# EEMs and PARAFAC in North Patagonia (Argentina): adapting to a methodology in continuous progress

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### *Abstract*

The study of the fluorescent dissolved organic matter in Northwestern Patagonia through excitation emission matrices (EEMs) by our research group started in 2012. The first paper that we published using EEMs included six mountain lakes. The *peak picking method* was used due to the low number of EEMs collected, and three peaks were identified (Peak C, Peak A and Peak T) (García, P. *et al*., 2015a) (Figure 1). In this study, we deal not only with the low number of EEMs to perform PARAFAC analyses, but also low fluorescence was found in some samples.

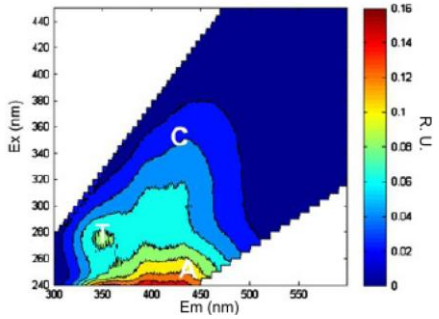


**Figure1:** a) The location of the peak picking used in García P. *et al*., 2015 b) EEM from Schmoll.

The next research deals with the terrestrial inputs of DOM in four headstreams in North Patagonia (García, R. *et al*., 2015b). In this opportunity, we were able to perform PARAFAC on 120 EEMs and a three-component model was validated through slit-half and random initialization (Figure 2). Two components were humic-like: C1 (peak A+ peak M) and C2 (peak A + peak C), and one was protein-like: C3 (peak T). This study highlighted the used of PARAFAC in order to identify underlying components such as C1 (A+M), that were not taken in consideration in the previous study.

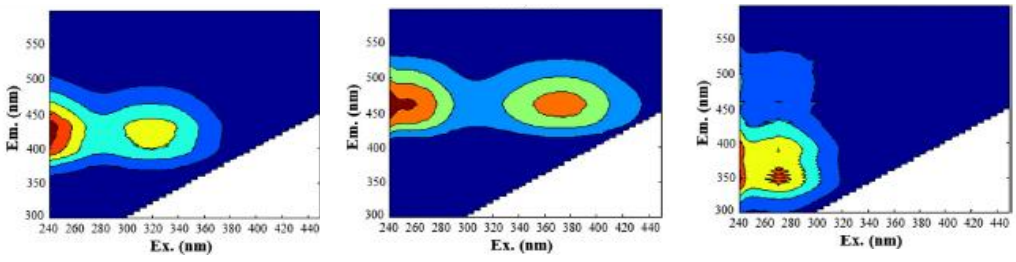


**Figure 2:** Three component PARAFAC model found.

Continuing with the use of PARAFAC, we performed the analysis in samples on two neighboring shallow lakes during rainy and dry seasons (Soto Cárdenas *et al*., 2017). We collected 44 EEMs and, similar to previous findings, three-component model was validated: C1 (A+M), C2 (A+C) and C3 (T). At this point, we were almost convinced that only a three-component model could be achieved in the aquatic systems in our region.

In order to identify different sources of DOM for a small catchment area, our research group performed experiments using DOM leached from soil and leaf litter. At this time, PARAFAC validated a four-component model (Figure 3) (García, R. *et*

*al.*, 2018). The first three components were previously found in different lakes and streams from the area, while C4 showed up as a new component. The C4 was composed of humic substances and resembles a "shifted" peak M. This component prevailed only in samples of leaf lecheates, reason why it was called $M_{leaf}$. This scientific contribution highlighted that DOM quality is affected by different sources and processes acting simultaneously and that must be taken into account when performing PARAFAC analysis.

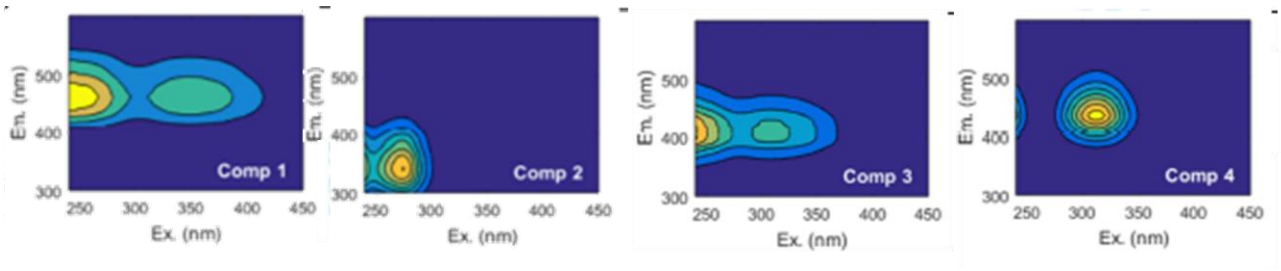


**Figure 3:** Four-component PARAFAC model. Component 4 is a new component present only in leaf leachates.

Evidently, PARAFAC is a useful tool to identifying fluorophores and at least three components were consistent through the freshwater DOM in North Patagonia. However, every dataset produces a unique set of components, making difficult to compare results across studies. Therefore, a combination of **PARAFAC** and ***peak picking*** seems to be the most conservative measurement in order to compare different types of environments in the same region. Consequently, we must use them carefully, particularly when we include in the analysis the DOM sources and different types of environments. Finally, we leave open for discussion which peaks should be "picked".

**References**

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