particles increases with depth



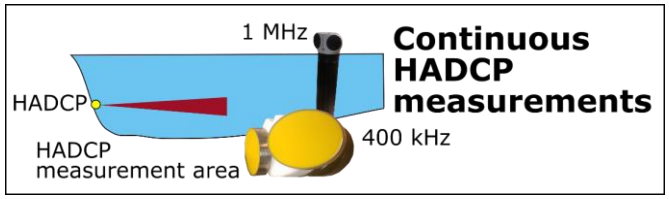


Measurement by
- Direct sampling
- Indirect measurement

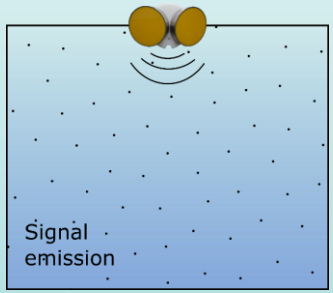
Aim of research:
Establish continuous time series of concentration and grain size of suspended sand using an acoustic method

Developping a bi-frequential method

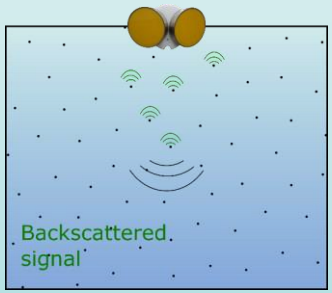
Based on Topping & Wright 2016, Moore et al. 2012, Vergne et al. 2018



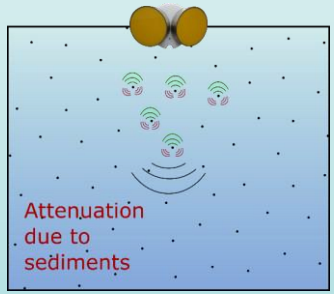
Horizontal Acoustic Doppler Current Profiler (HADCP)



Based on the principle of sonar and the Doppler effect



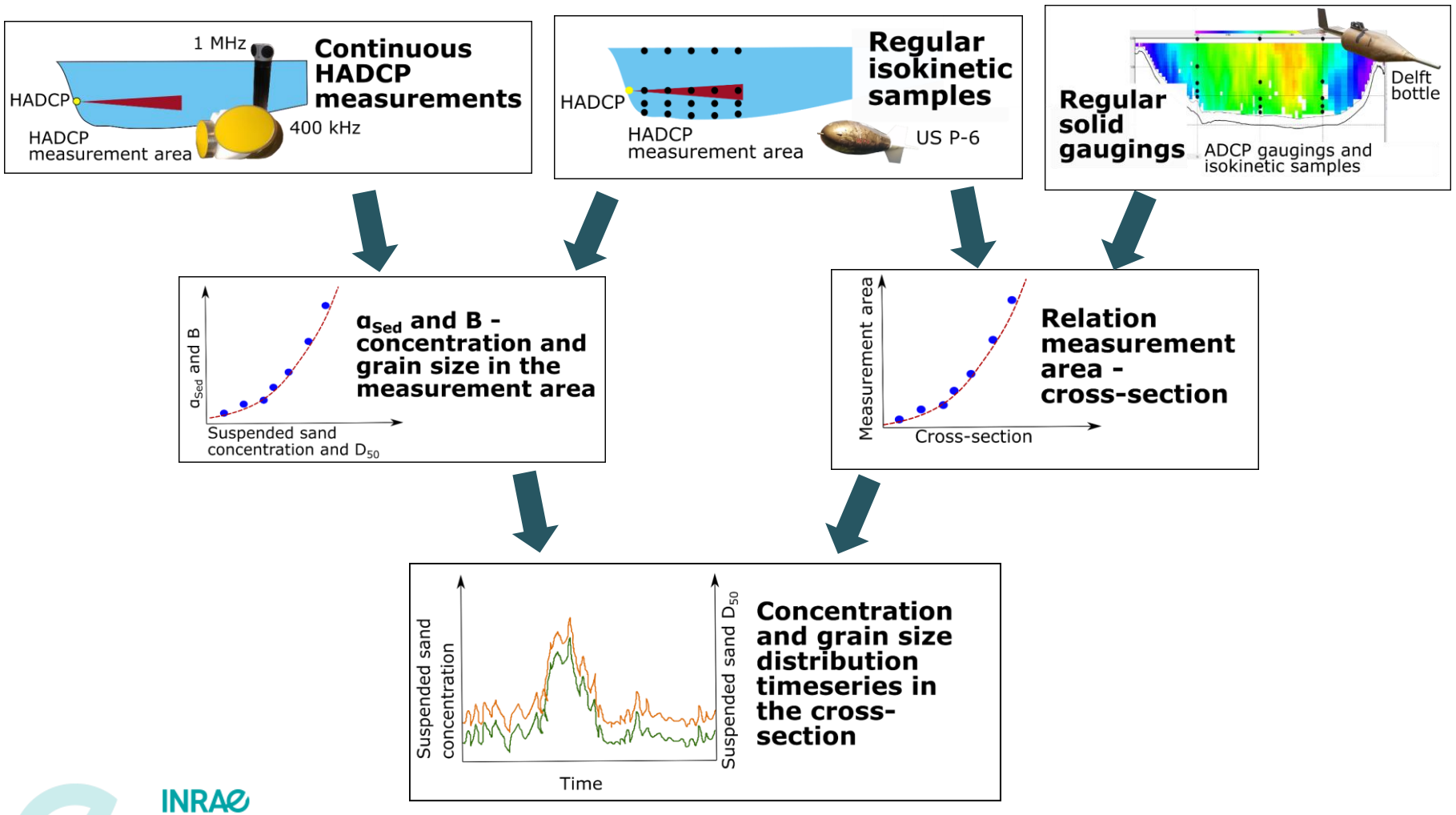
Backscatter (B)
Dominated by sand



Attenuation (α)
Attenuation due to suspended particles (α_{Sed}): Dominated by fine sediments

Developping a bi-frequential method

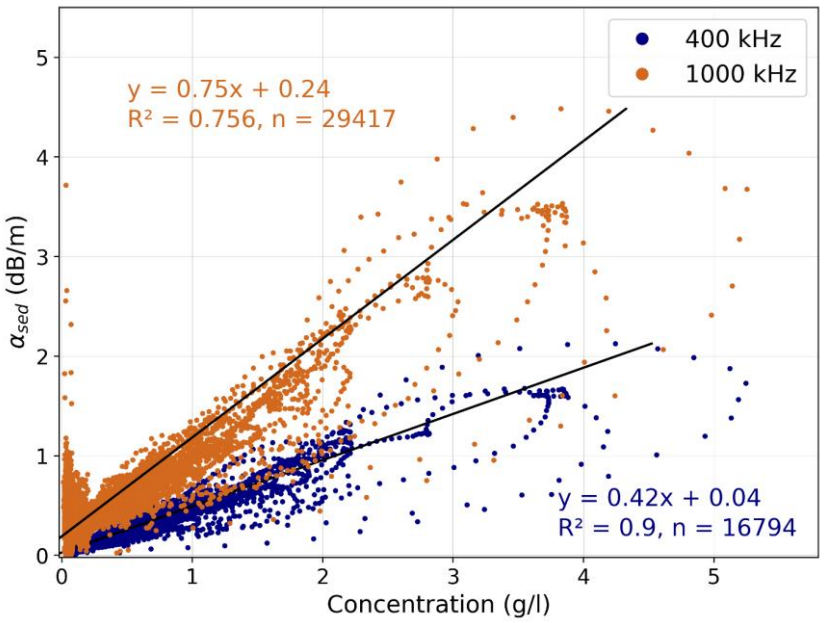
Based on Topping & Wright 2016, Moore et al. 2012, Vergne et al. 2018



Relation suspended sediment samples - α_{Sed} and $\bar{B}$

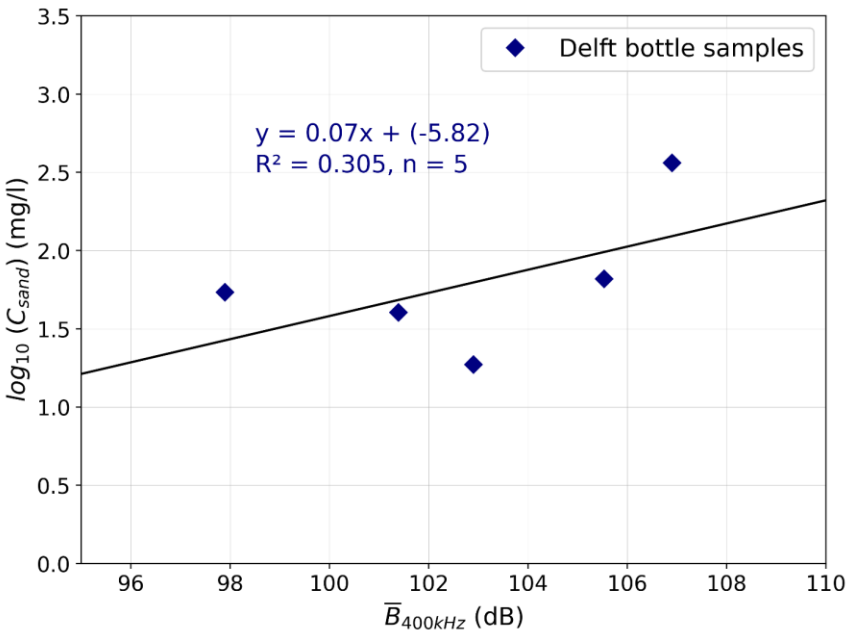
Fine sediments

α_{Sed} and concentration measured by turbidimetry



Sands

Beam-averaged backscatter $\bar{B}$ and Delft bottle samples



Conclusions and Perspectives

Conclusions

- Continuous deployment of 2 HADCPs since one year
- Regular sampling campaigns under various hydro-sedimentary conditions
- Calculation of α_{Sed} and $\bar{B}$
  - α_{Sed}: good relation with sampling data (concentration)

Perspectives

- Use both frequencies to estimate sand grain size distribution
- Evaluate existence and influence of changes in grain size distribution on α_{Sed} and $\bar{B}$



Thank you for your attention!

Jessica.laible@inrae.fr
@laible_jessica




RÉPUBLIQUE FRANÇAISE
Liberté Égalité Fraternité

INRAE

EDF

CNR