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Obtaining high-precision solubilities of helium and neon in fresh water and seawater

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The observed small excesses of helium and neon over solubility-equilibrium concentrations in the ocean mixed layer serve as a tool to study the physics of the atmosphere-ocean exchange of gases in general. Currently this application is limited by the fact that published solubilities differ by 1% or more, compared to excesses of mostly about 4% and to measurement precisions of 0.4% or better. To resolve that discrepancy, we have developed a procedure capable of solubility measurement accurate to 0.2%. Water and clean atmospheric air are equilibrated in a container under precise temperature control and at exact laboratory pressure. The solubility equilibrium is reached within about 1 hour. Samples of both the water and air phases are analyzed for helium and neon using the Bremen mass spectrometric facility. To minimize systematic errors, we rely on direct comparison for the samples of the two phases (alternate measurement). Sample treatment and transfer into the mass spectrometer is much the same for the two phases, and we made sure that remaining differences between the phases are small (< 0.1%). First results are presented, in comparison with literature data.