Estimation of Model Parameters for Radiation Budget Instruments

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Radiation budget instruments scan the earth, taking radiation maps that get converted into temperature. Basically, these detectors continuously monitor the earth's temperature. Since the measured signals are so low, accurate mathematical modeling is critical to the design process. A mathematical model of the thermal response and the ensuing voltage signal response from a radiation budget instrument has been developed. An important ingredient of an accurate and robust model of the system response is to have a correspondingly accurate estimation of the model parameters. The main objective of this paper is to describe the procedure and results of the parameter estimation process. The model equations are solved using a finite volume method. A sensitivity study is then performed to indicated the relative importance of the parameters. In order to estimate the best combination of system parameters, a least squares technique is utilized to minimize the difference between the theoretical model and experimental data. Fortunately, a statistically significant amount of data for the voltage output of the sensor was available. We were successfully able to estimate the model parameters and obtain an excellent agreement between the mathematical model and experimental data.