Uncertainty analysis of sedimentation measurement in complex floodplains: A case study in the Mekong Delta - Vietnam

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Outlines

1. Study objective – study area
2. Monitoring network
   - Sediment trap
   - Trapping sites
   - Analysed datasets
   - Trap retrieval test
3. Uncetainty analysis
   - Monte Carlo scheme
   - Uncertainty bounds
4. Conclusion

Objective – Study area

Objective: Quantification of sediment–nutrient deposition including uncertainty in the Mekong Delta floodplains

The Mekong Delta:

Intensive rivers networks: 91.061 km

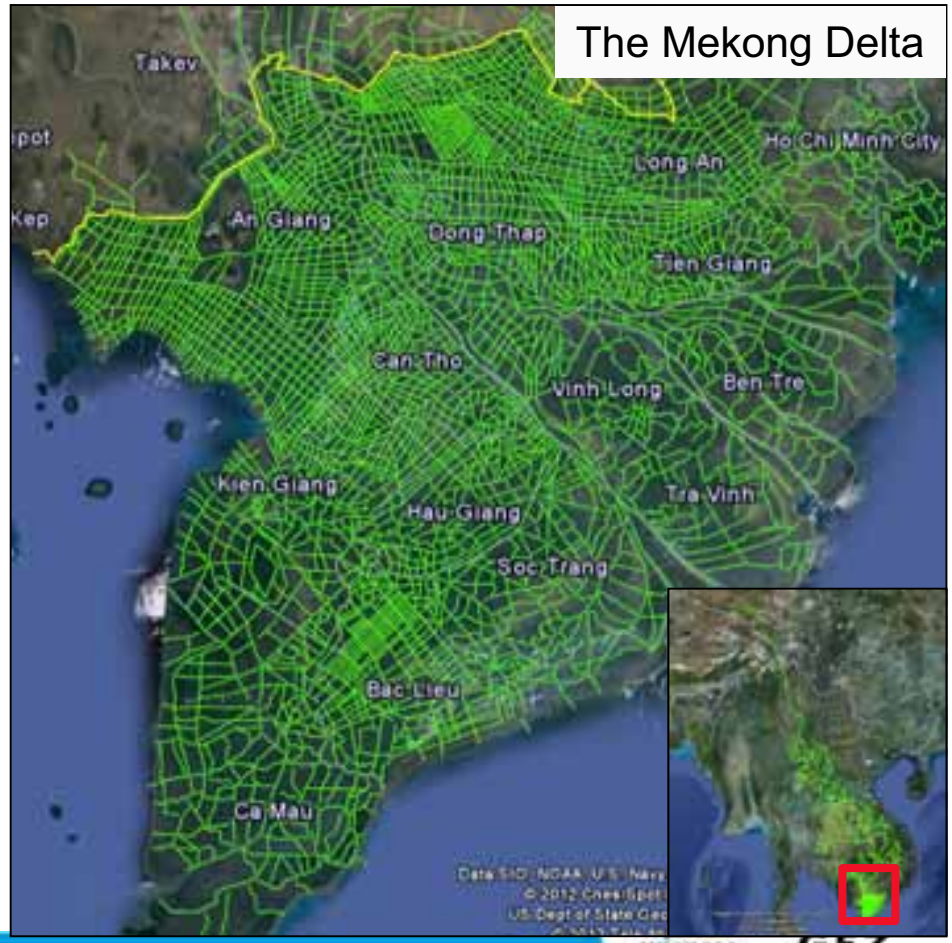
Inundation time is from 3-5 months

Intensive cultivation in floodplains

High uncertainty

Sampling uncertainty: => **cluster of traps**

Measurement uncertainty: in submerged condition => **retrieval test**



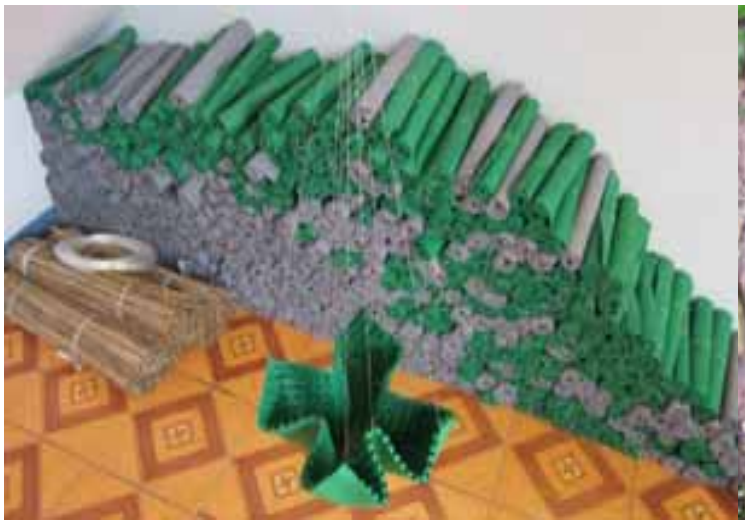
Monitoring network - Sediment traps

Field work: sediment trapping – in flood 2011 from August to December

Available method: Post-event surveys, conveyance losses, artificial marker horizons; erosion pin, **sediment trap.**

Trap design: Artificial grass: 30x 30 cm

8 fishing rod strings – working like bowl-shaped



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Monitoring network - Trapping sites

1. Identify the sediment trapping sites

   Flood depth

   a) 0 -1 m

   b) 1-2 m

   c) > 2m

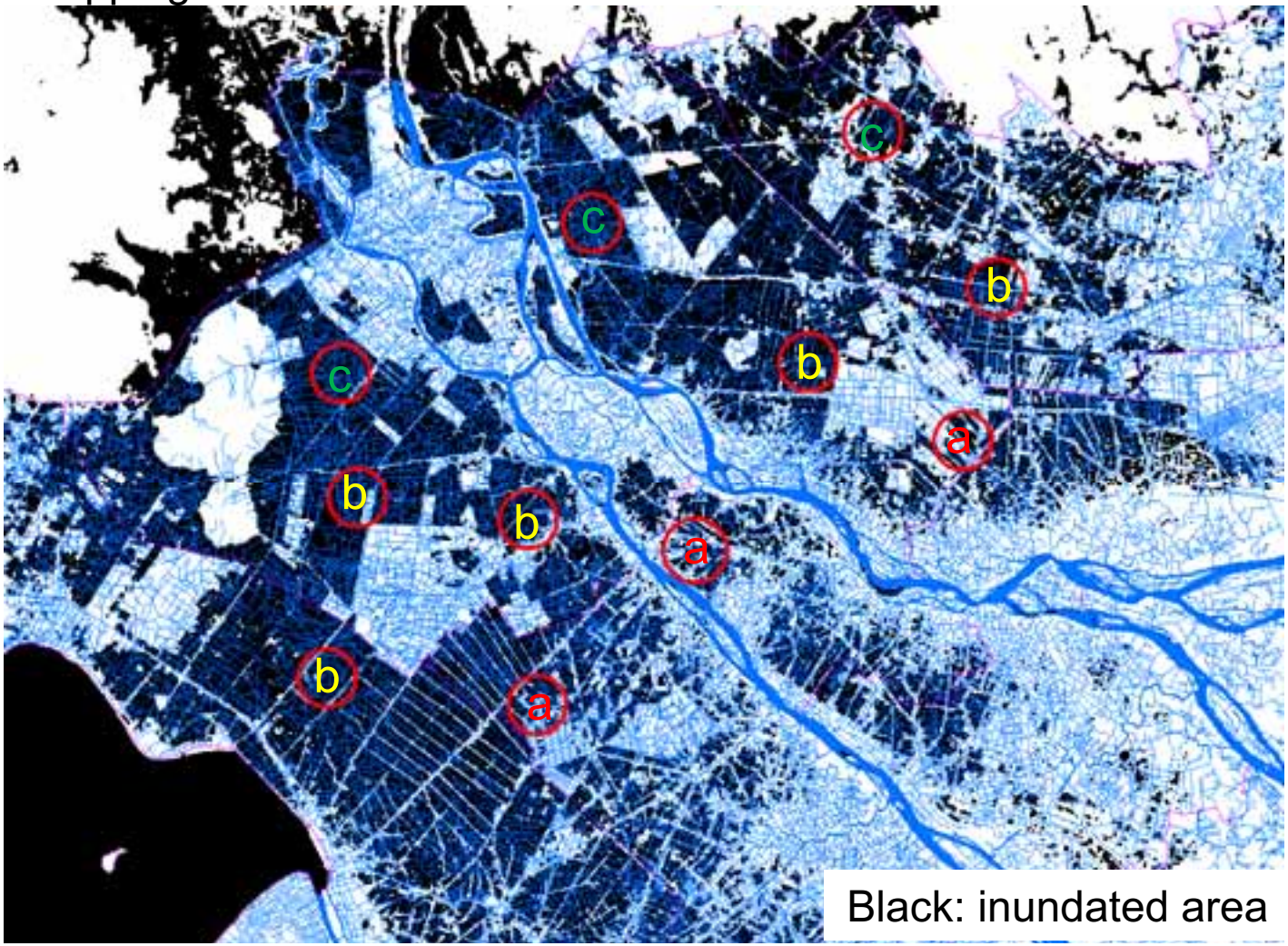
   Dike systems

   a) High dike

   b) Low dike

   Inundated duration

   Long-term



Inundation maps overlay for the years: 2000, 2002, 2004, 2007, 2008

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Monitoring network - Trapping sites

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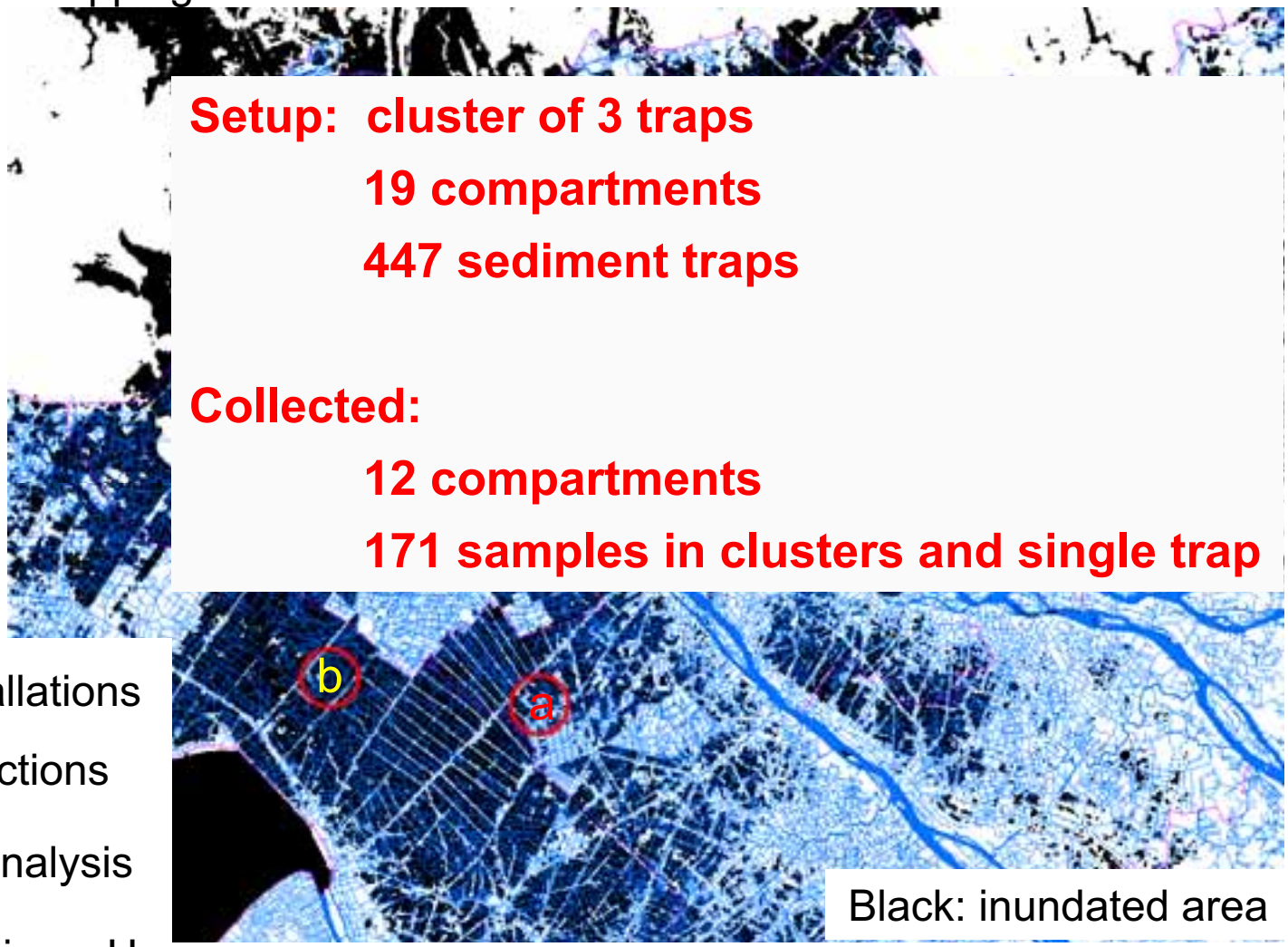
2. Sediment trap installations
3. Sediment trap collections
4. Sediment sample analysis

   Nutrient and grain size, pH



Setup: cluster of 3 traps

19 compartments

447 sediment traps

Collected:

12 compartments

171 samples in clusters and single trap

Black: inundated area

ation maps overlay for the years: 2000, 2002, 2004, 2007, 2008

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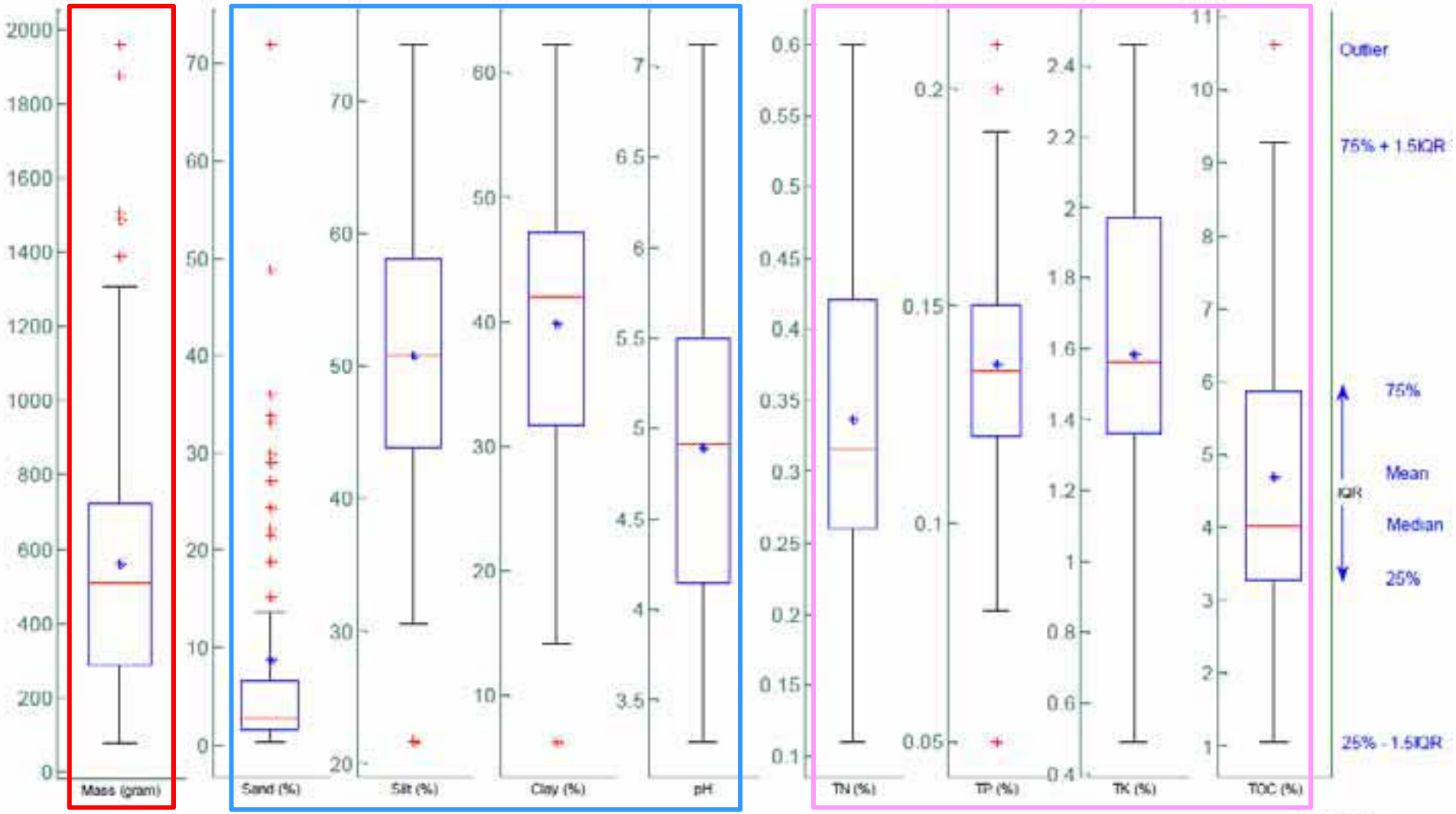
Monitoring network - Datasets

C_v	0.64	1.53	0.20	0.28	0.17	0.36	0.22	0.28	0.44



Monitoring network - Trap retrieval test

Higher sample mass with higher uncertainty

Trap collection test

Dry floodplains

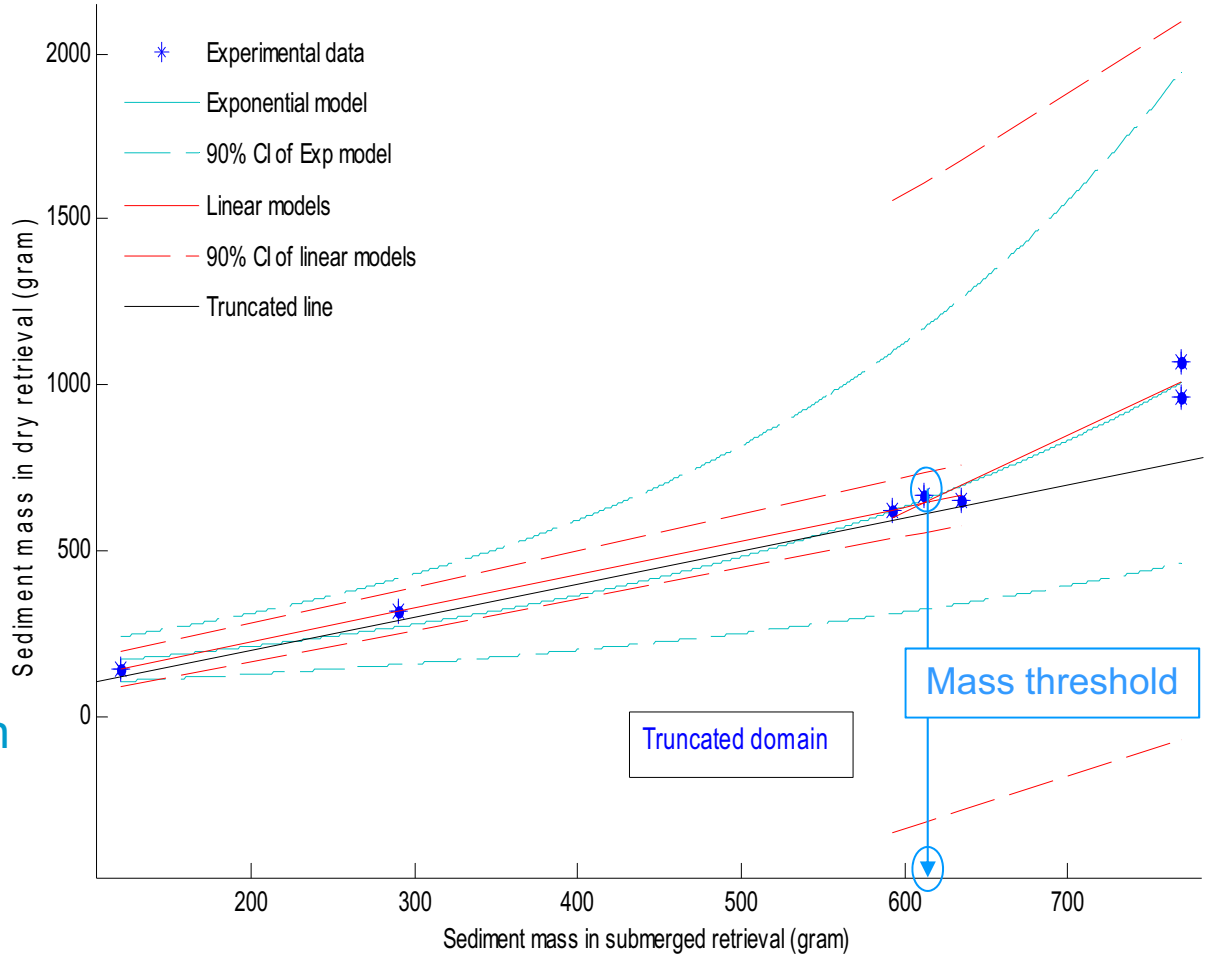
Submerged floodplain

Exponential model

Linear models

Constrain of the Mass

Dry condition ≥ Wet condition



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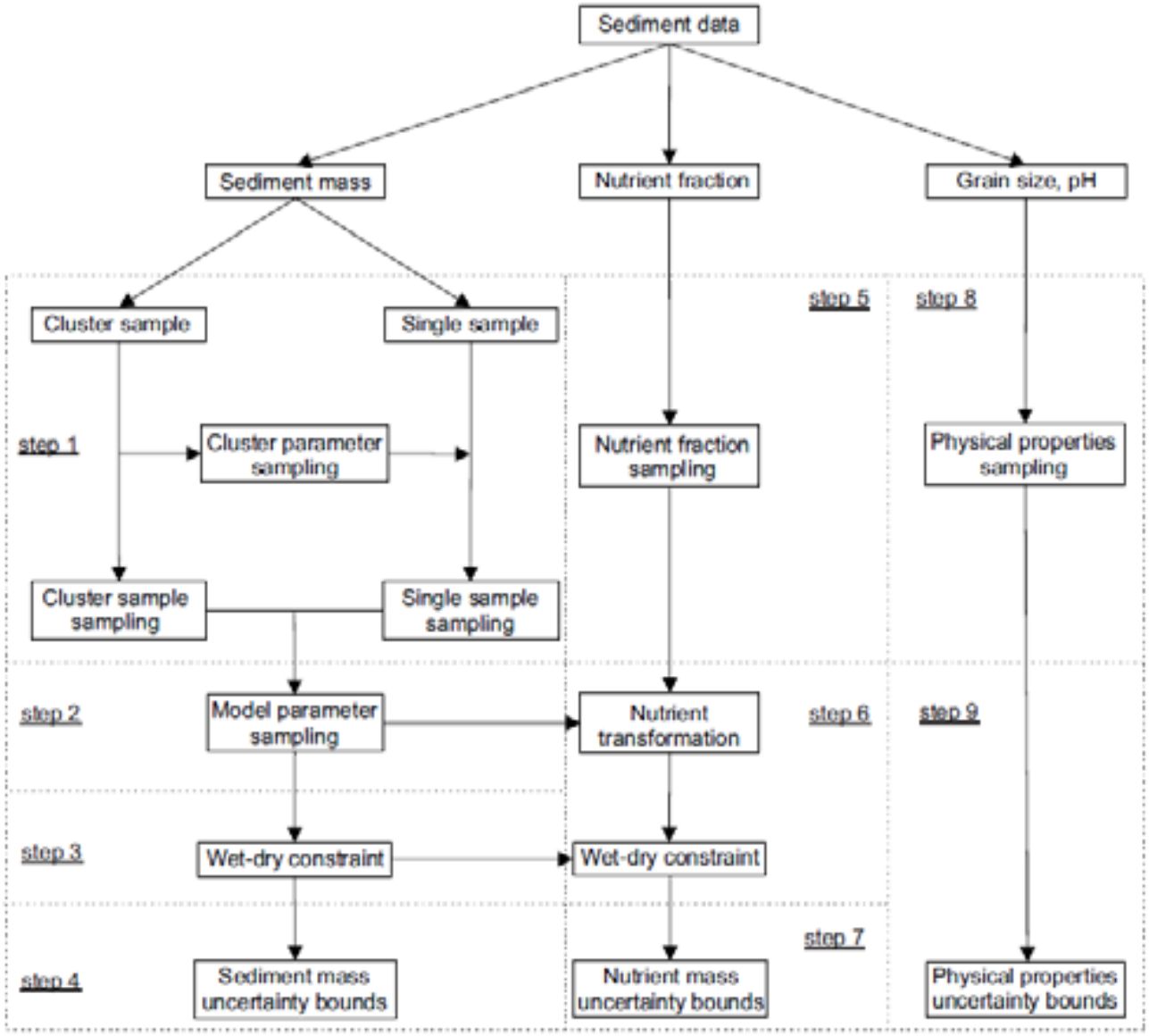
Uncetainty analysis - Monte Carlo scheme



Sediment mass

Step 1: PDFs of cluster traps and single traps

Step 2: Uncertainty in wet-dry correction models

Step 3: Correct calculated deposition mass

Step 4: Uncertainty bounds for sediment mass

Nutrient fraction

Step 5: PDFs of nutrient fractions

Step 6: PDFs of nutrient mass

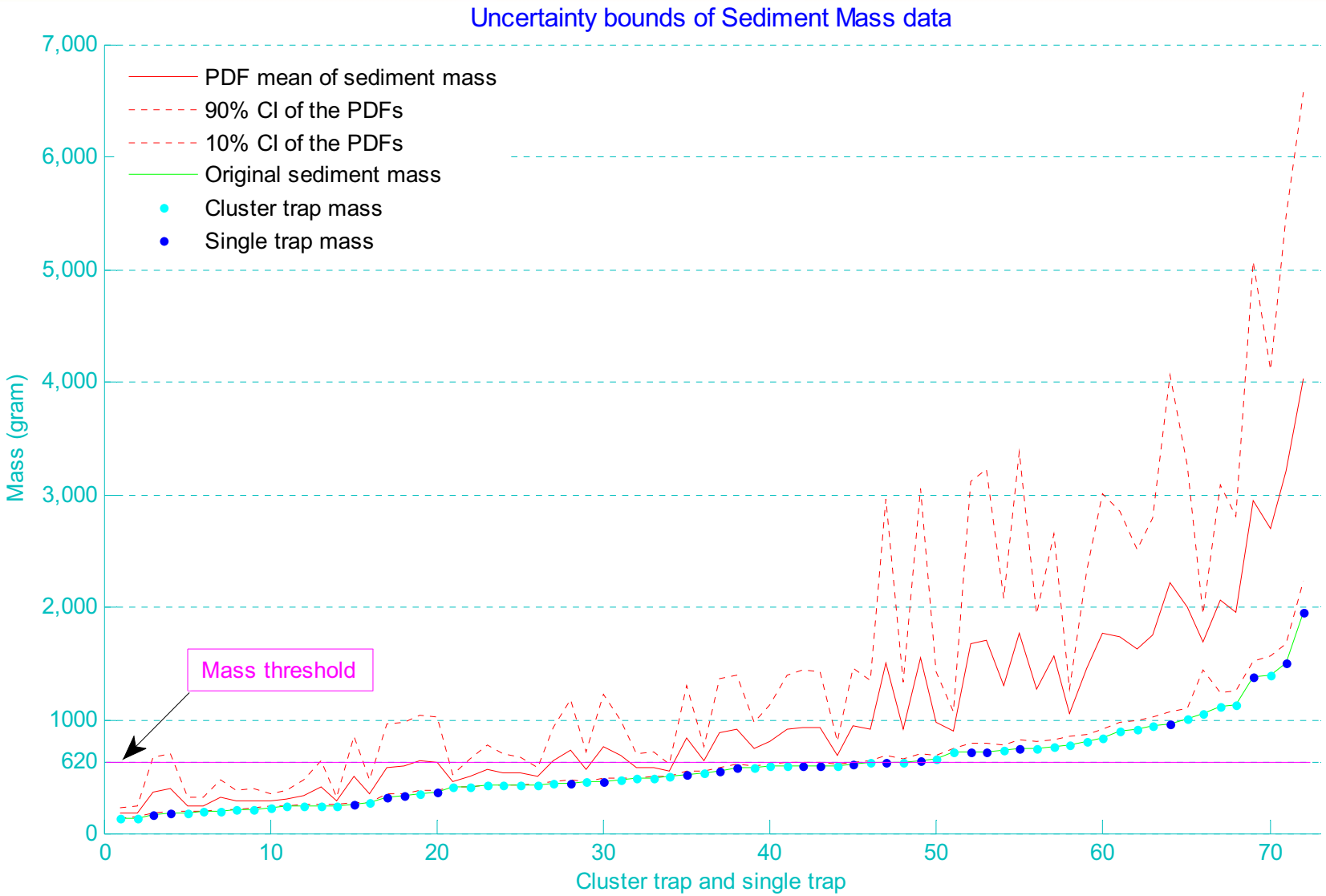
Step 7: Uncertainty bounds for nutrient mass

Grain size, pH

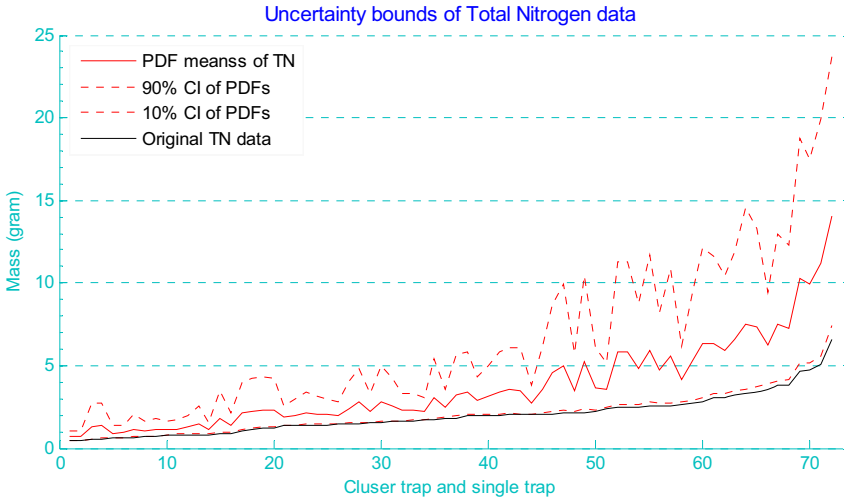
Step 8: PDFs of grain size fractions and pH

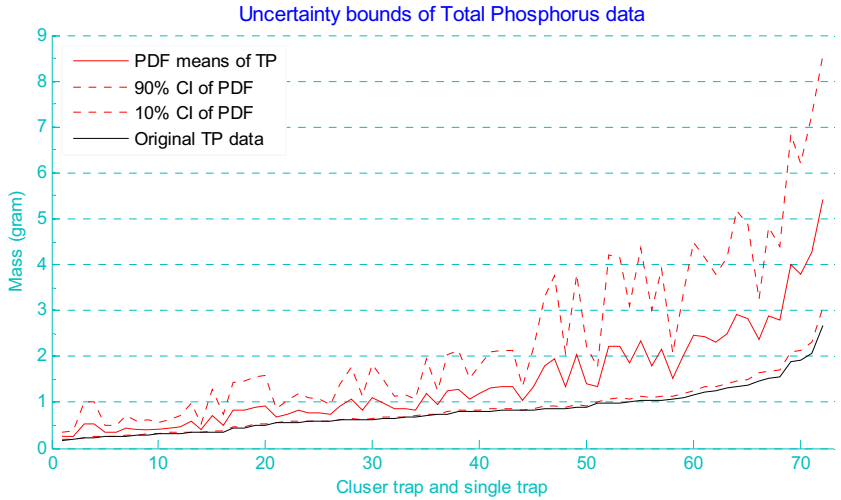
Step 9: Uncertainty bounds for grain size fraction and pH

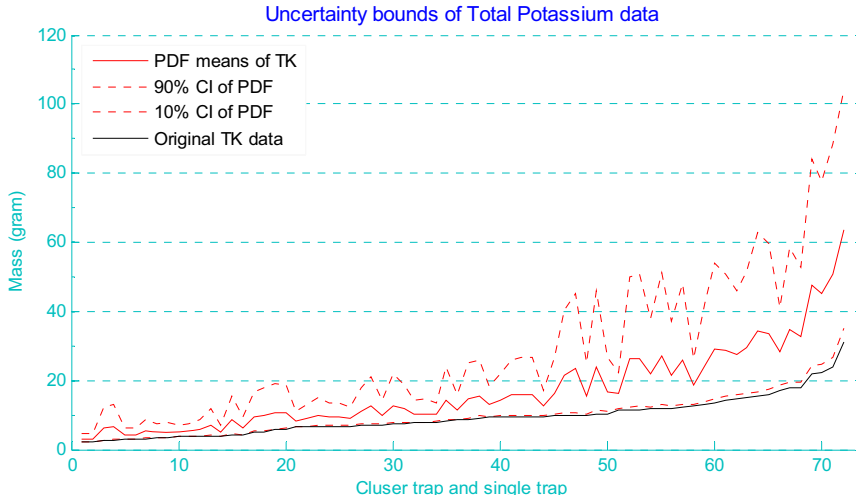
Uncetainty analysis – Sediment mass

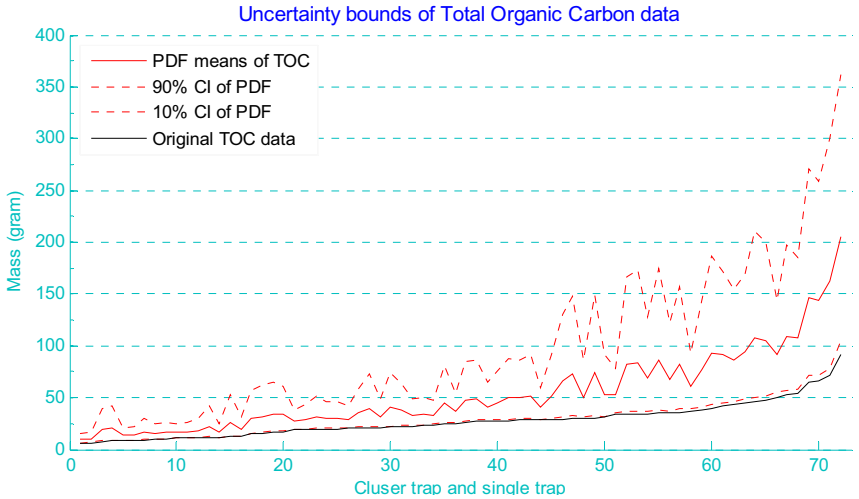


Uncetainty analysis – Nutrient fraction

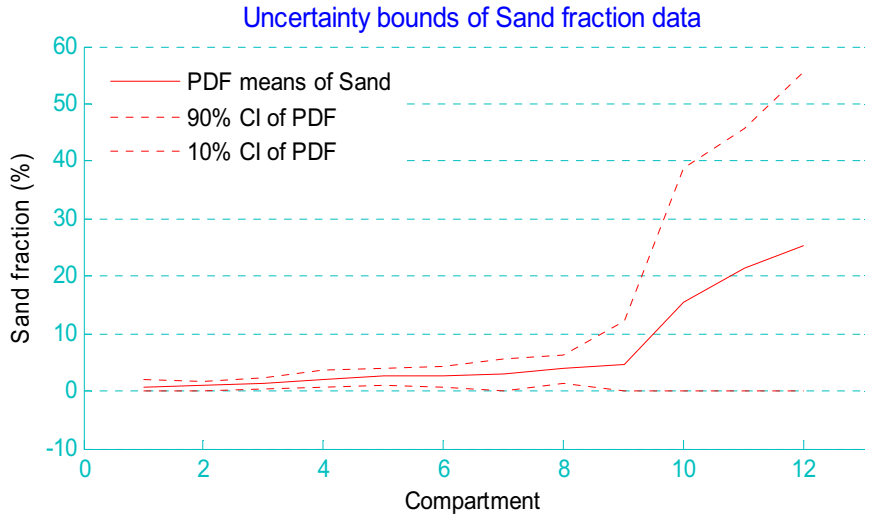


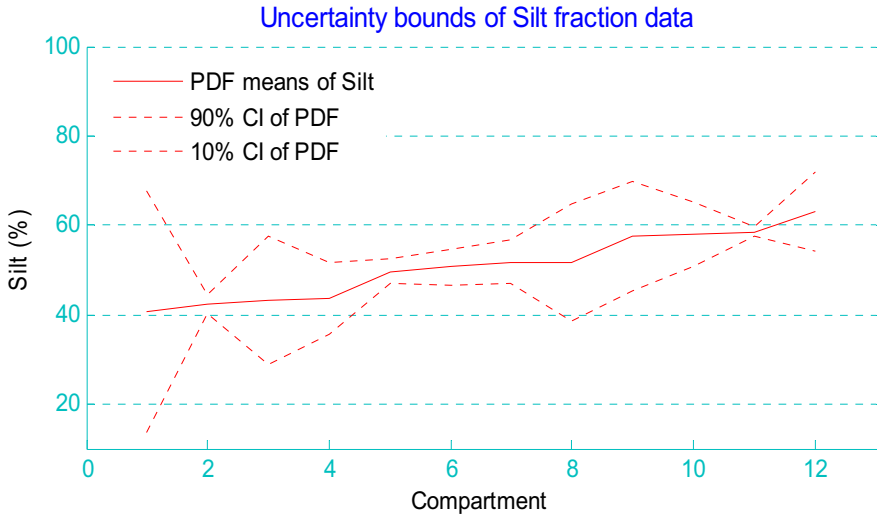


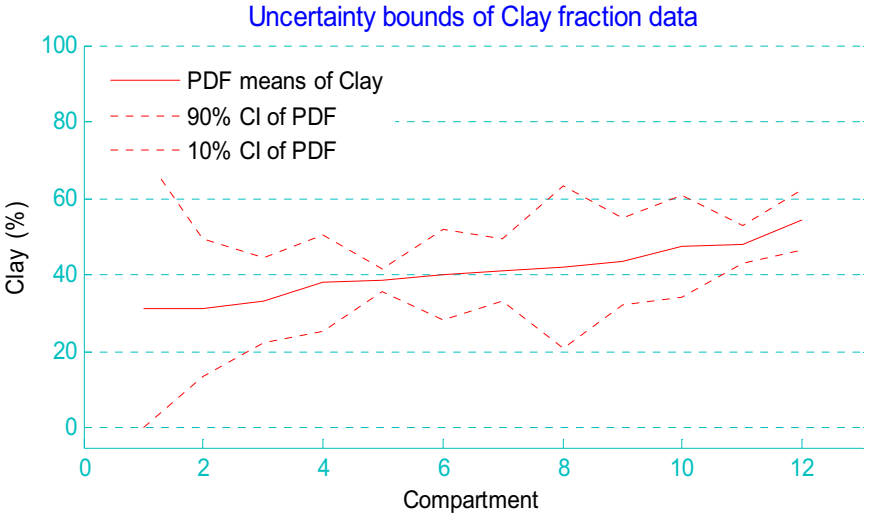


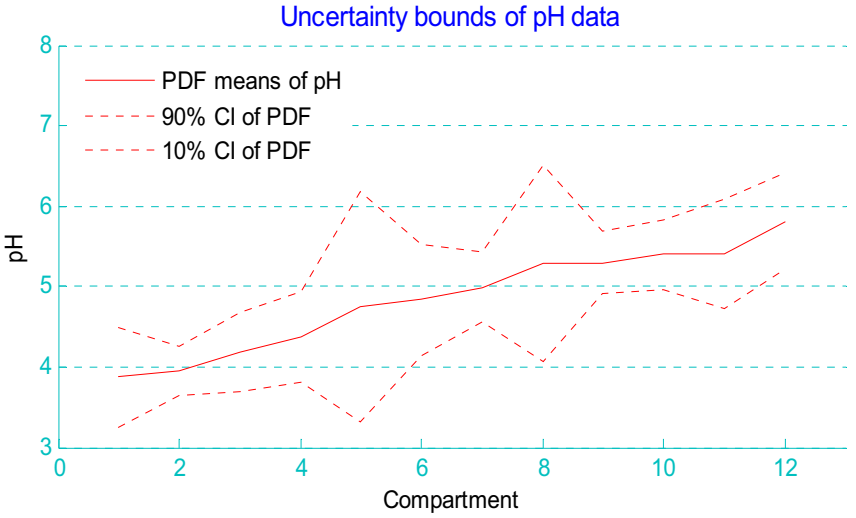


Uncetainty analysis – Grain sizes and pH

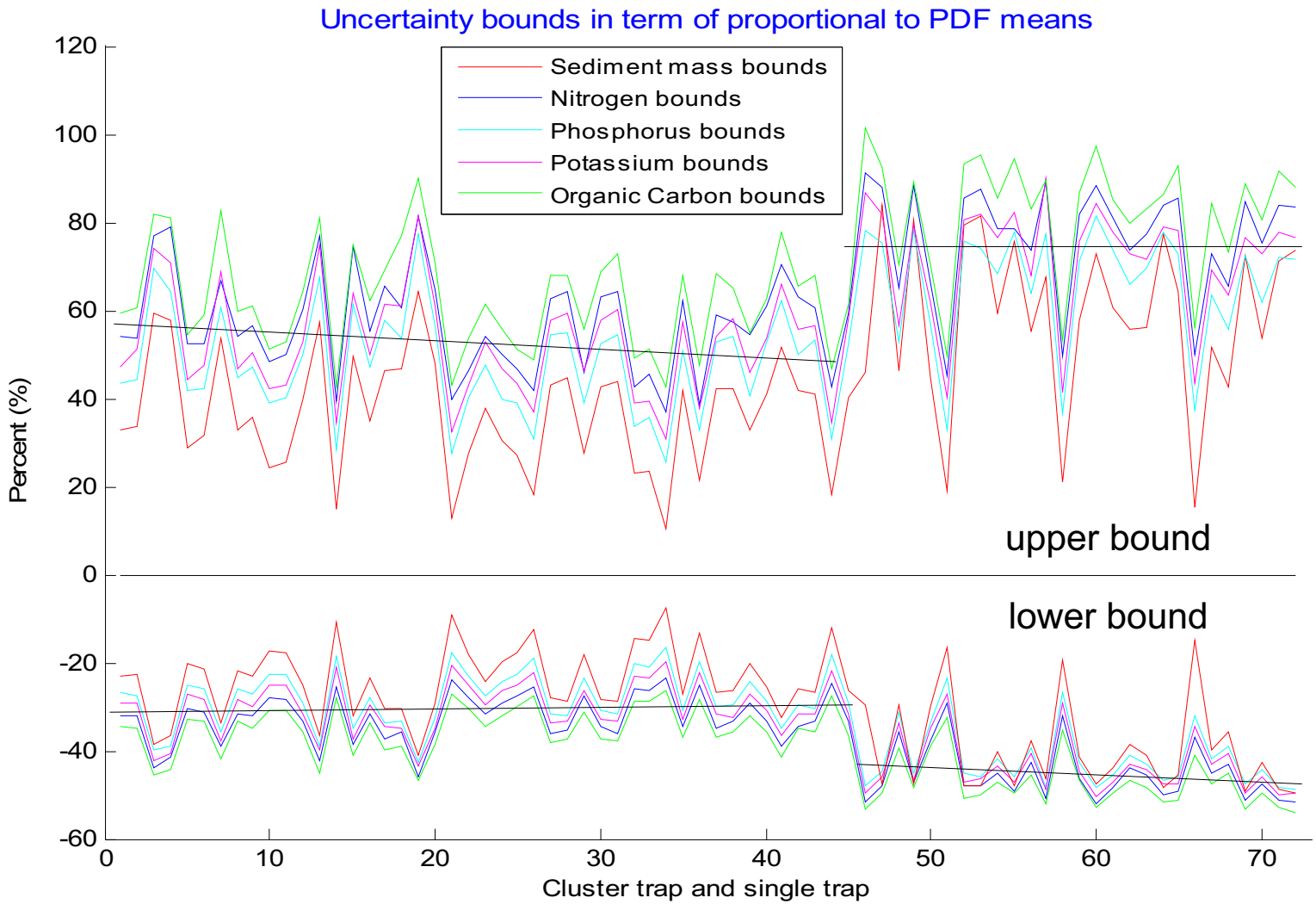








Uncetainty analysis – Sediment and Nutrient



Conclusion

- Proposed a procedure to estimate uncertainty in sediment trap sampling particularly suitable in large and complex floodplains.
- The main uncertainty sources are the trap retrieval from still inundated floodplains and human interference on the floodplains.
- The 90% CIs are less than 100% of the mean values for the entire dataset.
- Sediment retrieval uncertainties are systematic and quantifiable,
- The variability caused by human interference is difficult to attribute to distinct activities and factors
- The derived data and uncertainty estimates can provide the required calibration data for a sediment transport model for floodplains

Thank you very much