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Measurement and modeling of small-scale to mesoscale ocean circulation in the Straits of Florida

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Predicting ocean circulation in strong currents remains challenging because of limits in modelling capabilities such as resolution. Coastal ocean circulation models typically have horizontal resolution starting from 1 km. To address this matter, we have developed a high resolution three-dimensional computational fluid dynamics (CFD) model for strong ocean currents such as the Gulf Stream. Our model domain contains three inlets and an outlet and has been verified with field data from the Straits of Florida. For model verification, a 6 ADCP mooring array in a rectangular shape was deployed 8 miles offshore on the Miami Terrace. The data from 5 ADCP moorings were used to produce the inlet boundary conditions, which were updated every 1 minute. The sixth ADCP in the center of the outlet was used for model verification. This approach has demonstrated good predictive ability for ocean circulation in the challenging environment of a strong western boundary current. We anticipate our work to be a starting point for the development of sophisticated prediction models applicable to western boundary currents in the range from small-scales to sub-mesoscales, based on advanced data assimilation techniques.