SCCWRP #0975

An evaluation of ISFET sensors for coastal pH monitoring applications

Karen McLaughlin[1], Andrew Dickson[2], Stephen B. Weisberg[1], Kenneth Coale[3], Virginia Elrod[4], Craig Hunter[3], Kenneth S. Johnson[4], Susan Kram[2], Raphael Kudela[5], Todd Martz[2], Kendra Negrey[5], Uta Passow[6], Frank Shaghnessy[7], Jennifer E. Smith[2], Dawit Tadesse[8], Libe Washburn[6], Kyle R. Weis[7]

[1]*Southern California Coastal Water Research Project, Costa Mesa, CA*

[2]*Scripps Institution of Oceanography, University of California San Diego, La Jolla, CA*

[3]*Moss Landing Marine Laboratories, Moss Landing, CA*

[4]*Monterey Bay Aquarium Research Institute, Moss Landing, CA*

[5]*University of California Santa Cruz, Santa Cruz, CA*

[6]*Marine Science Institute, University of California Santa Barbara, Santa Barbara, CA*

[7]*Humboldt State University, Arcata, CA*

[8]*California State Water Resources Control Board, Sacramento, CA*

ABSTRACT

The accuracy and precision of ion sensitive field effect transistor (ISFET) pH sensors have been well documented, but primarily by ocean chemistry specialists employing the technology at single locations. Here we examine their performance in a network context through comparison to discrete measurements of pH, using different configurations of the Honeywell DuraFET pH sensor deployed in six coastal settings by operators with a range of experience. Experience of the operator had the largest effect on performance. The average difference between discrete and ISFET pH was 0.005 pH units, but ranged from –0.030 to 0.083 among operators, with more experienced operators within ±0.02 pH units of the discrete measurement. In addition, experienced operators achieved a narrower range of variance in difference between discrete bottle measurements and ISFET sensor readings compared to novice operators and novice operators had a higher proportion of data failing quality control screening. There were no statistically significant differences in data uncertainty associated with sensor manufacturer or deployment environment (pier-mounted, flowthrough system, and buoy-mounted). The variation we observed among operators highlights the necessity of best practices and training when instruments are to be used in a network where comparison across data streams is desired. However, while opportunities remain for improving the performance of the ISFET sensors when deployed by less experienced operators, the uncertainty associated with their deployment and validation was several-fold less than the observed natural temporal variability in pH, demonstrating the utility of these sensors in tracking local changes in acidification.