Supporting information for: Quantifying air-sea gas exchange using noble gases in Monterey Bay, CA

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Description of figures

The gas data and model results in the main paper are presented using the gas solubilties of Lott and Jenkins (personal communication, 2015) for He, Kr, and Xe, and Hamme and Emerson (2004) for Ne and Ar [1]. Here, we present the gas data and model results using the published solubilities of Weiss (1971) for He, Weiss and Kyser (1978) for Kr, Hamme and Emerson (2004) for Ne and Ar, and Wood and Caputi (1966) fit following the procedure of Hamme and Emerson (2004) for Xe [1–4]. We have provided a MATLAB function for calculating Xe solubility using Hamme's fit to Wood and Caputi (1966) [4] in the Supporting Information. At the typical sea surface conditions during our study (S = 34.4 PSS, T = 16 °C), the solubilities of Lott and Jenkins are 2.2 % higher for He, 1.3 % higher for Kr, and 0.1 % less for Xe, compared to the published solubilities.

References

[1] Hamme R and Emerson S 2004 *Deep-Sea Res. I* **51** 1517–1528
[2] Weiss R F 1971 *J. Chem. Eng. Data* **16** 235–241
[3] Weiss R F and Kyser T K 1978 *J. Chem. Eng. Data* **23** 69–72
[4] Wood D and Caputi R 1966 *Technical report. U.S. Naval Radiological Defense Laboratory, San Francisco, CA*

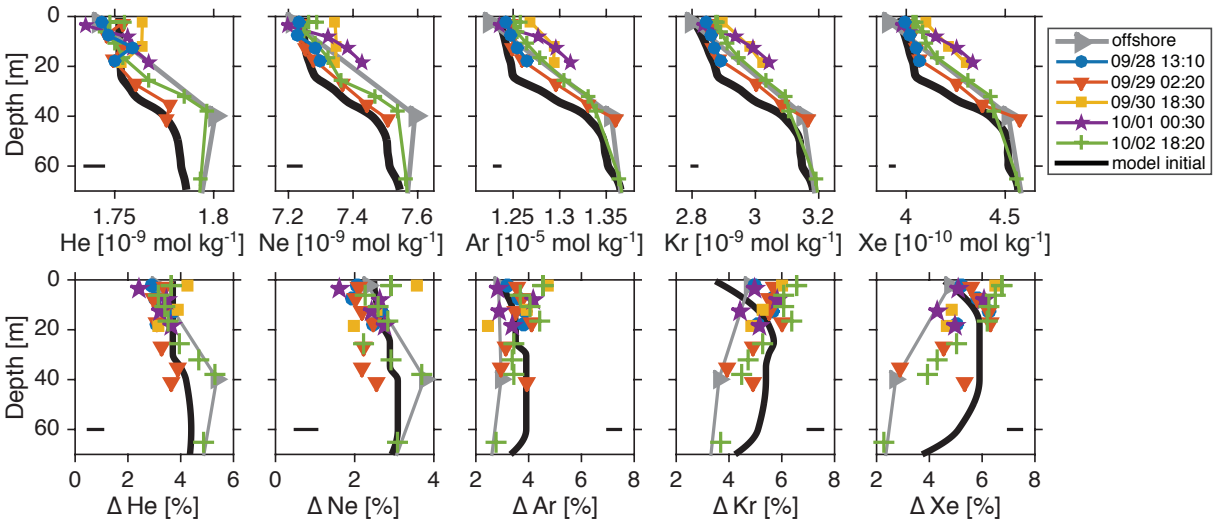

Figure 1. Measured profiles and idealized initial profile of noble gas concentrations (a–e) and saturation anomalies (f–j) during the cruise. The offshore cast was collected on Sept 30, 21:30 and its location is shown in Figure 1 in the main text. The black line is the idealized profile that was used to initialize the model on Sept 28, 00:00. The horizontal black lines show the estimated measurement error. This figure is equivalent to Figure 2 in the main text, but uses published solubility functions for He, Kr, and Xe [2–4].

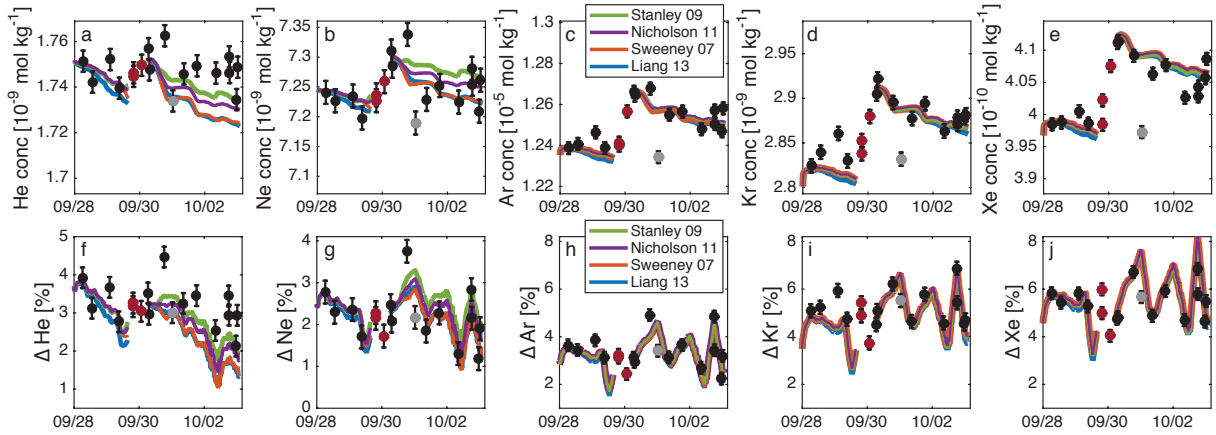

Figure 2. Near-surface gas concentrations (a–e) and saturation anomalies (f–j), from samples and model results. The gap in the models around midnight Sept 30 corresponds to the upwelling event. Error bars reflect one standard deviation error in concentration measurement and do not include solubility uncertainty. Maroon circles are samples during the upwelling event that were not included in the Monte Carlo error analysis. The grey circle is an unexplained outlier that was included in the error analysis. This figure is equivalent to Figure 4 in the main text, but uses published solubility functions for He, Kr, and Xe [2–4].

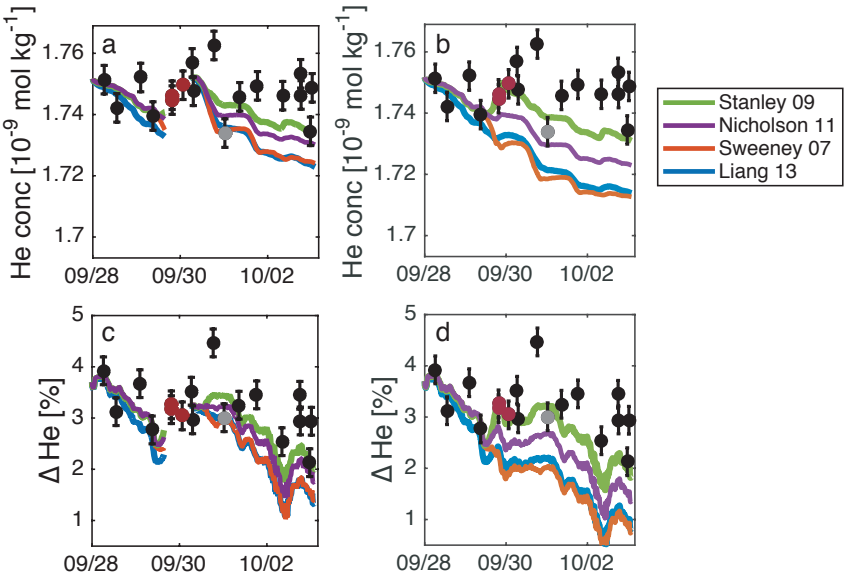

Figure 3. Near-surface He concentrations (a–b) and He saturation anomalies (c–d), from samples and model results, using the published He solubility of Weiss (1971) [2]. Comparison of model results with upwelling adjustment (a, c) and without upwelling adjustment (b, d). Note that all parameterizations underestimate the He concentrations and saturation anomalies. This figure is equivalent to Figure 4 (a, f) and 5 (a, d) in the main text, but uses published solubility functions for He [2–4].

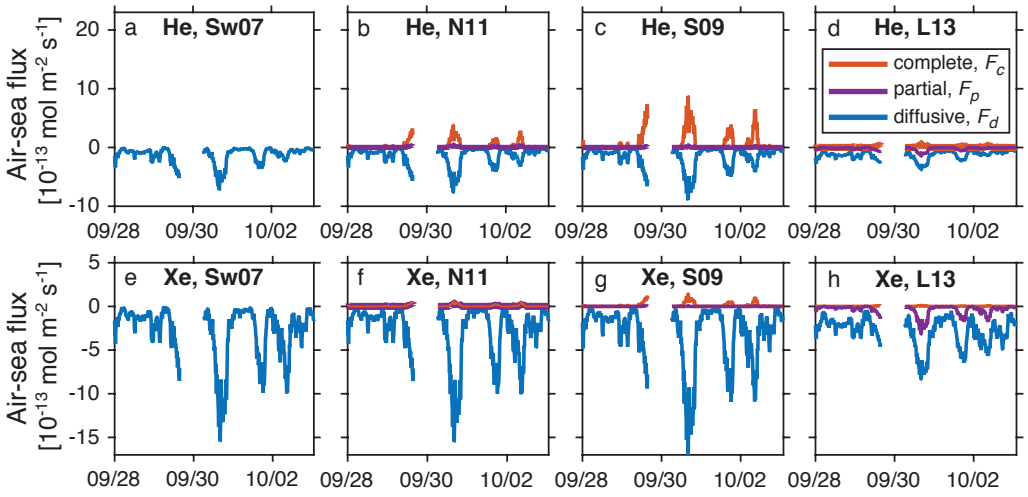

Figure 4. Air-sea gas fluxes of He (a–d) and Xe (e–h) during the time series modeled using all four parameterizations. Positive fluxes are into the ocean. The flux is separated into three components: diffusive flux (F_d), complete bubble trapping (F_c), and partial bubble trapping (F_p). The Sw07 parameterization only includes F_d. This figure is equivalent to Figure 5 in the main text, but uses published solubility functions for He and Xe [2, 4].