

MAR17-2016-000929

Abstract for an Invited Paper
for the MAR17 Meeting of
the American Physical Society

The Volume of Earth's Lakes¹

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How much water do lakes on Earth hold? Global lake volume estimates are scarce, highly variable, and poorly documented. We develop a mechanistic null model for estimating global lake mean depth and volume based on a statistical topographic approach to Earth's surface. The volume-area scaling prediction is accurate and consistent within and across lake datasets spanning diverse regions. We applied these relationships to a global lake area census to estimate global lake volume and depth. The volume of Earth's lakes is $199,000 \text{ km}^3$ (95% confidence interval $196,000\text{-}202,000 \text{ km}^3$). This volume is in the range of historical estimates ($166,000\text{-}280,000 \text{ km}^3$), but the overall mean depth of 41.8 m (95% CI 41.2-42.4 m) is significantly lower than previous estimates (62 - 151 m). These results highlight and constrain the relative scarcity of lake waters in the hydrosphere and have implications for the role of lakes in global biogeochemical cycles. We also evaluate the size (area) distribution of lakes on Earth compared to expectations from percolation theory.

¹This material is based upon work supported by the National Science Foundation Graduate Research Fellowship Program under Grant No. 2388357