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Earth Radiation Imbalance from a Constellation of 66 Iridium Satellites: Climate Science Aspects

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The "global warming hiatus" since the 1998 El Nino, highlighted by Meehl et al., and the resulting "missing energy" problem highlighted by Trenberth et al., has opened the door to a more fundamental view of climate change than mere surface air temperature. That new view is based on two variables which are strongly correlated: the rate of change of ocean heat content d(OHC)/dt; and Earth Radiation Imbalance (ERI) at the top of the atmosphere, whose guesstimated range is 0.4 to 0.9 W/m2 (this imbalance being mainly due to increasing CO_2). The Argo float array is making better and better measurements of OHC. But existing satellite systems cannot measure ERI to even one significant digit. So, climate model predictions of ERI are used in place of real measurements of it, and the satellite data are tuned to the climate model predictions. Some oceanographers say "just depend on Argo for understanding the global warming hiatus and the missing energy", but we don't think this is a good idea because d(OHC)/dt and ERI have different time scales and are never perfectly correlated. We think the ERB community needs to step up to measuring ERI correctly, just as oceanographers have deployed Argo to measure OHC correctly.

This talk will overview a proposed constellation of 66 Earth radiation budget instruments, hosted on Iridium satellites, that will actually be able to measure ERI to at least one significant digit, thus enabling a crucial test of climate models. This constellation will also be able to provide ERI at two-hourly time scales and 500-km spatial scales without extrapolations from uncalibrated narrowband geostationary instruments, using the highly successful methods of GRACE to obtain spatial resolution. This high time resolution would make ERI a synoptic variable like temperature, and allow studies of ERI's response to fast-evolving phenomena like dust storms and hurricanes and even brief excursions of Total Solar Irradiance. Time permitting, we will also discuss the emerging view of clear vs. cloudy and its implications for the traditional ERB approach.