

An assessment of organic carbon exports in an Arctic watershed presenting permafrost using the coupled SWAT model and Carbon modules.

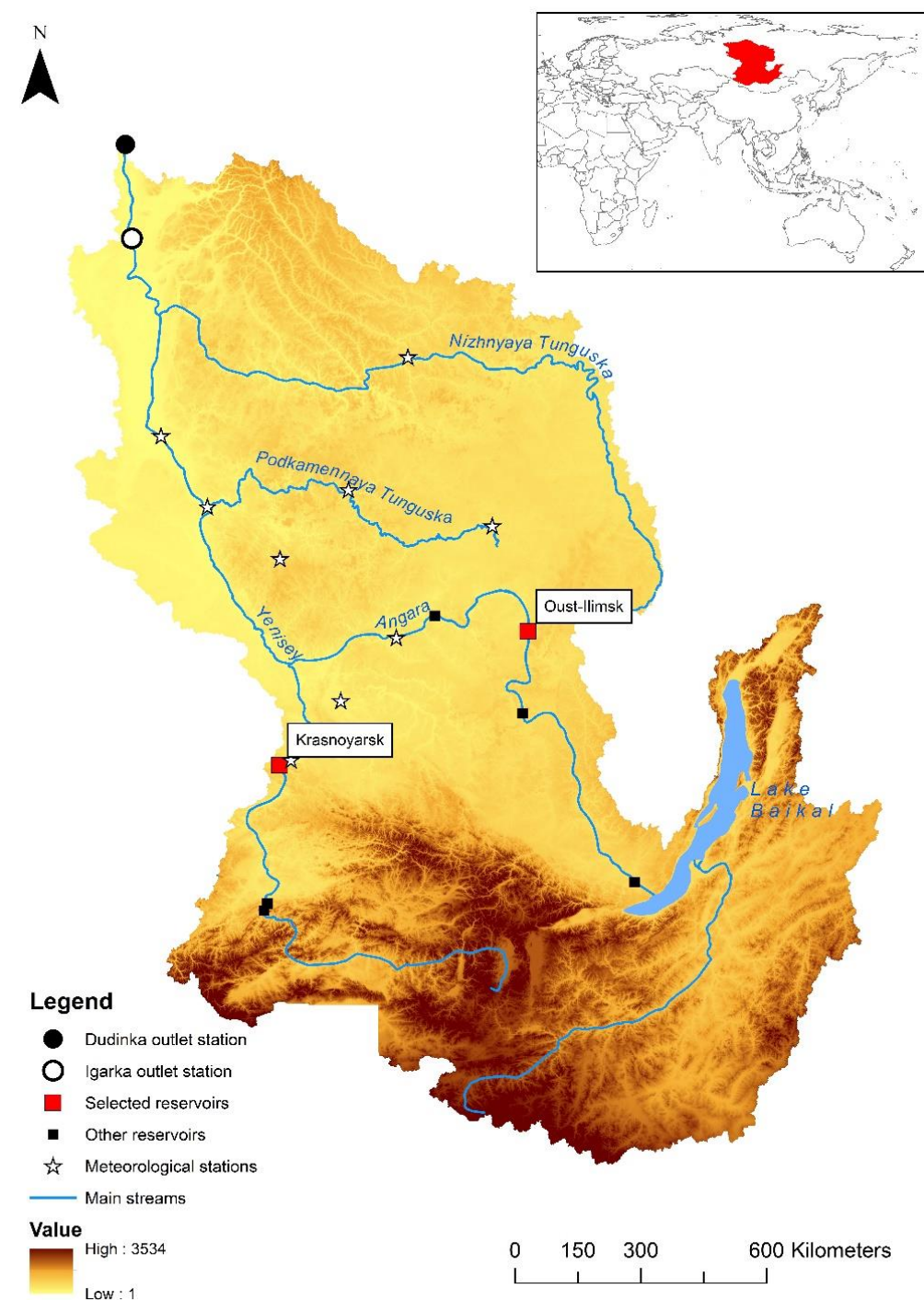
Clément Fabre, Sabine Sauvage, Nikita Tananaev, Grégory Espitalier Noël, Roman Teisserenc, Jean-Luc Probst, Raghavan Srinivasan, José Miguel Sánchez Pérez

Presented by Clément Fabre



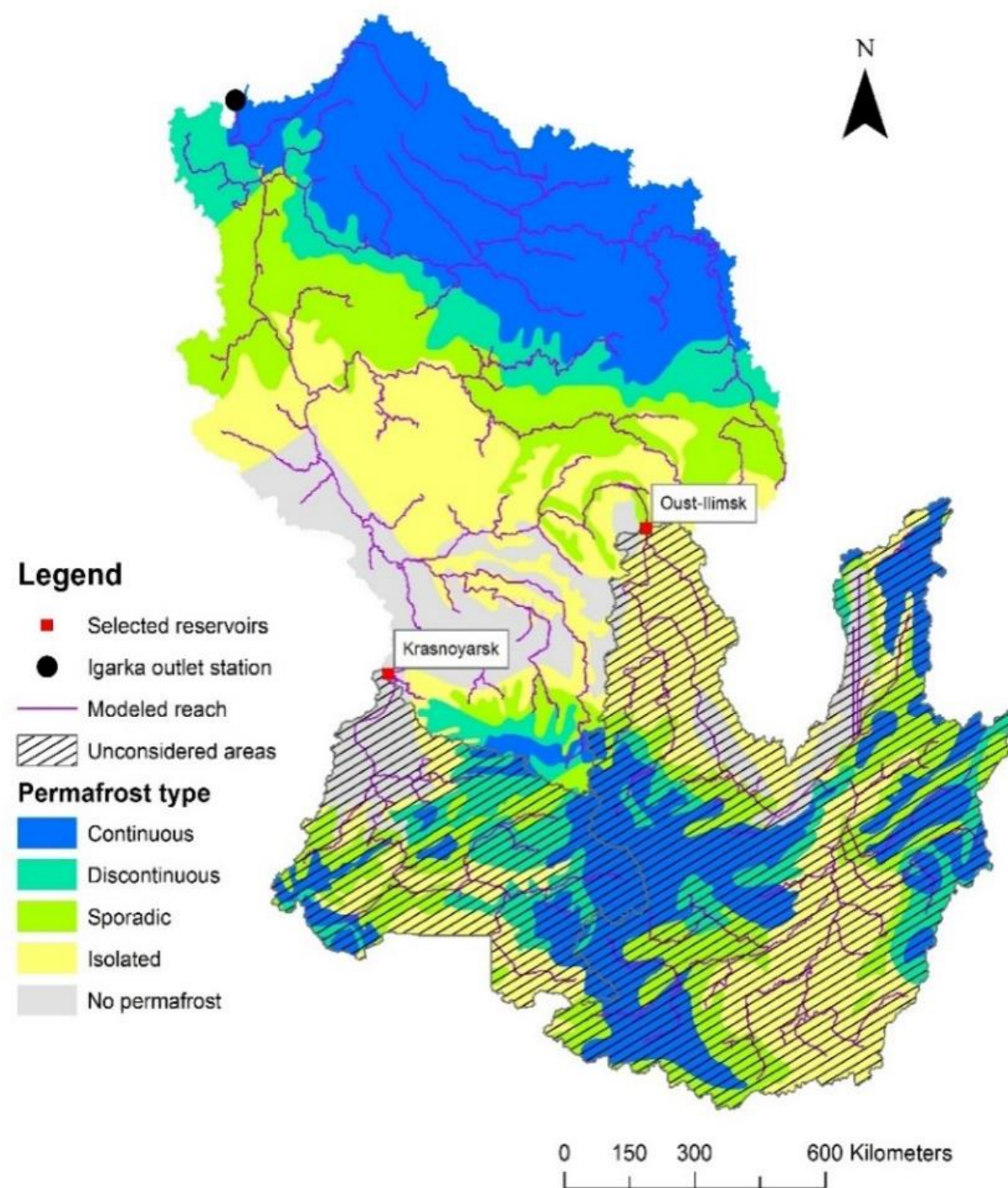
The Yenisei

- Area : 2,540,000 km² (6th)
- Average discharge : 19,800 m³.s⁻¹ (6th)

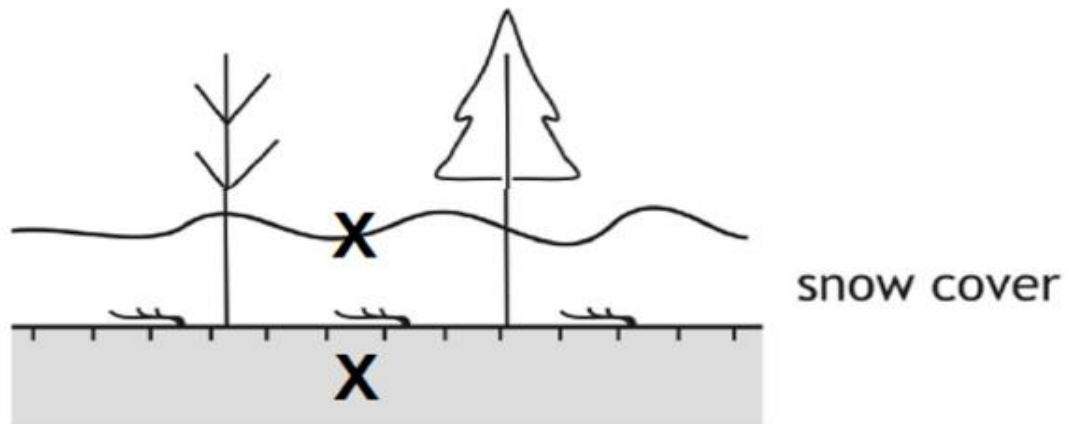


The Yenisei

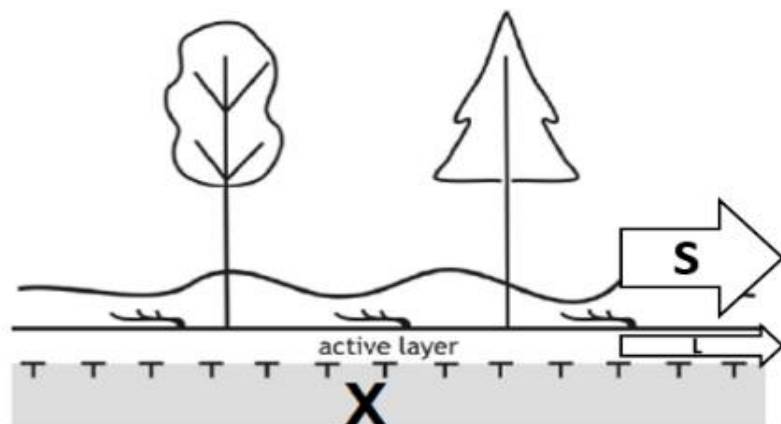
- 4 permafrost types
- Reduction of the watershed to 1,300,000 km²



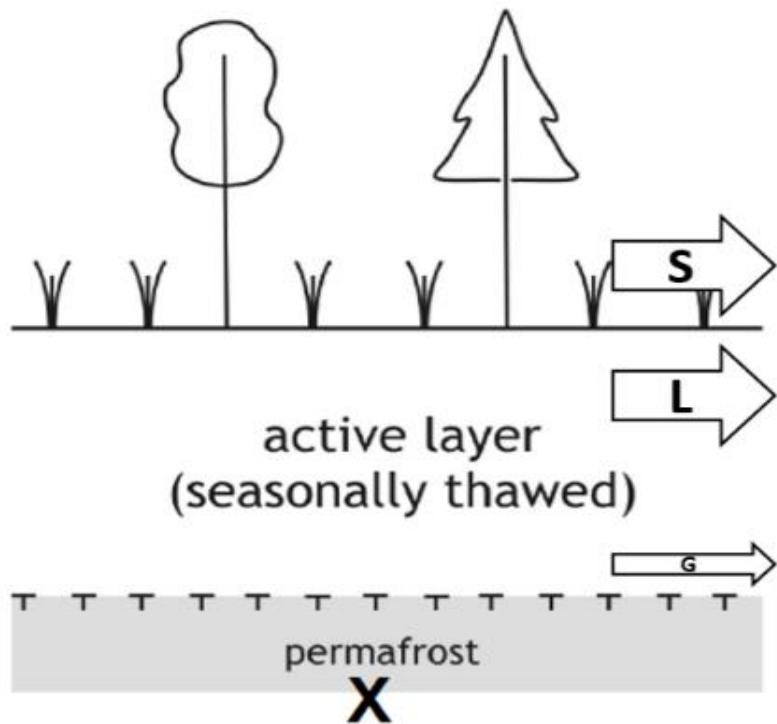
January - April



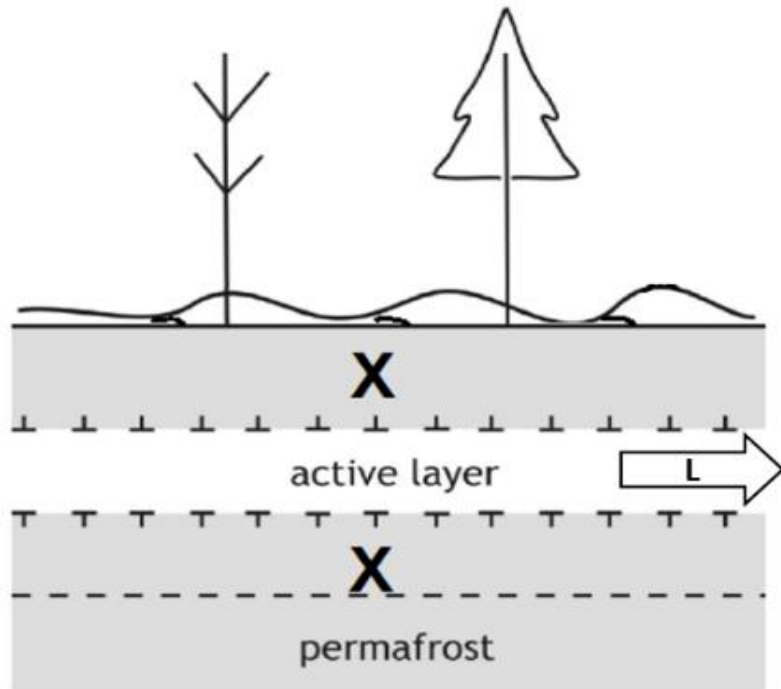
May



June - September

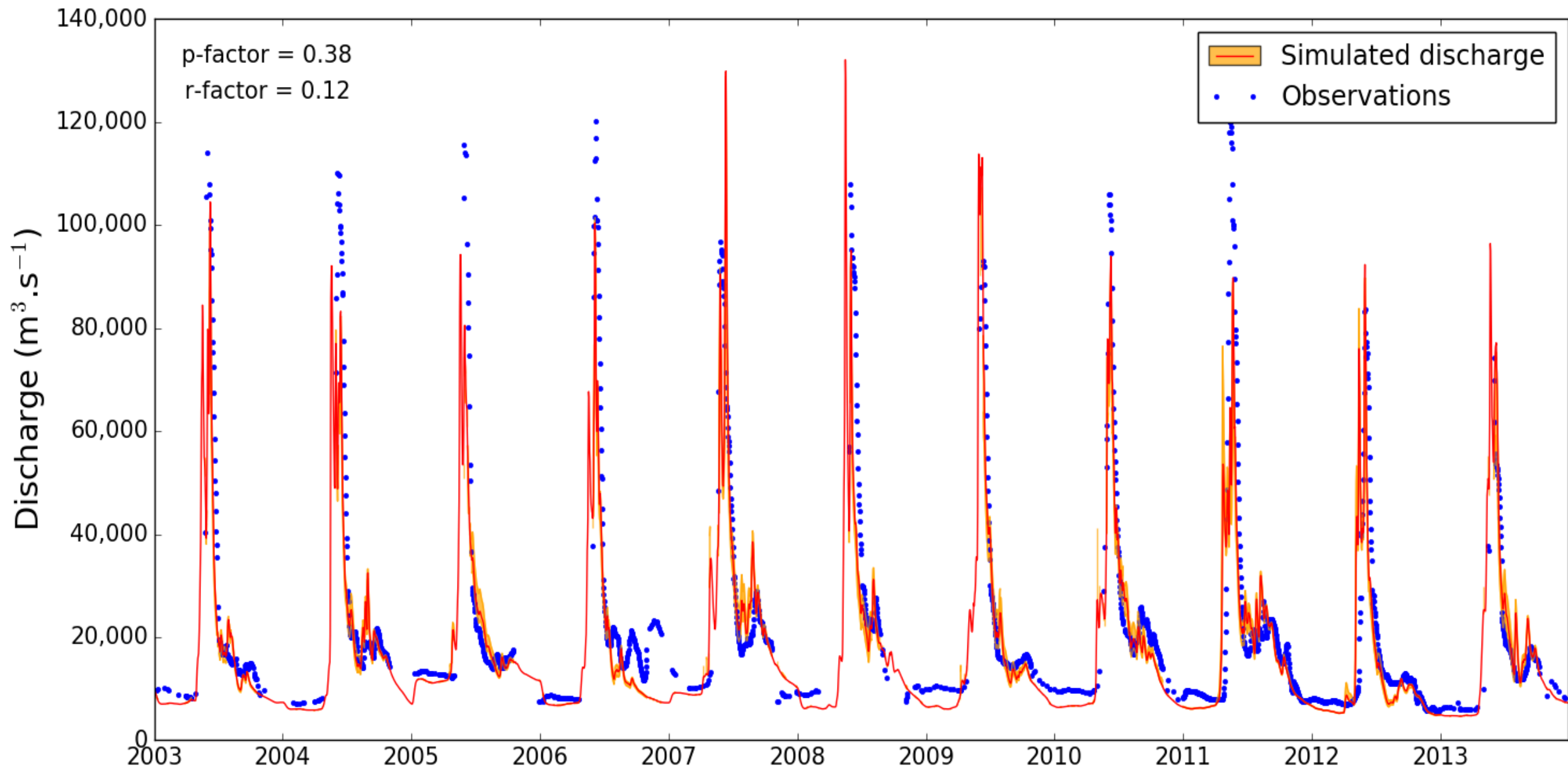


October - December



Calibration (NSE: 0.75, R^2 : 0.79, PBIAS: 14.7, RSR: 0.51)

Validation (NSE: 0.75, R^2 : 0.76, PBIAS: 6.5, RSR: 0.50)

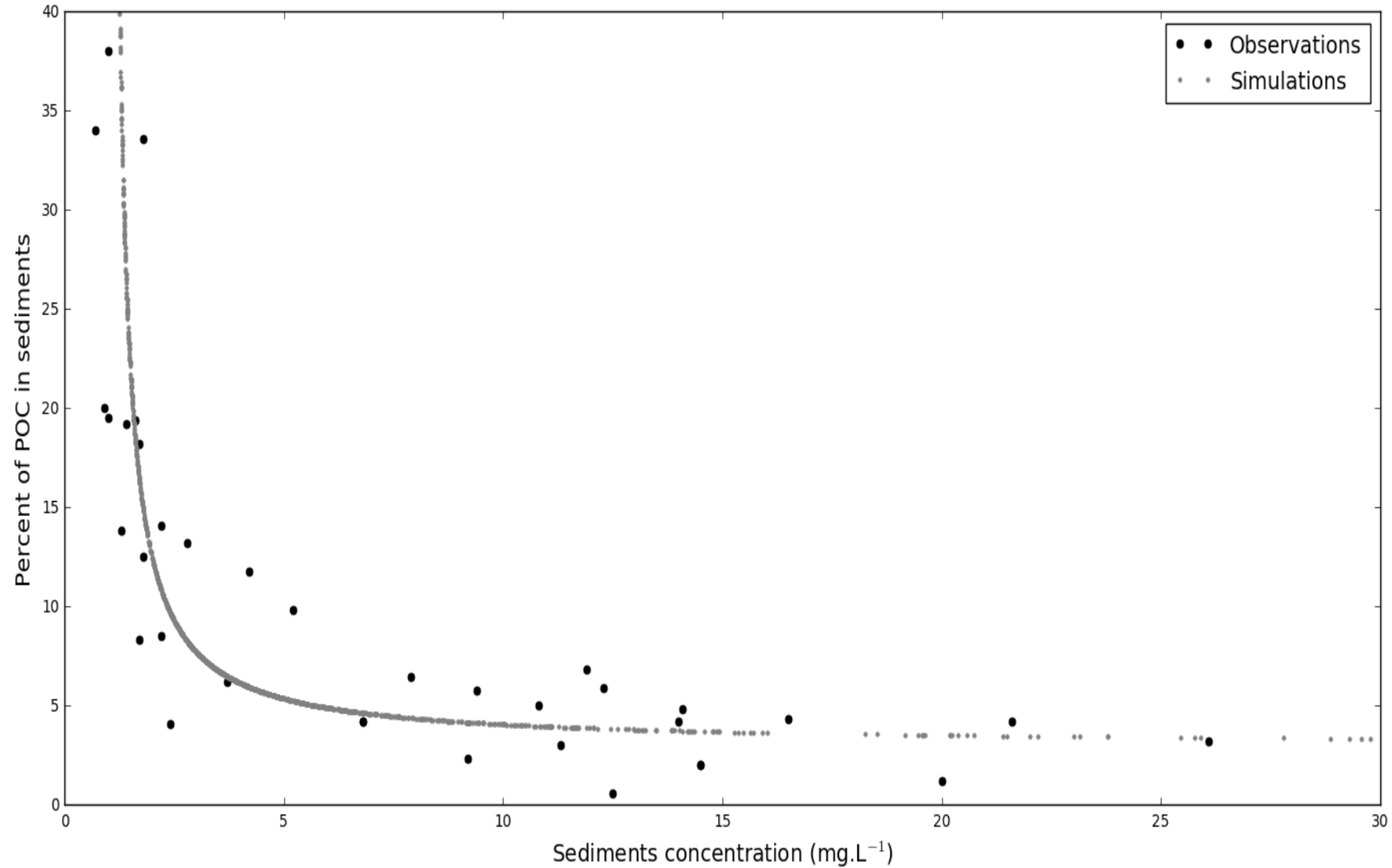


Fabre, C.; Sauvage, S.; Tananaev, N.; Srinivasan, R.; Teisserenc, R.; Sánchez Pérez, J.M. **Using Modeling Tools to Better Understand Permafrost Hydrology.** *Water* **2017**, *9*, 418.

POC : Equation

$$\%POC = \frac{9.40}{[TSS] - a} + b$$

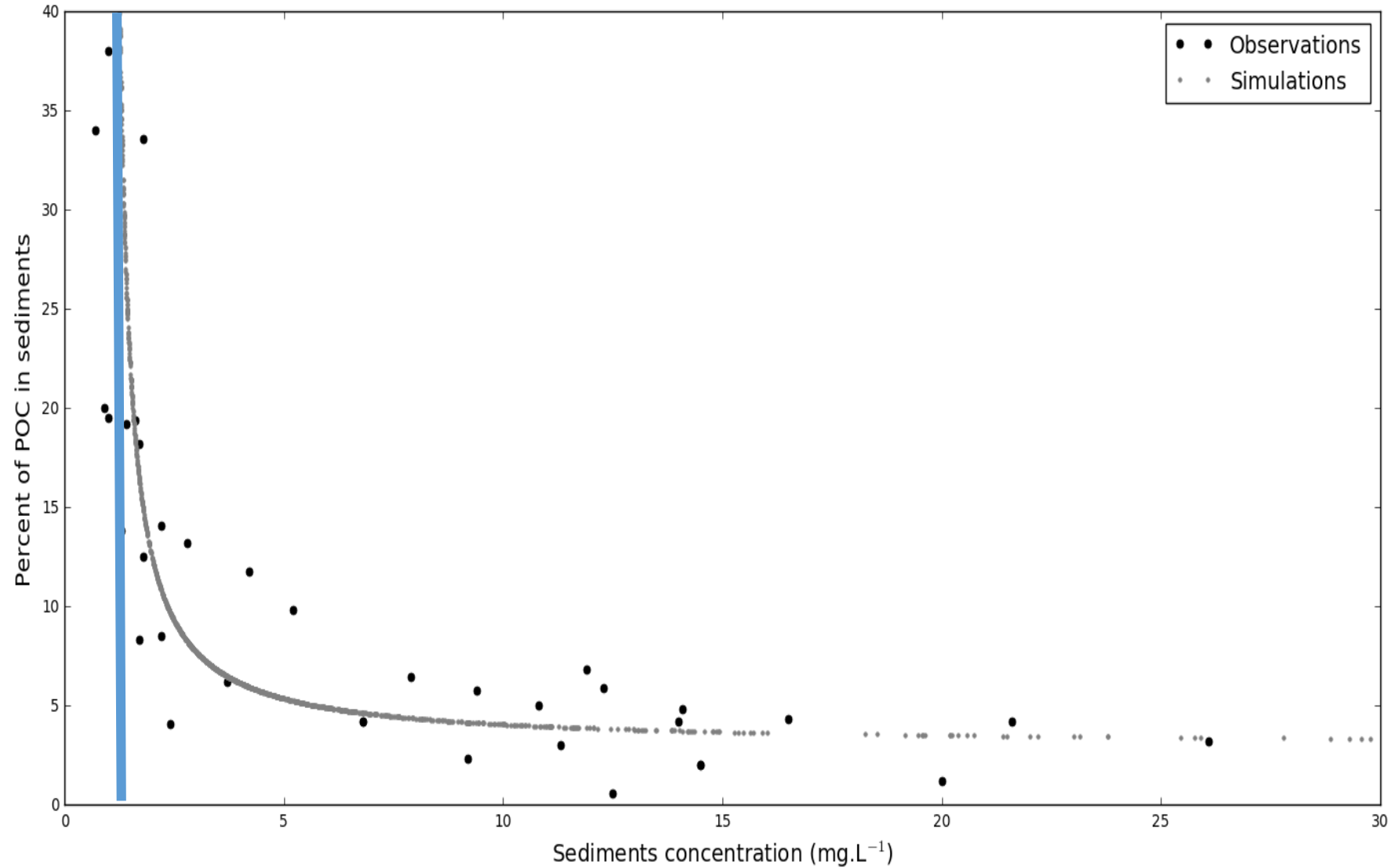
Boithias et al. 2014



POC : Equation

$$\%POC = \frac{9.40}{[TSS] - a} + b$$

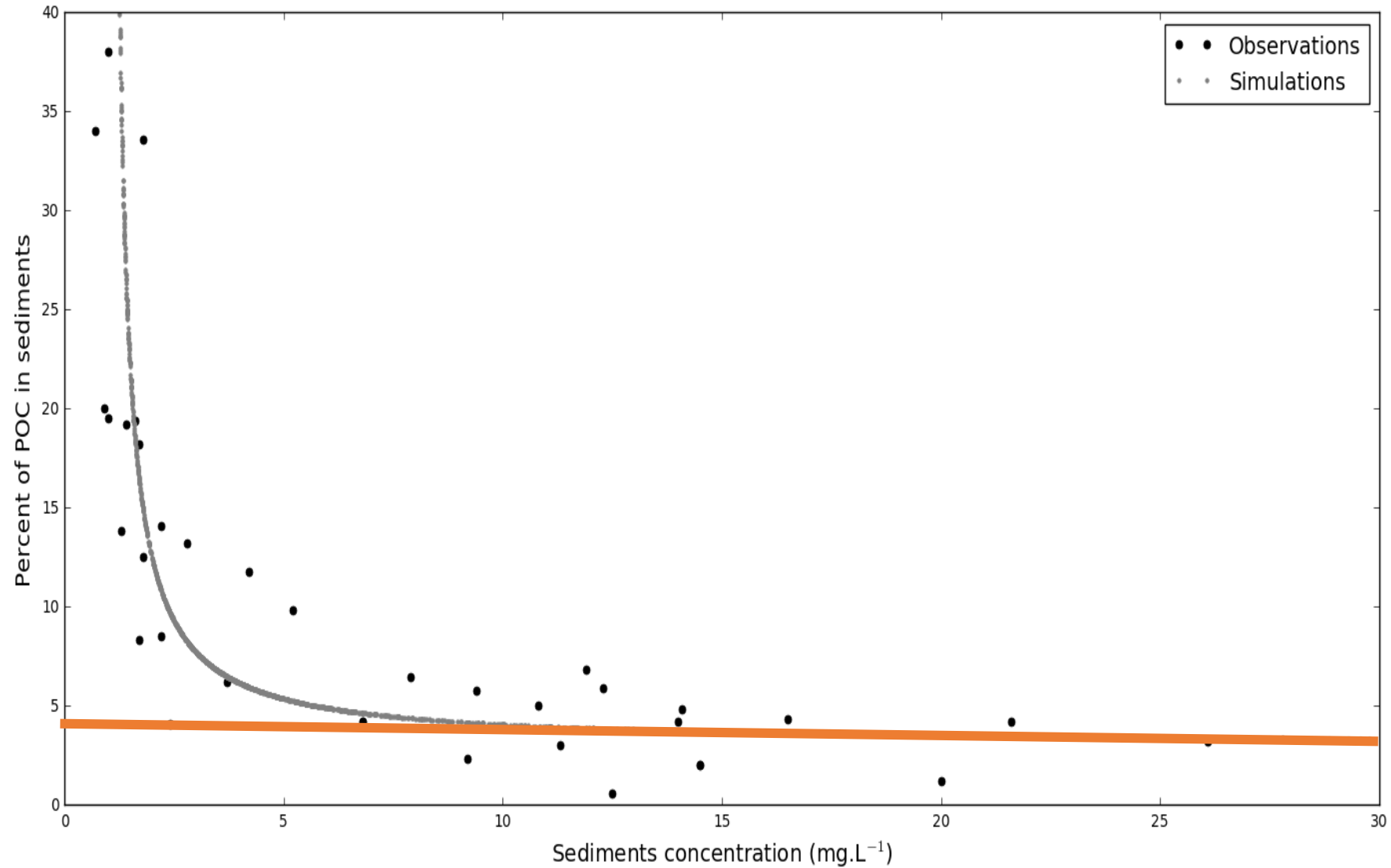
Boithias et al. 2014



POC : Equation

$$\%POC = \frac{9.40}{[TSS] - a} + b$$

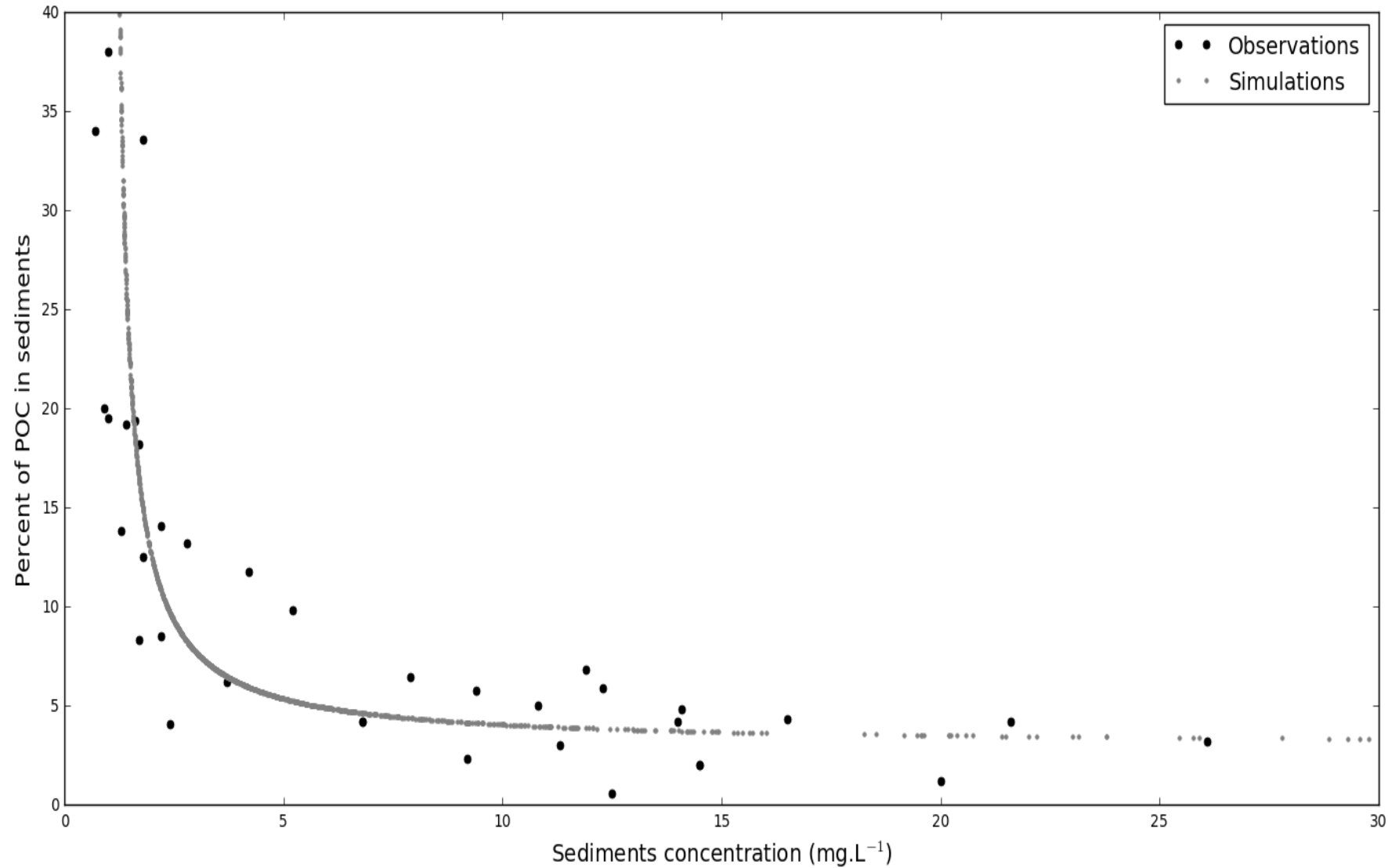
Boithias et al. 2014



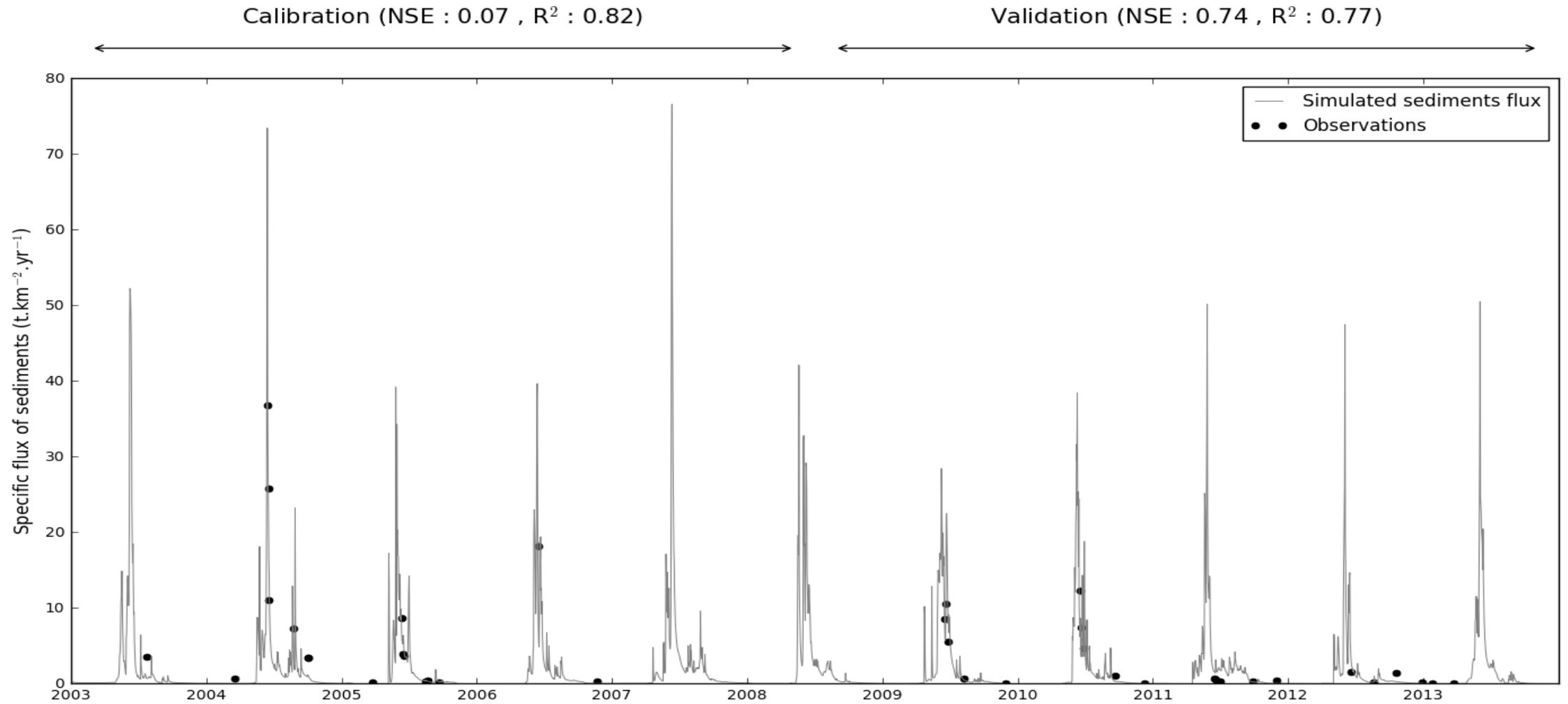
POC : Equation

$$\%POC = \frac{9.40}{[TSS] - a} + b$$

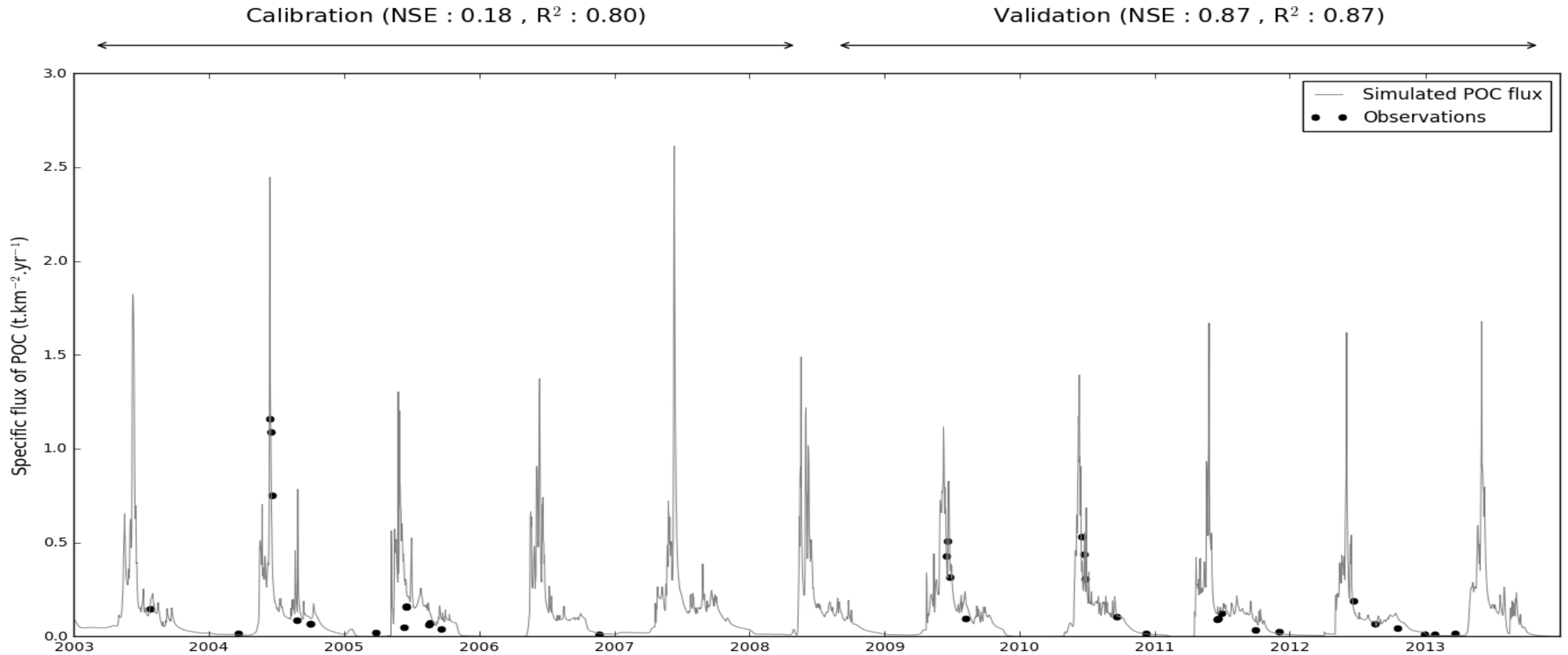
Boithias et al. 2014

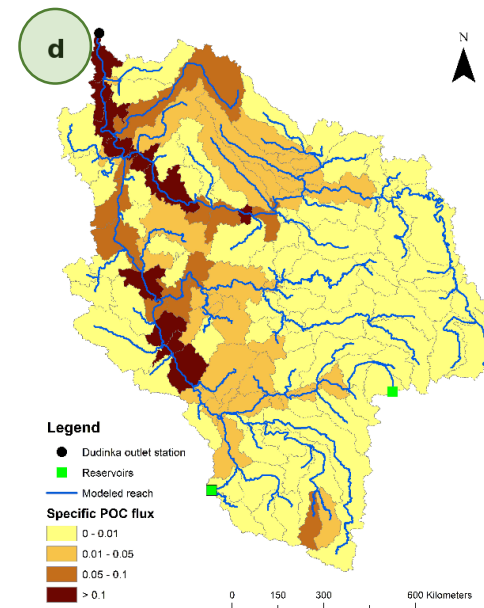
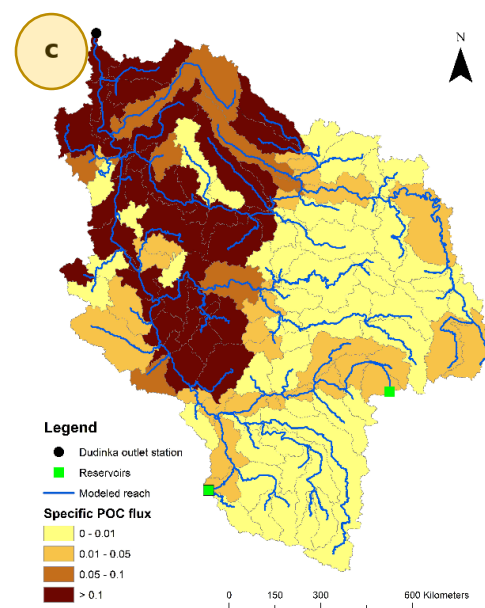
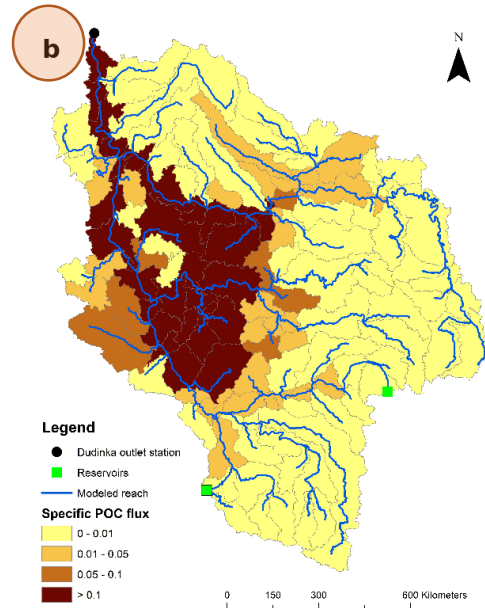
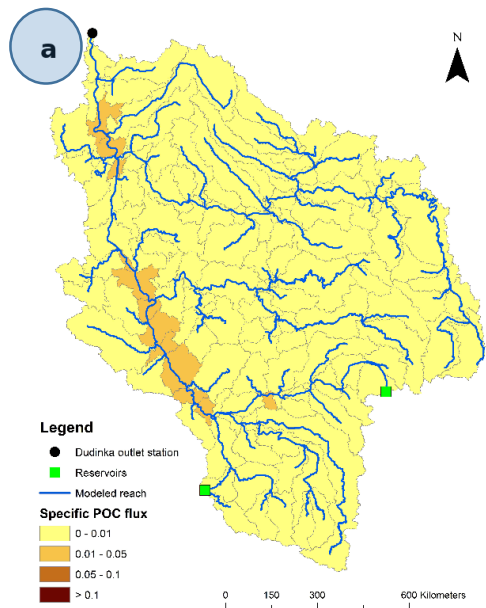
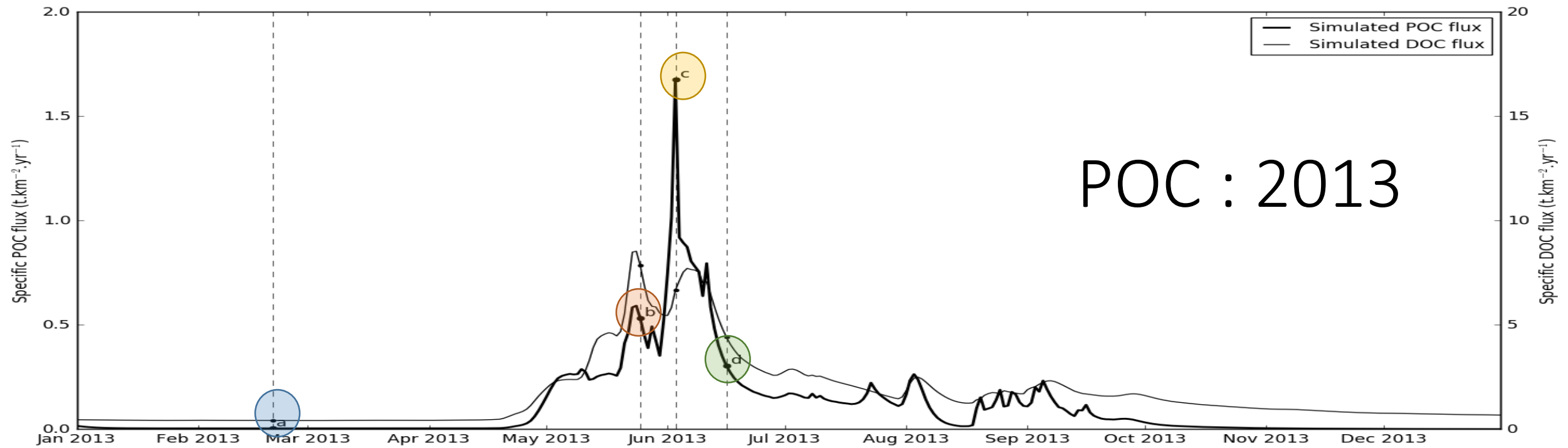


Sediments



POC : Dynamic

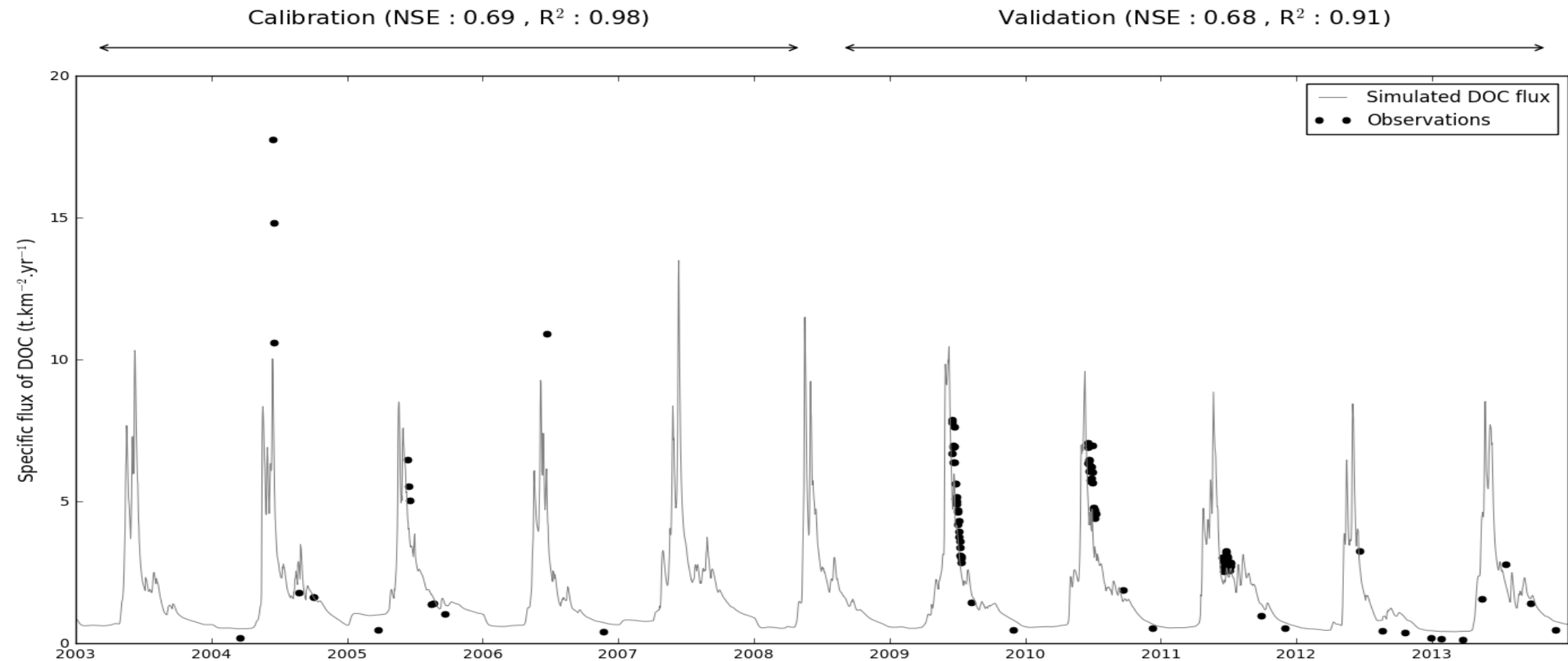


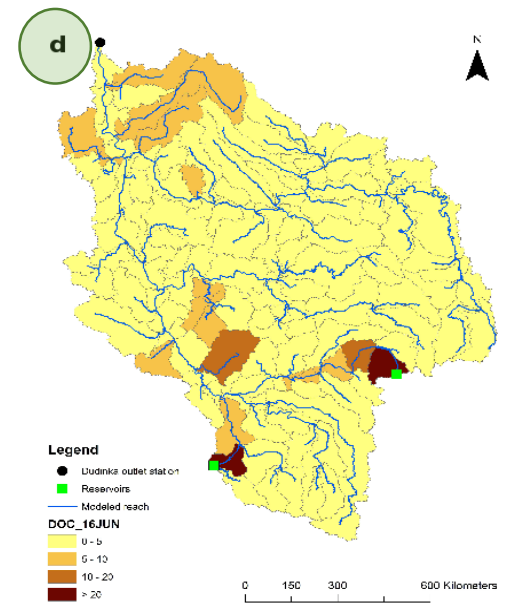
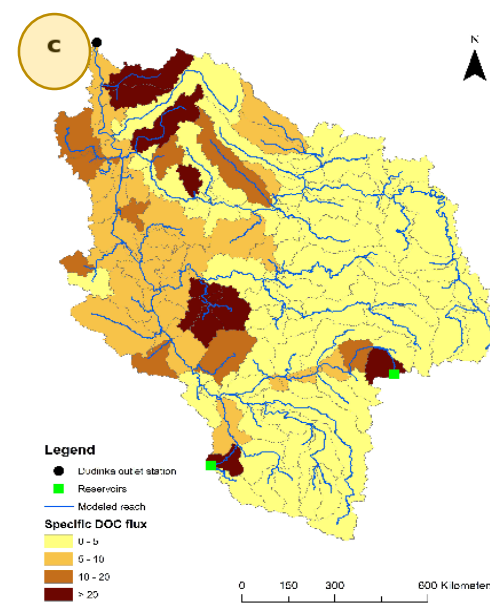
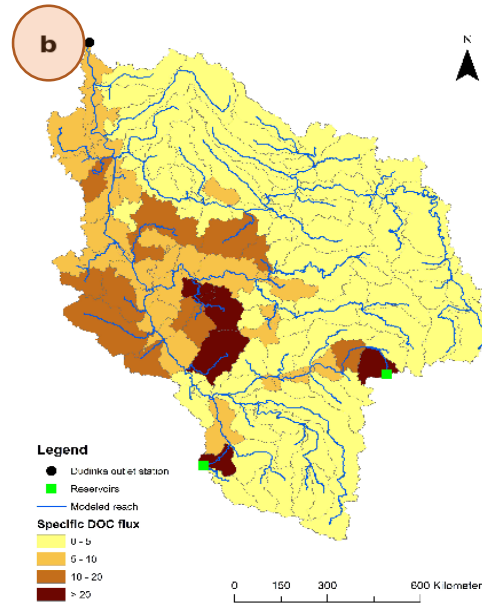
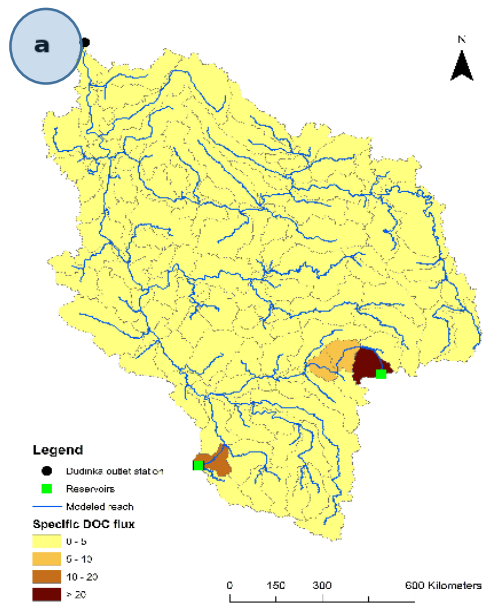
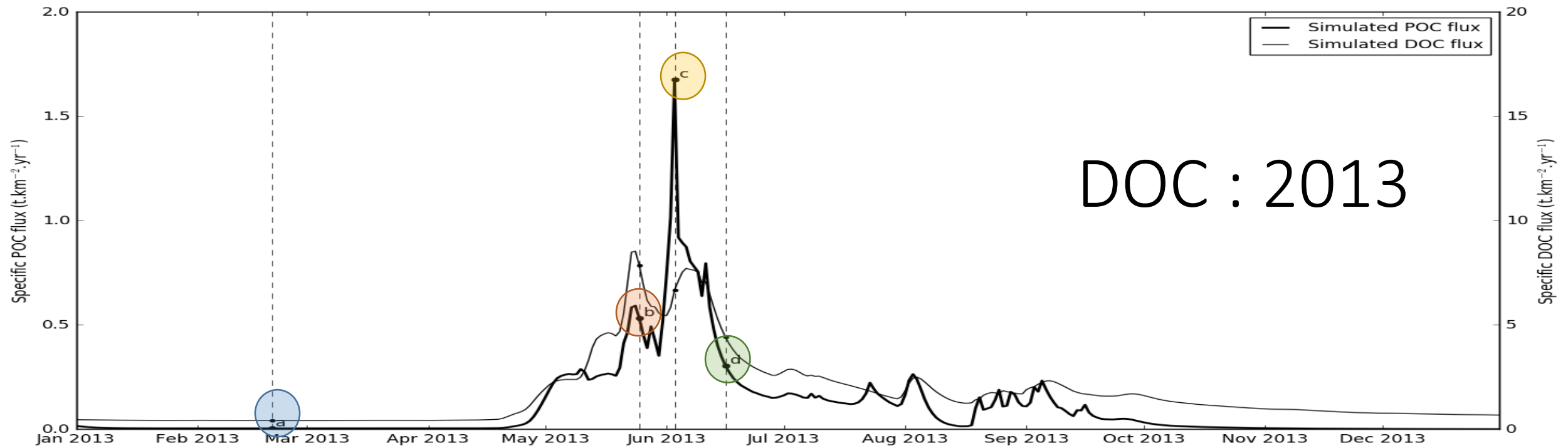


DOC : Equation and Dynamic

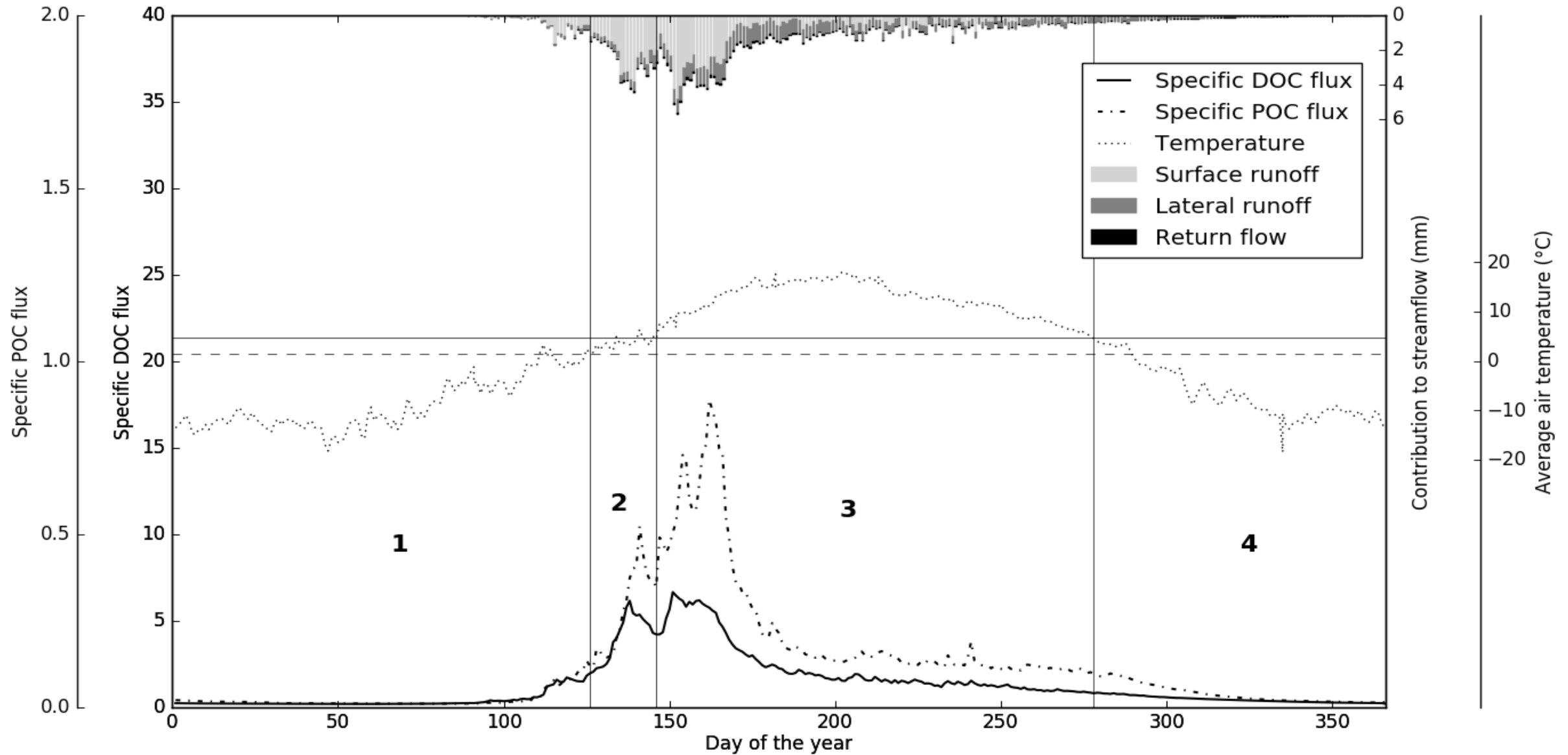
$$F_{\text{DOC}} = 0.0040 Q - 8.76 \text{ Slope} + 0.095 [\text{SoilC}]$$

Ludwig and Probst 1996

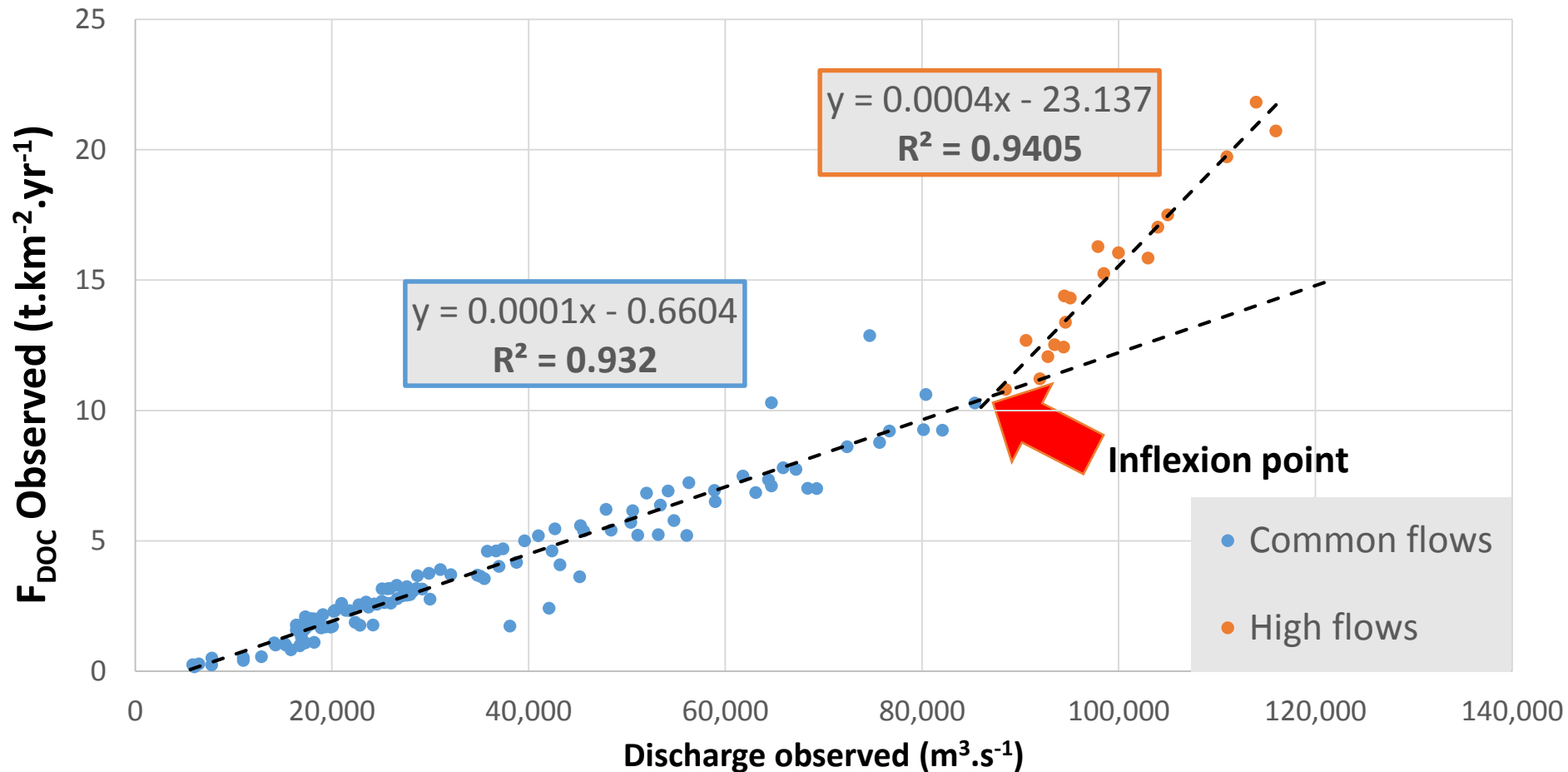
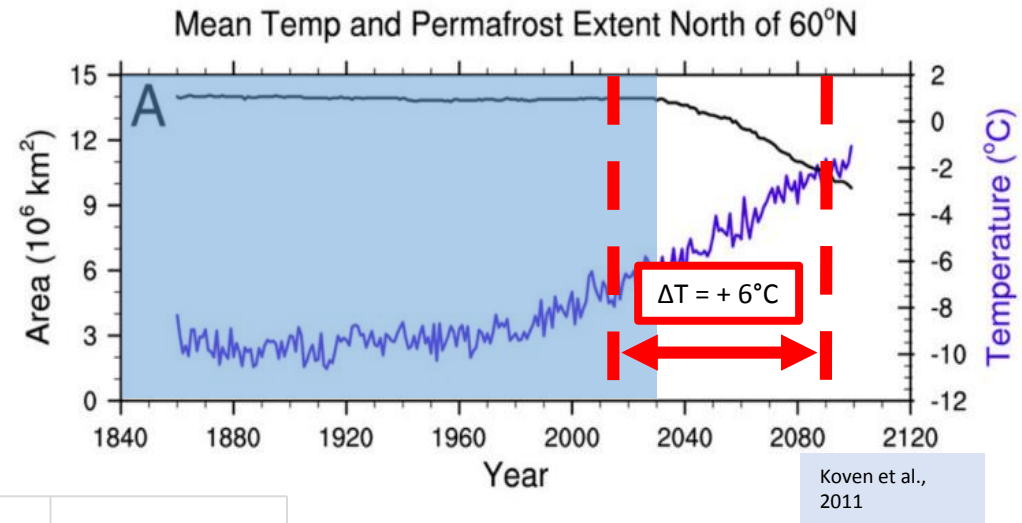




Interrannual outputs

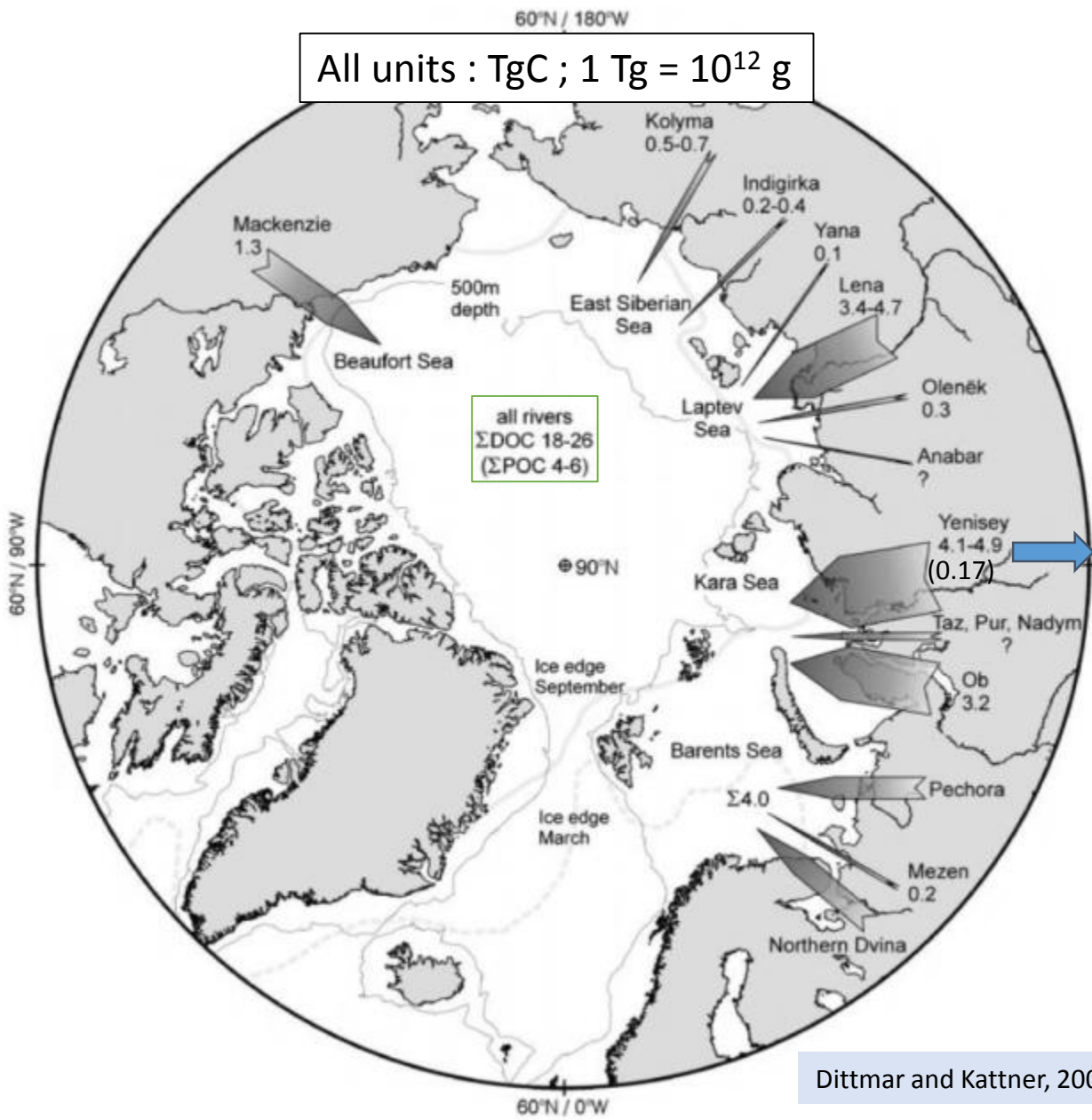


Climate change hypothesis

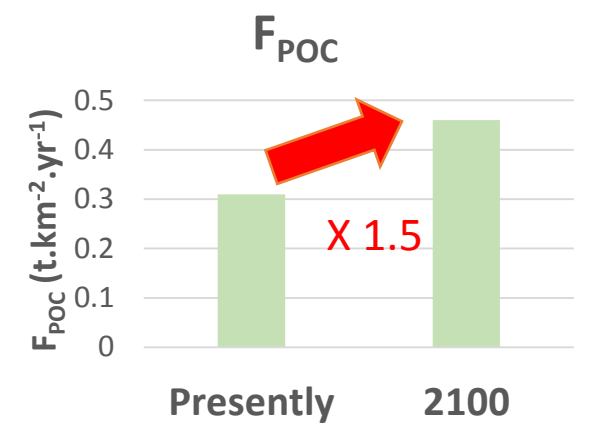
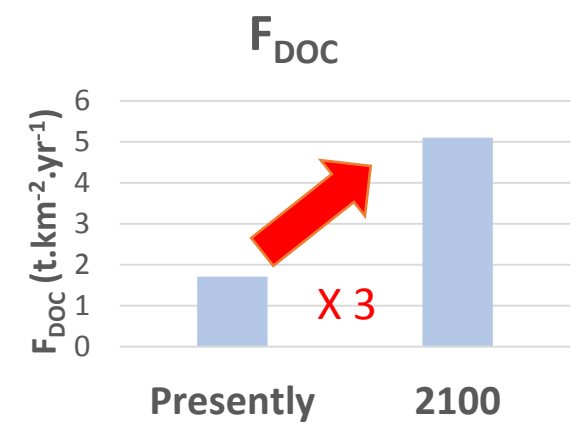


- Increase in Arctic rivers discharges expected (Peterson et al., 2002)
 - **Change in erosion regime due to climate change ???**

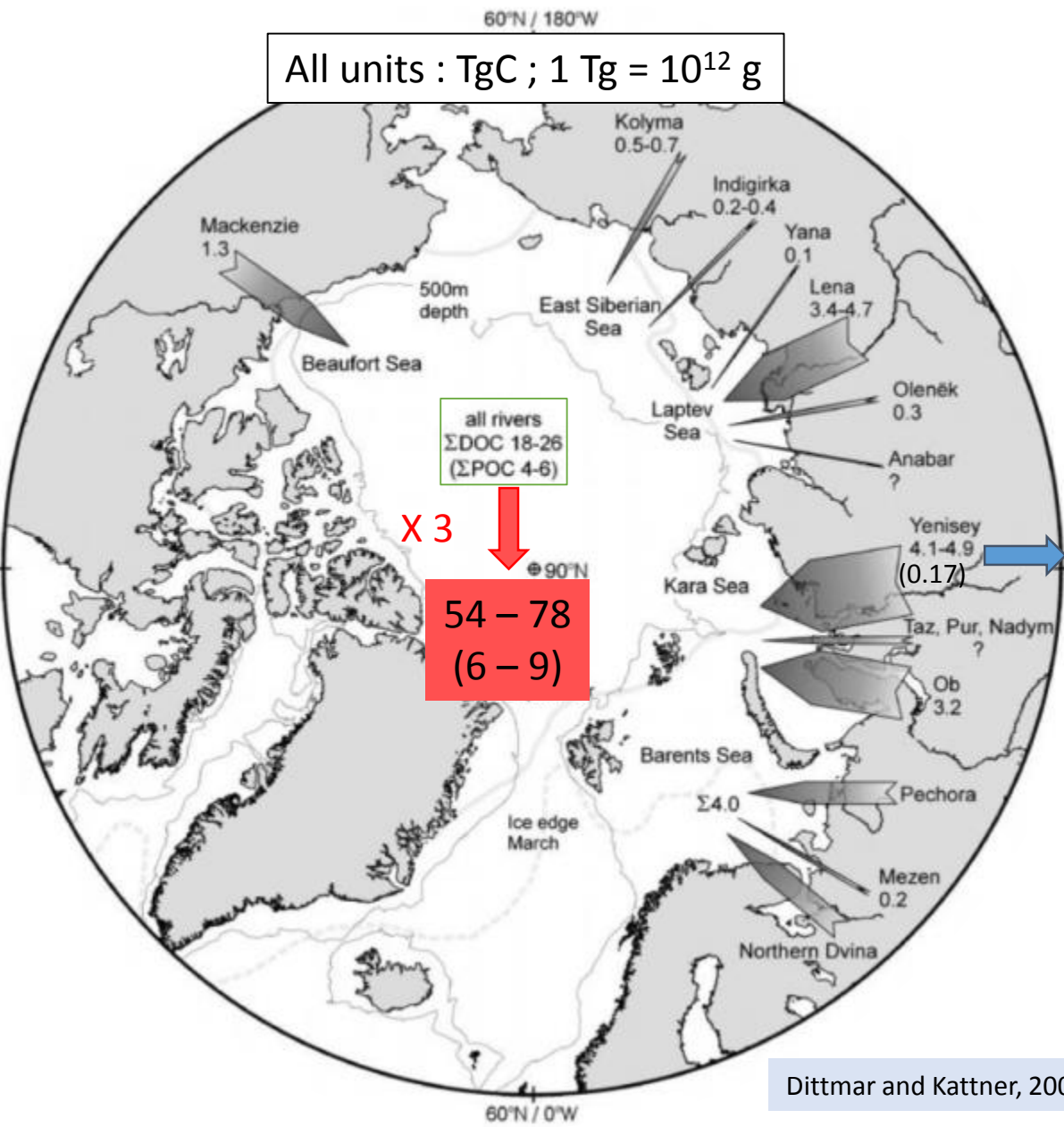
All units : TgC ; 1 Tg = 10^{12} g



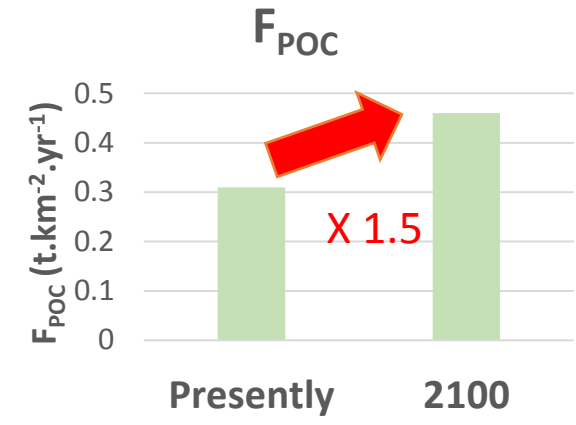
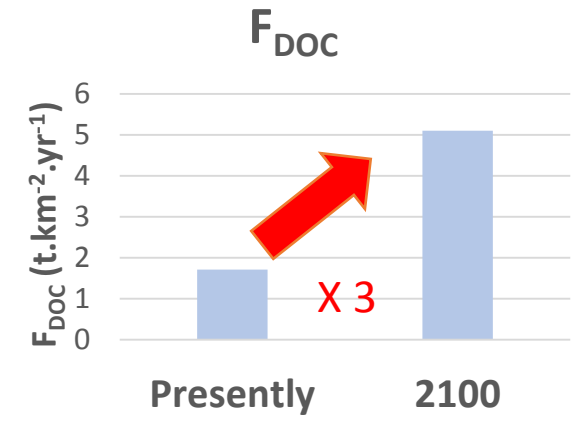
Dittmar and Kattner, 2003



All units : TgC ; 1 Tg = 10¹² g



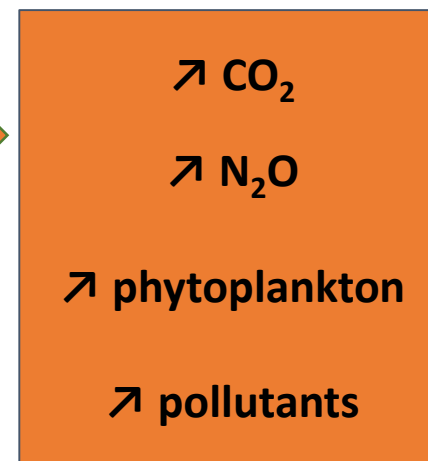
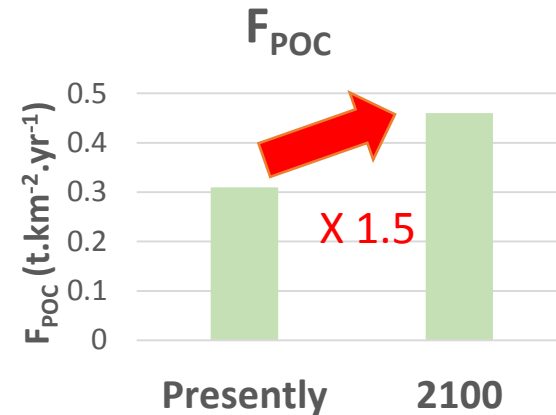
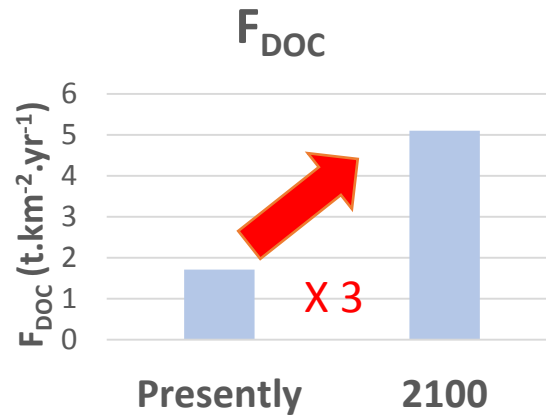
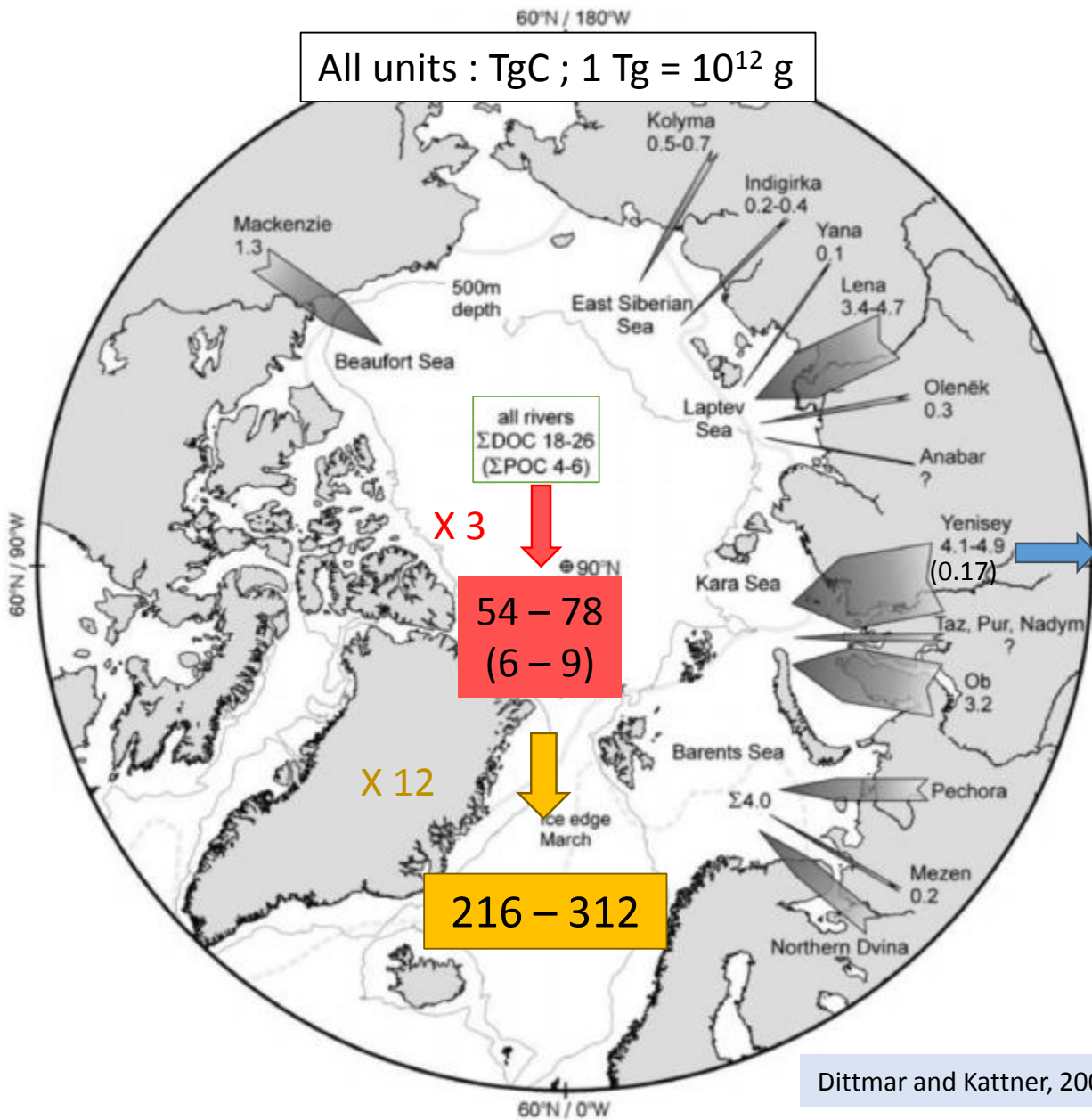
Dittmar and Kattner, 2003



↗ CO₂
 ↗ N₂O
 ↗ phytoplankton
 ↗ pollutants

Znachor and Nedoma, 2009

All units : TgC ; 1 Tg = 10¹² g



Znachor and Nedoma, 2009

+ Erosion regime change ???

World TOC Export : 370 - 410

Schlesinger & John M. Melack

Conclusions & Perspectives

- SWAT is able to represent water and carbon exports in Arctic watersheds at a daily time step

Coming:

- *Water and carbon exports modifications in Arctic watersheds in front of climate change scenarios*

Thank you for your attention

