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Physics and Biology of Ocean Fronts

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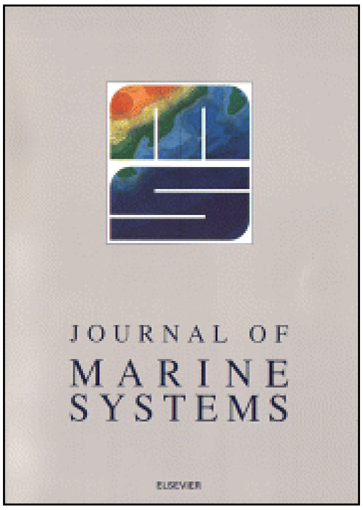

Ocean fronts always attracted oceanographers' attention. These narrow zones of enhanced gradients of water properties have been observed over a bewildering range of scales: from 100 m to 10,000 km along-front; from 10 m to 100 km across-front; from 1 m to 1 km down-front; their lifetime varies from hours to millions of years. Fronts separate water masses that might change little over many hundreds of kilometers, and yet, frontal gradients of temperature and salinity might be as sharp as 10°C and 1 ppt, respectively, over a O(100 m) distance. Fronts are accompanied by current jets, convergencies, eddies, subsurface intrusions and lenses. They are associated with strong mixing and stirring, elevated bioproductivity and ecotones, acoustical wave guides, marginal ice zones and atmospheric boundary layer fronts.

There has never been a better time to study fronts. Modern technology has enabled high-resolution observations of frontal phenomena, unthinkable a decade ago. Satellites and towed undulated vehicles have allowed frontal structures to be studied over an unprecedented variety of spatial and temporal scales. Powerful computers helped achieve a very high resolution in numerical modeling of fronts. Advanced front detection algorithms applied to satellite imagery have revolutionized ocean remote sensing. The explosive growth of front-resolving technology, both in the field research and modeling, has mirrored the growing realization of the paramount importance of fronts.