17. Spatio-temporal variability of water quality derived from Sentinel-2: the Po River case study

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For centuries, human activities have heavily altered river systems, driving widespread restoration efforts across Europe, such as the Italian "Action Programme for the restoration of the Po River Area". In this study, we present a satellite-based framework using 509 Sentinel- 2 (Level-1C) images, atmospherically corrected via RAdCor algorithm (ACOLITE v2025), to assess water quality across six representative areas of the Po River over four years (2018, 2022, 2024, and 2025) characterised by both dry and wet conditions. The analysis focused on four key parameters: dominant wavelength, optical water types, suspended particulate matter concentration, and trophic status derived from chlorophyll-a levels. The results reveal a highly dynamic environment, where water quality exhibits strong coupling with spatial and seasonal patterns, river discharge, and the resulting hydrological fluctuations of the river. Overall, this study establishes a comprehensive water quality baseline for the Po River and provides a satellite-based monitoring approach to assess the effects of upcoming river restoration measures.