<u>Climate Sensitivity Inferred from Atmosphere's Response to the Radiative Forcing of the 11-Year Solar Cycle, including Feedbacks</u>

Ka-Kit Tung [tung@amath.washington.edu], University of Washington, Seattle.

Model predictions of equilibrium global mean warming due to a doubling of atmospheric CO2 have spanned an uncomfortably large range of 1.5-4.5 K through two decades. The uncertainty is due to differing magnitudes of the feedback processes in models, including water-vapor, ice-albedo and, mostly cloud feedbacks, which in aggregate magnify the climate response by a factor g~1 to 3. To narrow the uncertainty, progress has been made in understanding the physical processes involved. It is also useful to calibrate model sensitivity with measured reality. Previously, Vostok ice core drillings have yielded past proxy surface temperature record and greenhouse gas concentration which led to an empirical estimate of climate sensitivity of ~0.75+-0.25 K per watt m-2, implying ~2.8+-0.9 K of global warming for doubling CO2. These estimates have possibly large unstated uncertainties related to proxy data conversion and from extrapolation of polar record to global mean values. Here we use recent instrumental record to obtain an independent estimate of climate sensitivity and to establish in particular a “largest lower bound”. We establish with high statistical significance a solar cycle signal with a globally averaged surface warming of 0.17+-0.04 K for each watt m-2 increase in the solar constant. This translates into 0.80 +- 0.19 K per watt m-2 of direct radiative forcing, about the same as the Vostok result but with smaller uncertainties. Models which predict an equilibrium warming of less than 2.3 K are ruled out by our result. It thus excludes the possibility of no positive climate feedback.