Exploring Climate, Ecosystems, and Society Interactions:
Insights from the first steps in the Biocean5D Project

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Our evolving socio-economic dynamics are driving our biosphere towards critical tipping points: ice sheets are melting, marine currents are slowing, Amazon rainforests are transitioning to savannas, and deserts are expanding. Anthropogenic pressures notably impact marine ecosystems, yet the resulting effects on ecosystem function remain complex, poorly understood, and challenging to forecast. While the decline of marine ecosystems is evident, the underlying changes in functionality remain elusive. Despite our knowledge of biodiversity-ecosystem function relationships in terrestrial ecosystems and controlled experiments, applying this understanding to marine environments poses unique challenges. The Biocean5D project is advancing new theories to untangle this intricate relationship. Our approach aims to integrate spatial, temporal, and human scales to develop a comprehensive understanding. In this presentation, we will explore the interactions among climate, ecosystems, and human societies. How can modeling improve our understanding of underlying mechanisms and enhance predictivity? Why are results obtained from terrestrial ecosystems not directly applicable to marine environments? Are current ecosystems within safe thresholds? Should we incorporate higher-order interactions to better predict ecosystem responses? Can we forecast emerging social transformations?