Comparing Derived and Actual Upwelling Longwave Measurements at the CERES Ocean Validation Experiment (COVE)

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Introduction:

• The Clouds and the Earth’s Radiant Energy System (CERES) Ocean Validation Experiment, or COVE, was established at Chesapeake Light Station as a validation site for CERES and other satellites in 2000.

• Pictures of COVE and the upwelling instrument locations are displayed.

• The upwell LW “tower radiating effect” issue shows an extra heat signal measured in the afternoon, due to this undesired heat signal, an emphasis is presented on “deep” night measurements when solar insolation is not an issue.

• Analysis of Infrared Radiation Thermometer (IRT) data (which was used to measure sea surface temperature, or SST) and upwell Precision Infrared Radiometer (PIR) measurements are displayed and will strive to make a case for using both measurements for a new derived upwell PIR reading to account for the tower radiating effect.

• A source term is introduced as another means to attempt to explain the tower radiating effect.

Left: Determining sky emissivity from the “deep night” dataset. Center: The derived upwelling longwave equation. Results from this equation are used to compare to the actual upwell longwave measurements made by the pyrgeometer. Right: Using data only from the “deep night” period, the mean, median, standard deviation and standard error is -0.378, -0.14, 1.906 and 0.005 respectively. The relative error is larger in the colder months and smaller in the warmer months. This result has led to the plots below in attempt to understand tower effects that may be occurring in the nighttime.

Summary:

• Upwelling radiation measurements in this research were from 2009-2012.

• There is an afternoon bias, particularly noticeable on clear, sunny days when we believe is the tower heating up and re-radiating the extra heat that the upwell PIR is obtaining.

• Using “deep night” periods (15 ≤ sa ≤ 55), to remove any solar insolation effects, a new derived upwell longwave term may be achieved combining upwelling PIR, IRT, and the emissivity of air and water; but there is a seasonal dependence that still needs to be addressed.

• Another attempt to understand the tower radiating effect is adding a source term to our radiation budget equation. Determining where the air temperature is measured can affect your derived results.

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