A Dynamical System-Based Methodology for Validating High Resolution Ocean Models

Validating high-resolution ocean models in coastal areas presents a significant challenge due to the limited availability of in-situ observations. This paper introduces a novel approach that leverages satellite imagery to bridge this gap, utilizing the Regional Ocean Modeling System (ROMS) to simulate the hydrodynamics of the Rafina area in Greece. Our methodology integrates Lagrangian Descriptors (LDs) with satellite data to trace the distribution of suspended matter and identify Lagrangian Coherent Structures (LCS) that dictate material transport patterns. Through a series of sensitivity experiments, critical parameters such as horizontal diffusivity, viscosity, bottom drag coefficient, and boundary conditions were adjusted, yielding different outputs that were linked to the satellite images through dynamical systems objects. By defining a performance index, the study quantifies which experiment best represents the local ocean state. This approach not only offers a practical alternative to direct in-situ measurements in data-sparse coastal zones but also enhances our comprehension of these dynamic and complex environments.

Guillermo García-Sánchez Digital Earth Solutions