


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DOC transport and export in a dynamic tropical catchment


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
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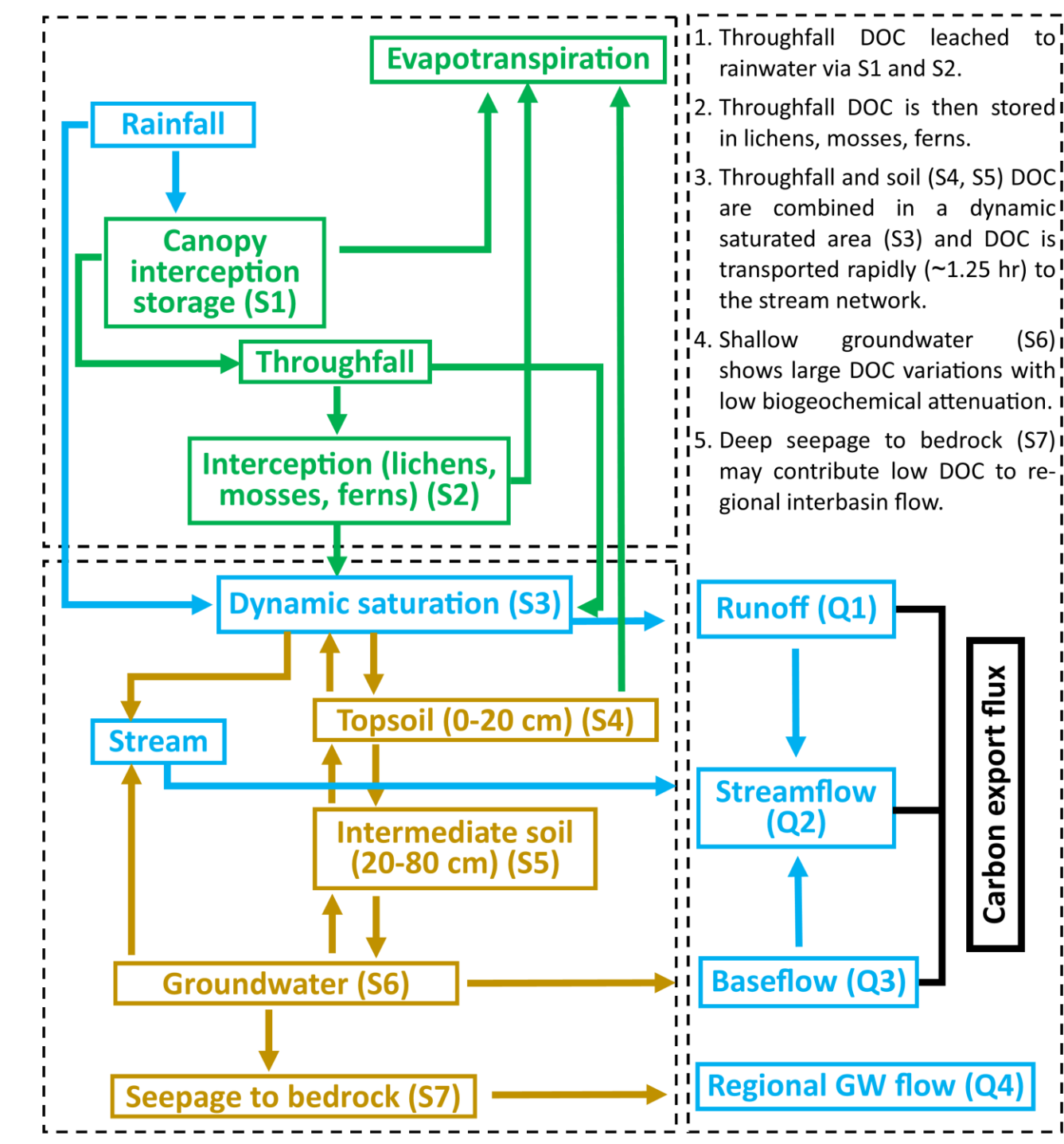
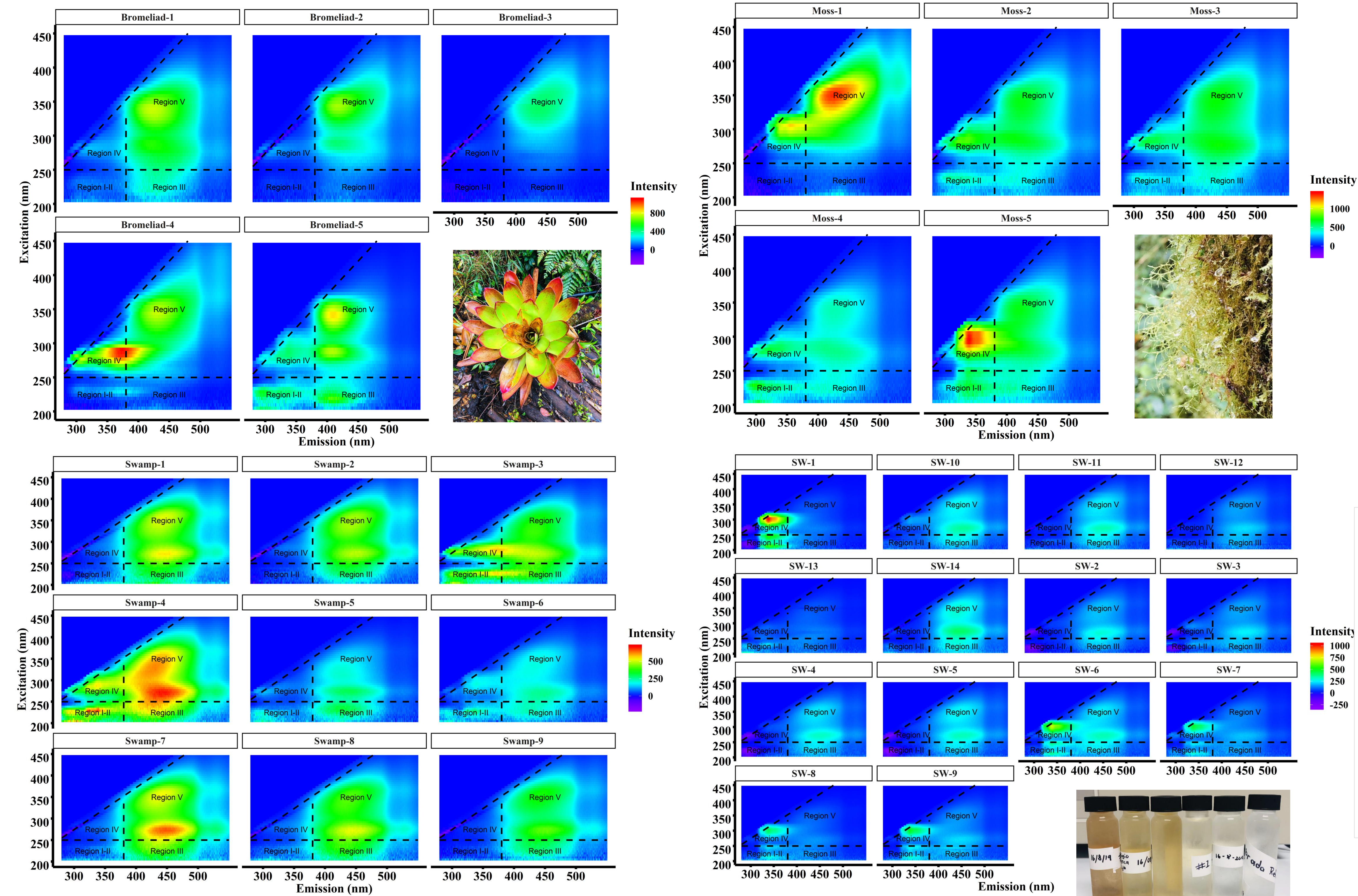
I. Background

In this study, we focus on the seasonal changes (baseflow and storm events) of DOC in a pristine and small (~2.6 km²) humid forested catchment of central Costa Rica to assess the governing mechanisms on DOC variability. High resolution (15-30 minutes) hydro-meteorological data (i.e., stream discharge, rainfall, and soil conditions) were combined during a hydrological year with baseflow and stormflow DOC sampling, soil and vegetation characterization.

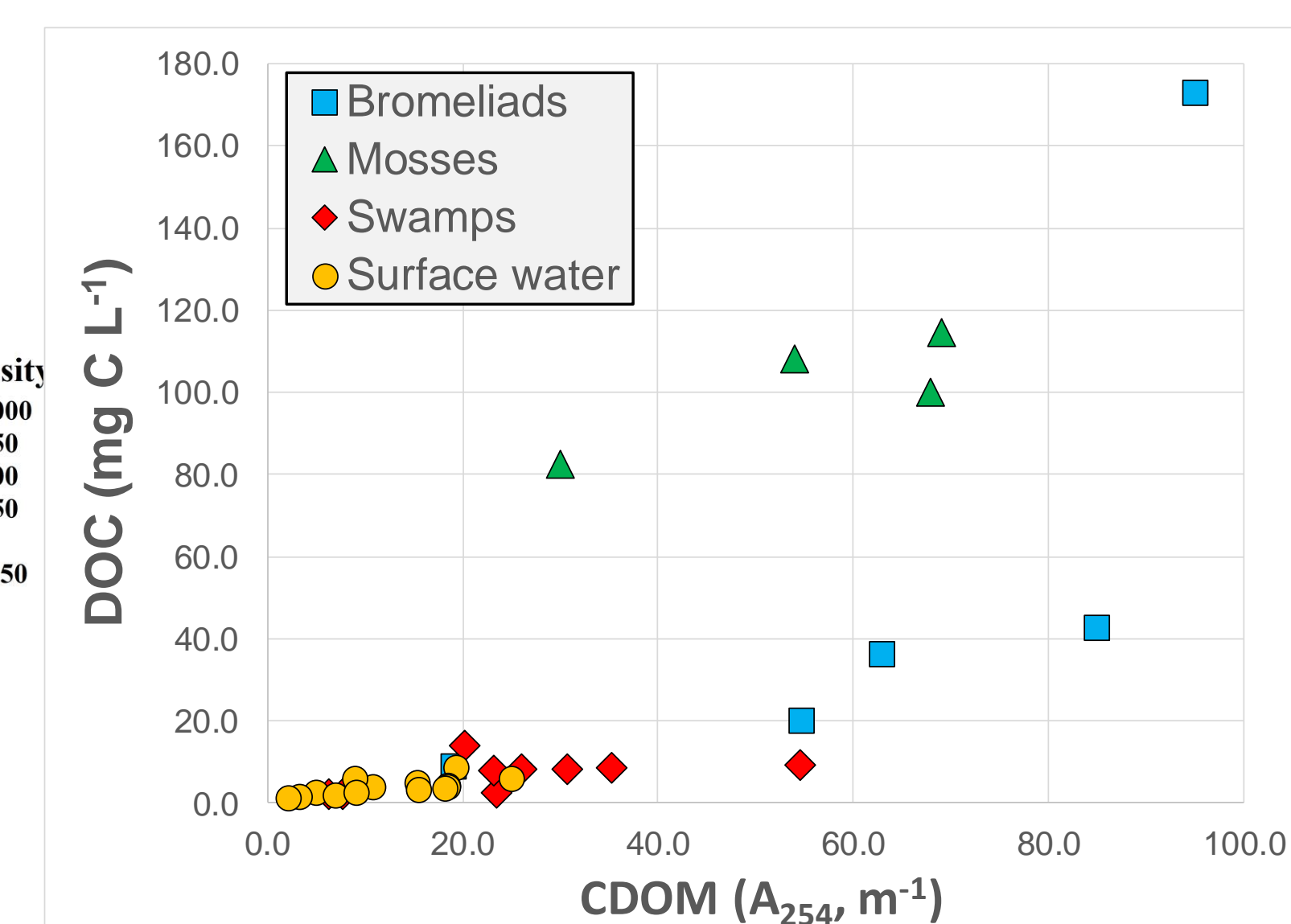
isotope hydrograph separation and mean transit times, and weekly physical and chemical stream water characteristics to evaluate two fundamental research questions for tropical regions: **1) to what extent does event or pre-event water and biogeochemical processes govern DOC transport and export? and 2) what is the discharge-weighted carbon annual flux and how much is contributed by baseflow and storm events?**

We hypothesize that a) DOC is largely and rapidly transported during large rainfall events with minimal biogeochemical attenuation during intermittent baseflow episodes and b) dynamic headwater tropical catchments may contribute large amounts of organic matter to lowland freshwater ecosystems during rapid pulses. Our results provide high-resolution evidence (from local to global) to validate coupled DOC-hydrological modeling at the catchment scale and may improve spatial distributions of global riverine DOC yields for the Mesoamerican region.

III. EEMs by matrix (Bromeliads, Mosses, Swamps, and Surface Water)

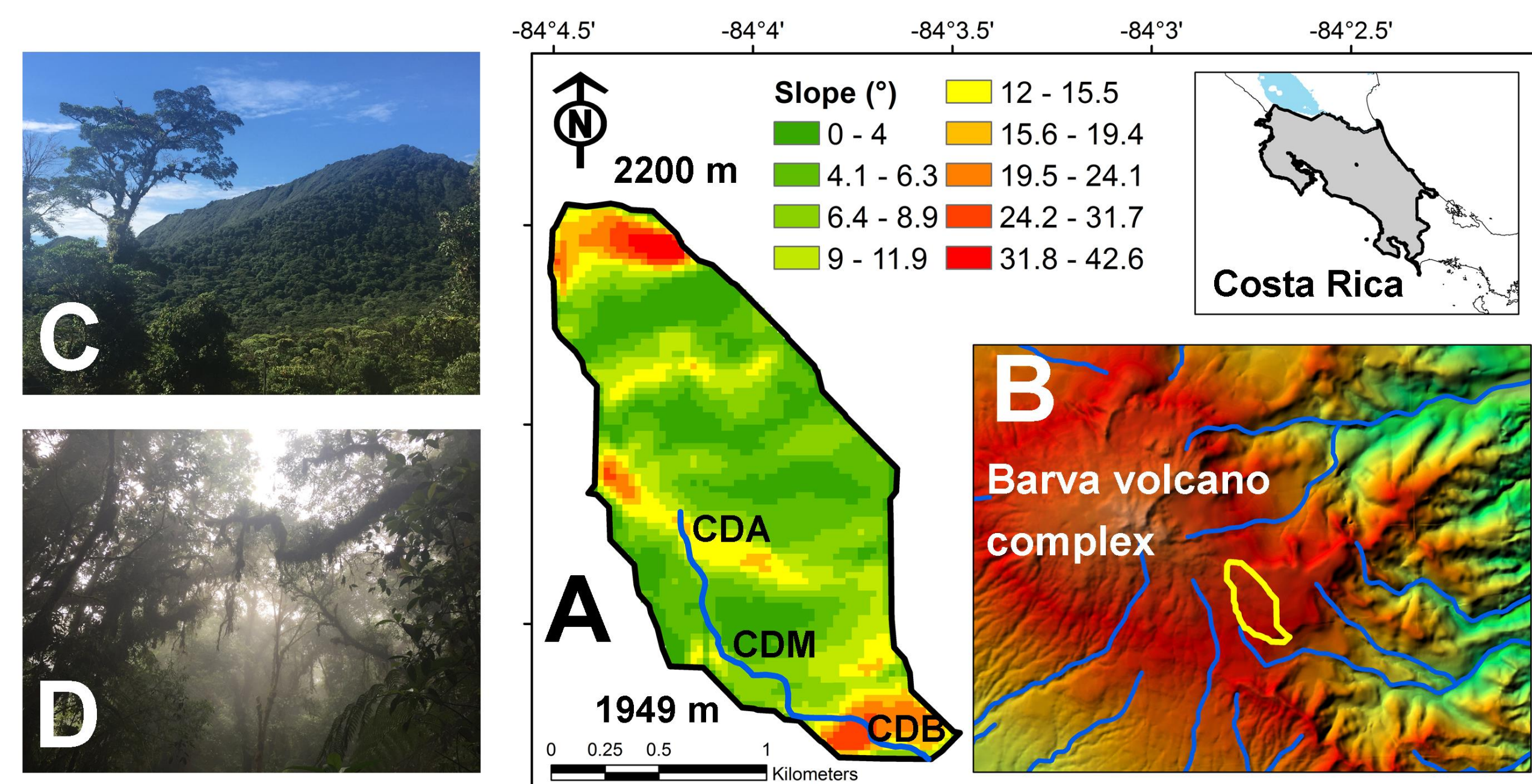


Conceptual Model
(Sánchez-Murillo et al., (2019). *JGR-Biogeosciences*.)

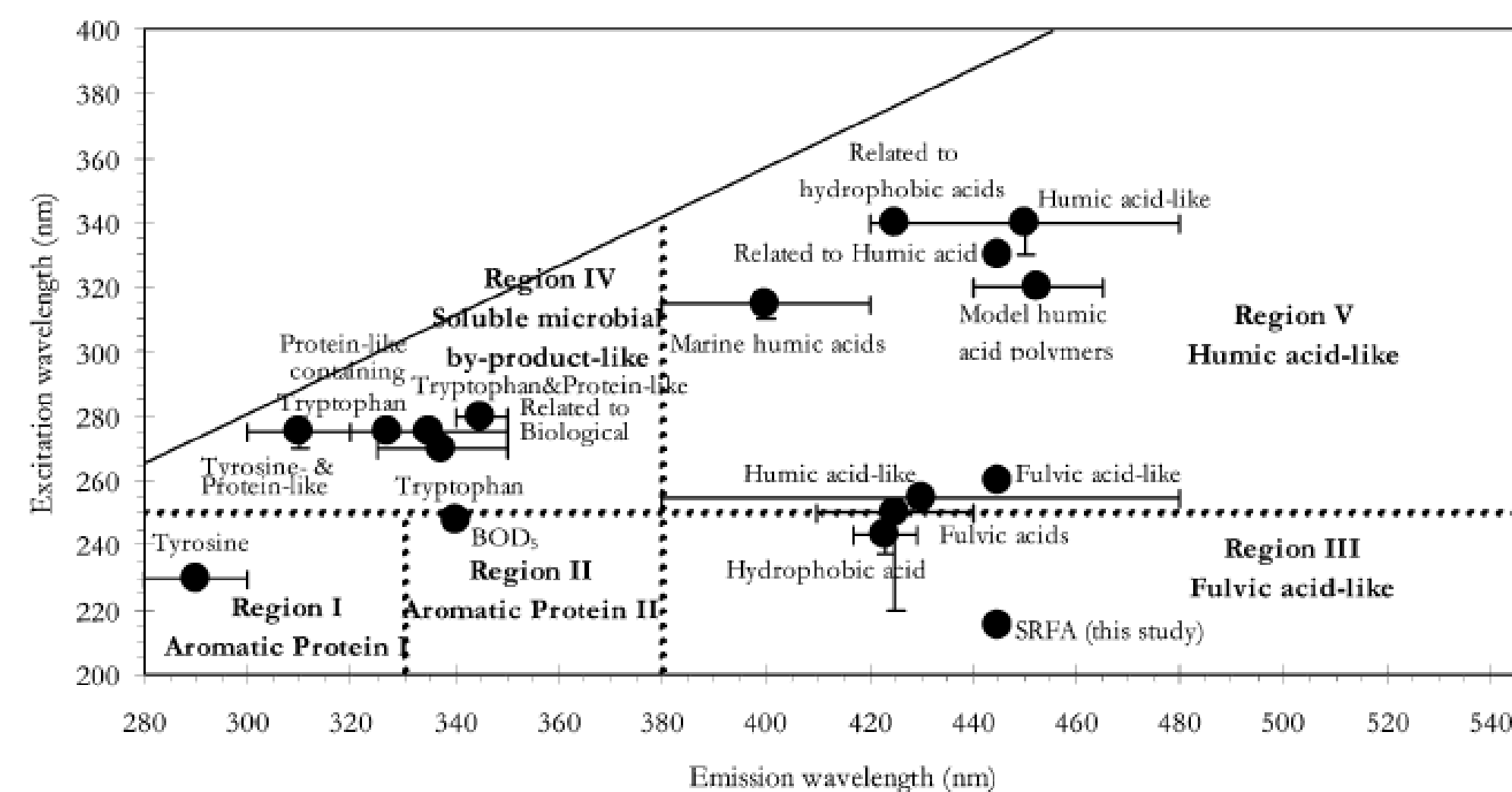


Absorbance vs DOC

II. Study area



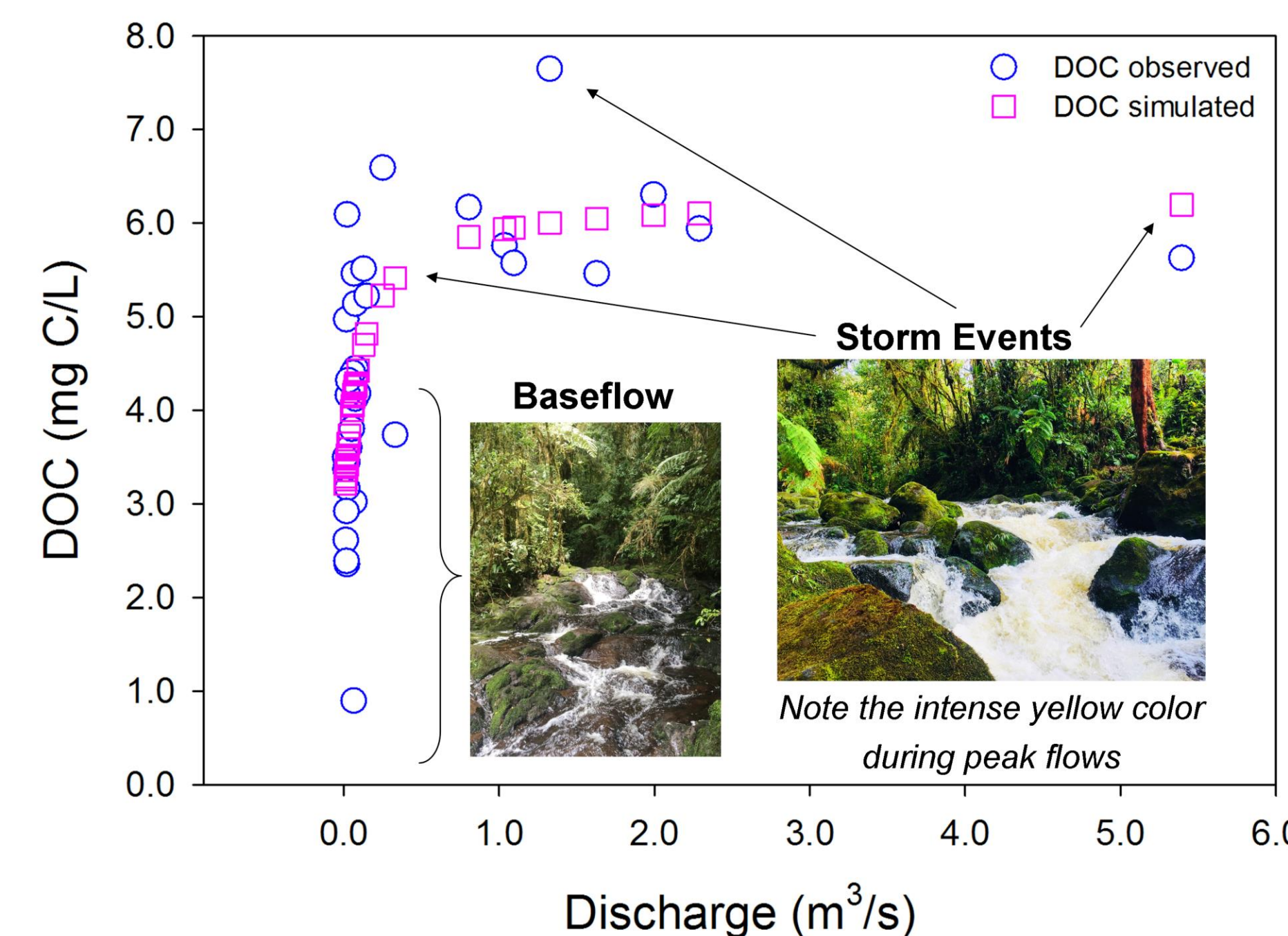
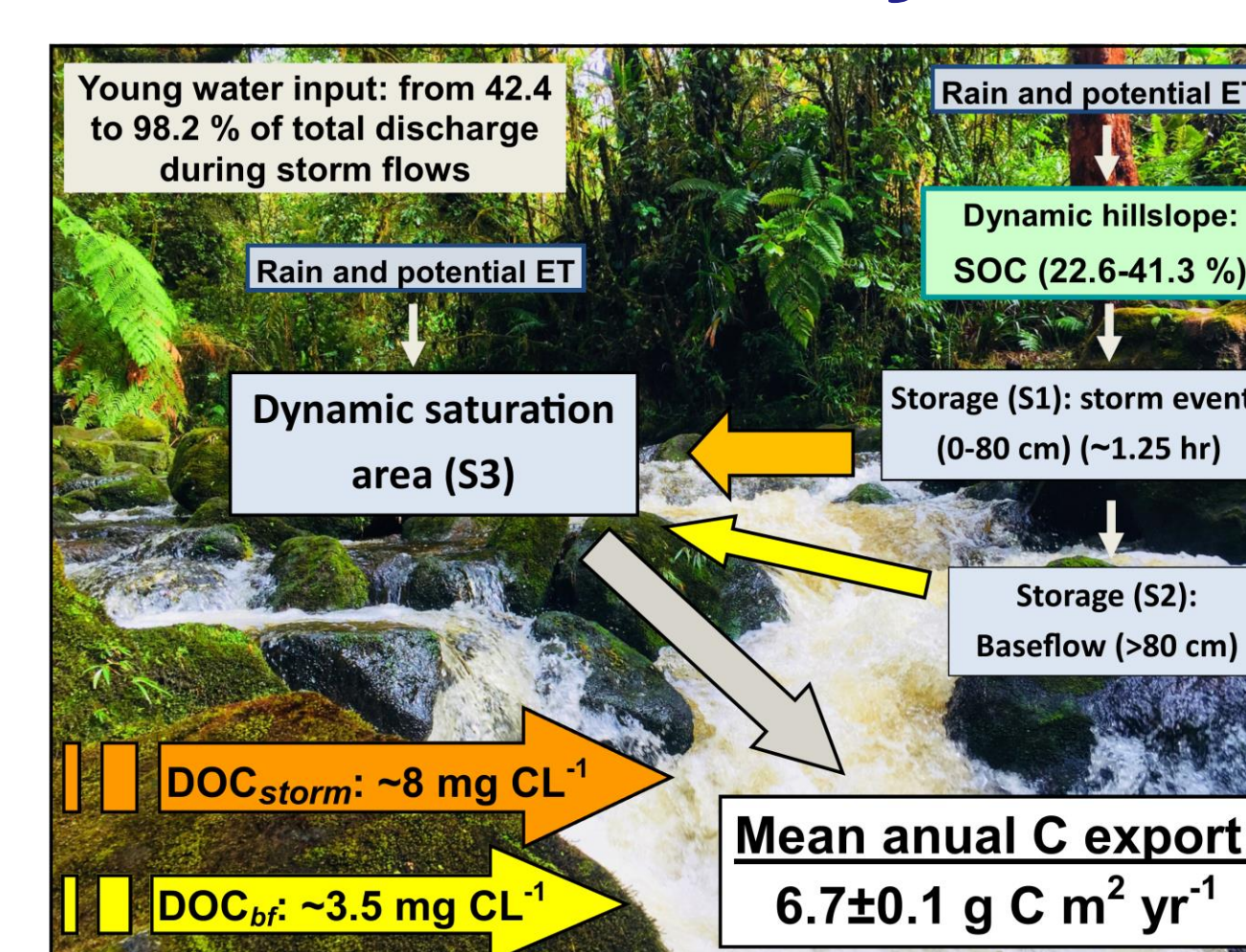
(A) Quebrada Grande (2.6 km²) catchment including sampling site locations (CDA, CDM, and CDB); hydrometric data, DOC, and stable isotope samples were collected near CDB. Catchment slope (in degrees) is color-coded. The upper-left inset shows the location of study site in central Costa Rica. (B) Quebrada Grande is located within the Barva volcano edifice. The catchment (yellow bold line) drains to the Caribbean basin within a relative complex topography. (C)-(D) Photographs showing the typical aspect of this mixed primary and secondary forested catchment.



- **Region I-II:** Aromatic proteins
- **Region III:** Fulvic acids
- **Region IV:** Humic acids
- **Region V:** Soluble microbial by-products

Diagram from Chen et al. (2003). *Environ. Sci. Technol.*

Summary



IV. Corollaries

- Rapid surface and lateral allochthonous DOC transport during storm flows.
- Mixture of humic and soluble microbial by-products in the stream.
- Isotope separation estimated large (42.4-98.2%) young water contributions during storm flows.
- DOC transport most likely occurred within ~1.25 hours after the rainfall maxima.
- Large rainfall events governed DOC transport in a humid tropical catchment.
- Mean annual flux-weighted C export: 6.7 ± 0.1 g C/m² yr.

V. Acknowledgments

This study was partially supported by International Atomic Energy Agency grant CRP-19747 to R.S.M. under the pan-tropical initiative "Stable isotopes in precipitation and paleoclimatic archives in tropical areas to improve regional hydrological and climatic impact models". Partial support from the Empresa de Servicios Públicos de Heredia (ESPH, S.A), the Research Office of the Universidad Nacional of Costa Rica through grants SIA-0482-13, SIA-0378-14, and SIA-0101-14 was also fundamental.