



A High-Resolution Modeling Study of the Bosphorus Strait Dynamics and Exchange Flows

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An all-time modelling challenge aims to establish a sound understanding of the high energy environment of the Turkish Straits System, relating to inter-basin water and material transports and their influence on the sensitive ecosystems of the adjacent seas. As a first step in this direction, well resolved, high level, physically representative predictive models of the Bosphorus Strait exchange flow hydrodynamics are developed, adequately representing its complex topography, hydraulic controls, dissipative hydraulic jumps, mixing and turbulence mechanisms, with the application of appropriate basin boundary and initial conditions and judiciously selected numerical and physical model options. Both the ROMS and MITgcm models are used and compared for performance. Idealized and real case model results successfully reproduce observed flow features. The unique maximal exchange regime of the Bosphorus Strait, with hydraulic controls are demonstrated, although frictional effects, especially of the highly irregular lateral boundaries, are found to be extremely important, associated with mixing and entrainment and nonlinear dynamics determining the two-way fluxes as a function of sea-level changes across the strait. The inter-comparison of ROMS and MITgcm results are extremely satisfactory in the basic elements of the flow, except for some small differences.