JOHN S. ALLEN JR. 1937–2023

John S. Allen Jr., a prominent leader in the understanding of continental shelf physical oceanographic processes, passed away September 6, 2023. His many seminal dynamical and observational contributions were built on his energy, enthusiasm, curiosity, quantitative process-based methodology, and passion for oceanography.

John was born in Brooklyn Heights, New York, and grew up in Manhasset, Long Island. In high school, he excelled both academically and athletically, playing in the football backfield with Jim Brown, the renowned NFL player. John attended Princeton University, where he studied aeronautical engineering and played lacrosse for four years. Immediately following graduation in 1959, he fulfilled his Reserve Officers' Training Corps obligation by serving three years as an artillery lieutenant in the United States Marine Corps. Following his time in the service, he returned to Princeton for a Ph.D. in 1968, again in aeronautical engineering. During 1967–68, he was a postdoc in the Department of Mechanics at The Johns Hopkins University. He also participated in the Woods Hole Geophysical Fluid Dynamics program in the summer of 1968, which set a new direction in his career: his publications were exclusively oceanographic after 1970 even though his appointment at The Pennsylvania State University was in aerospace engineering. He completed his transition to the oceanic sciences in 1973 by joining the vibrant School of Oceanography (later to become the College of Earth, Ocean, and Atmospheric Sciences) at Oregon State University in Corvallis, where he remained for the rest of his career.

John arrived at a particularly propitious time. Robert L. (Bob) Smith and his colleagues there were making good use of the then relatively new moored current meter technology to lead the way in the quantitative measurement of currents and water properties over the continental shelf. Bob understood the need for and importance of a better theoretical understanding of shelf circulation, and so he welcomed John wholeheartedly. At the same time, dynamical understanding of wind-driven fluctuations was just developing, notably through the work of Adrian Gill and his students. With his keen physical insights and mathematical skills, John was the right person at the right time. His theoretical contributions elucidated ways that 5–10 day coastal-trapped waves are affected by winds, irregular bottom topography, and density stratification. At the same time, John was personally involved in analyzing ocean datasets on time scales from days to years. He introduced new approaches to analysis and worked to unify observational and theoretical approaches. Together with Pijush Kundu (1976), he pointed out the peculiarity that alongshore currents over the shelf are correlated over alongshore scales vastly greater than for cross-shelf currents, an issue that took years to resolve.

One of the major controversies in the field at that time involved whether the coastal ocean's response to wind forcing was primarily local or wavelike in character. In a tour de force, John, working with his student Don Denbo (1984), used analytical theory to predict the statistics of the coastal ocean's response. They found that alongshore currents and coastal sea level should always be best correlated with earlier, distant (e.g., farther south along the U.S. West Coast) wind stress. This spatial/temporal offset is structured by long coastal-trapped waves, which depend on Earth's rotation and so only propagate in one direction (with the coastline to the right in the northern hemisphere). The alongshore distance to the location of maximum correlation depends strongly on the strength of bottom friction and on the predominant direction that atmospheric weather systems move along the coast. Thus, the local/remote controversy is ultimately explained by

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weather systems off the western United States that generally move northward (promoting resonance), while those off the U.S. East Coast generally move eastward (in the nonresonant sense).

John clearly recognized the limitations to analytical theoretical approaches, especially for inherently nonlinear phenomena such as fronts or eddy interactions. However, computational resources were limited in the 1980s, so it was desirable to develop an economical reduced-physics approach for coastal ocean numerical modeling rather than carry out primitive equation calculations. The quasi-geostrophic approximation, which is so useful for atmospheric and open-ocean conditions, fails in the coastal environment due to the magnitude of the shelf-slope depth changes, so another approach was called for. John, along with coworkers, developed new formulations and compiled a catalog of existing intermediate models. They then carried out rigorous intercomparisons and reported the results in a series of publications. The resulting documentation is a remarkable resource. As it turned out, the economics of computation improved dramatically by the mid-1990s, so that this body of work did not immediately receive the attention one might have expected. However, these intermediate-physics models became of interest again more recently in the context of interpreting high-resolution satellite altimeter observations over the shelf.

Beginning in the 1990s, John took advantage of improved computational capabilities by exploiting primitive equation numerical models. He appreciated their value both for understanding processes and for simulation/prediction applications. He brought to numerical approaches his sharp intellect, his process-focused theoretician's toolbox, and his interest in a wide range of coastal problems. First, he worked with collaborators to address the role of mixing and advection for creating fronts in the coastal ocean. Along the way, he found that for uniform alongshore conditions, downwelling gives rise to dramatic finite-amplitude roll instabilities in the bottom boundary layer, and he thoroughly analyzed the underlying physics. Next, John became involved with the coupling of physical and biological models to predict ecosystem responses to winds and currents. Further, he developed an interest in the inner shelf and sediment transport there. His research on these surf zone processes embraced barotropic instabilities and the generation of shallow-water eddies on scales of 10–20 m—small enough that Earth's rotation is irrelevant. Additionally, in partnership with Scott Durski (2005), he carried out seminal calculations that demonstrate how realistic alongshore winds, through baroclinic instabilities along the upwelling front, can give rise to a rich 10-km-scale eddy field over the shelf. Because of their near-isotropy and intermediate scale, these eddies, combined with larger-scale alongshore flows, appear to resolve the above-mentioned mystery of why observed cross-shelf currents have such a short along-shelf scale. Beyond these process-oriented studies, John became increasingly engaged in simulation modeling and data assimilation: many of his later publications address this important, more applied, class of problems.

For someone with interests as broad as John's, any attempt to organize his contributions systematically inevitably leads to loose ends. One particularly important example is his work with Roger Samelson (1987–91) applying chaos theory to a physically meaningful coastal ocean application. Specifically, they considered a model of wind-driven currents over a uniformly sloping bottom that has bumpy topography superimposed. The resulting solutions are sometimes chaotic but also rationalize the generation of a mean alongshore flow. The implications of these studies remain challenging to this day.

John's many accomplishments, of course, gained him a good deal of recognition, such as being named a fellow of the American Geophysical Union in 1999. AMS recognized him in 2005 both as a Fellow and by awarding him the Henry Stommel Research Award for his insightful and rigorous elucidation of ocean processes over the continental shelf and slope.

John took great pride in his role as a mentor. He advised 14 postdocs and many Ph.D. students. He had an engaging style that involved intense curiosity, rigor, involvement, and generosity; he was always one to share his best ideas with others. He was a regular attendee at the Coastal Ocean Gordon Conferences where he spent hours interacting with younger scientists, and he never failed to have a question for the speaker. Understandably, an aura grew about John's enthusiasm, especially regarding his desire to understand every equation and detail in seminar presentations. When a speaker described a dynamical process without mathematical rigor, John was legendary for saying, "Show me the equations." He held everyone to a high standard and by doing so he made better scientists of us all.

John led a full life outside the office. He married his high school sweetheart, Connie, in 1959, shortly after graduating from college, and their marriage endured until his passing. They had a daughter, Barbara; and sons, John III and William; along with two grandchildren. John was extremely active in physical activities until late in life when he was no longer able. His pursuits included running, bicycling, golf, and especially windsurfing.

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—**Kenneth H. Brink and Dudley B. Chelton**