DOCTOR OF PHILOSOPHY
IN
PHYSICAL OCEANOGRAPHY

SENSITIVITY STUDIES USING MULTI-REGION AND OPEN BOUNDARY CONDITIONS FOR TERRAIN BOTTOM-FOLLOWING OCEAN MODELS

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The objective of this thesis is to develop a prognostic model of the Northern Canary Current System (NCCS), based on the Princeton Ocean Model, with parallel processing capabilities on a cluster of workstations and improved boundary conditions. A one-way coupling with a z-level basin scale model, a North Atlantic version of the Parallel Ocean Program, will also be executed. The development of this model will allow the investigation of coastal processes and the development of numerical models in order to improve the results of sigma coordinate bottom-following ocean models. The roles of wind forcing, bottom topography, and thermohaline gradients in coastal processes will be investigated. In order to reduce the Pressure Gradient Force Error while maintaining a realistic topography, a new topographic smoothing technique will be developed. Modified Marchesiello boundary conditions will be applied to a version of POM model one-way coupled with a North Atlantic version of POP. Finally, an automatic multi-region parallelization will be developed, applying minimal changes to the serial POM code. It is shown that a prognostic sigma-coordinate model can be successfully developed for the NCCS, with more realistic topography, improved boundary conditions, and with parallel processing capabilities.

KEYWORDS: Sigma Coordinate Model, Parallelization, MPI, Boundary Conditions, Multi-region