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Sea surface temperature: Upper ocean temperature variability from Argo and AMSR-E

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The upper ocean is directly influenced by diurnal forcing, and mixed-layer temperatures can experience a clear diurnal cycle. Satellites are able to observe diurnal variations in the ocean's skin temperature but are not able to penetrate below the surface to provide information about diurnal mixed-layer variability. Thus one challenge in measuring sea surface temperature from sun synchronous polar orbiting satellites involves assessing the impact of the diurnal variability of the upper ocean, and this plays an important role in assessing ocean heat storage. In this study, individual Argo float temperature profiles have been paired with AMSR-E measurements collected within 48 hours before or after the profile. For small temporal separations of 3 hours or less, temperature differences between Argo and AMSR-E can be used to assess potential biases in AMSR-E data; they indicate temperature biases for low wind speeds, for low columnar water vapor, and for large cloud water. For larger temporal separations, the temperature differences are indicative of a clear diurnal cycle, with an amplitude that decreases with increasing latitude, from about 0.1 degrees C near the equator to 0.02 degrees C near 60 degrees N and S. The results suggest that maximum temperatures occur 2.5 hours after the AMSR-E daytime overpass, around 16:00. Minimum temperatures appear to occur just before sunrise, around 4:00 am. The diurnal signal propagates downward through the water and is detectable to about 15 m depth, with maximum temperatures occurring slightly later at greater depths.