Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.36047

Typhoon-Induced Temporal Dynamics of Dissolved Organic Matter in the Greater Bay Area

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The intensification of extreme climate events such as heavy rainfall and typhoons is increasing the risk of urban waterlogging and flooding in the Greater Bay Area (GBA), China. These events flush chemically heterogeneous mixtures of dissolved organic matter (DOM) and pollutants accumulated in urban and terrestrial environments into rivers and aquatic ecosystems, rapidly reshaping watershed hydrological connectivity. Conventional water quality monitoring, which relies heavily on numerous targeted analytes, remains insufficient to disentangle such mixed pollution sources.

In this study, Super Typhoon Ragasa (2025) was used as a natural disturbance in a cross city coordinated sampling campaign across six cities in the GBA. From 22 September to 2 October, more than 300 samples were collected at seven time points (−1, 0, +1, +2, +3, +8, and +10 days), capturing four hydro-meteorological response stages: antecedent conditions, peak impact, early recovery, and late recovery. This design enabled characterisation of the spatiotemporal responses of DOM and dissolved organo-halogens under extreme event forcing. Samples were extracted and desalted using solid-phase extraction, followed by ultrahigh-resolution molecular fingerprinting of DOM using 9.4T Fourier-transform Ion Cyclotron Resonance Mass Spectrometry, together with quantification of total organic halogens by combustion ion chromatography.

The results show that, on the temporal scale, concentrations at all monitoring sites exhibited a systematic decrease during the typhoon, indicating an emission driven dilution effect. Subsequently, although hydrological conditions rapidly receded after the event, total suspended solids and DOM related signals rebounded quickly and even intensified, suggesting a lagged risk window characterized by hydrological–chemical asynchrony. Ultrahigh-resolution mass spectrometry identified thousands of unique molecular species in each city and phase, reflecting marked differences by land use and storm impact.

Overall, molecular fingerprint evidence demonstrates that typhoon events not only enhance material export but may also, by increasing connectivity among urban surfaces, river networks, and riparian zones, restructure the DOM molecular pool and promote the remobilization of organo-halogens related components. These molecular level insights contribute to post-typhoon DOM source apportionment and the identification of risk windows, and provide support for emergency water quality monitoring and risk assessment in the GBA.