

Climate Research: A Challenge for Metrology

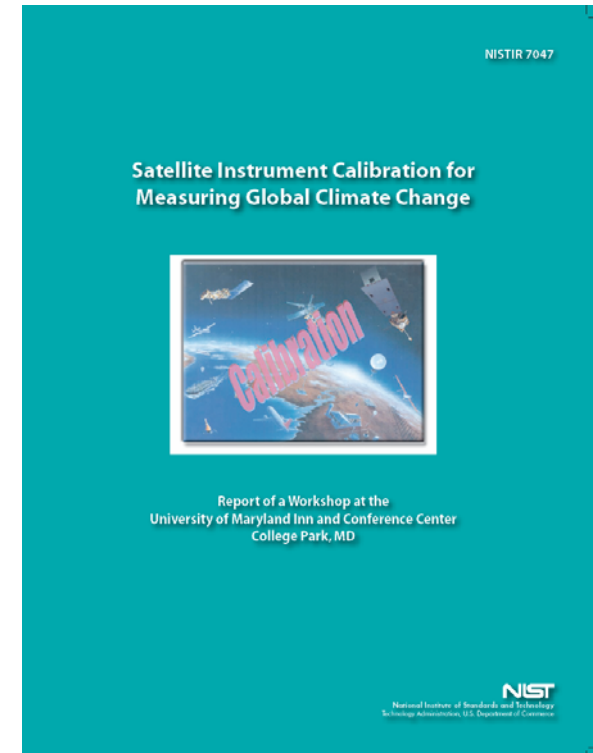
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Climate Measurements have Stringent Requirements

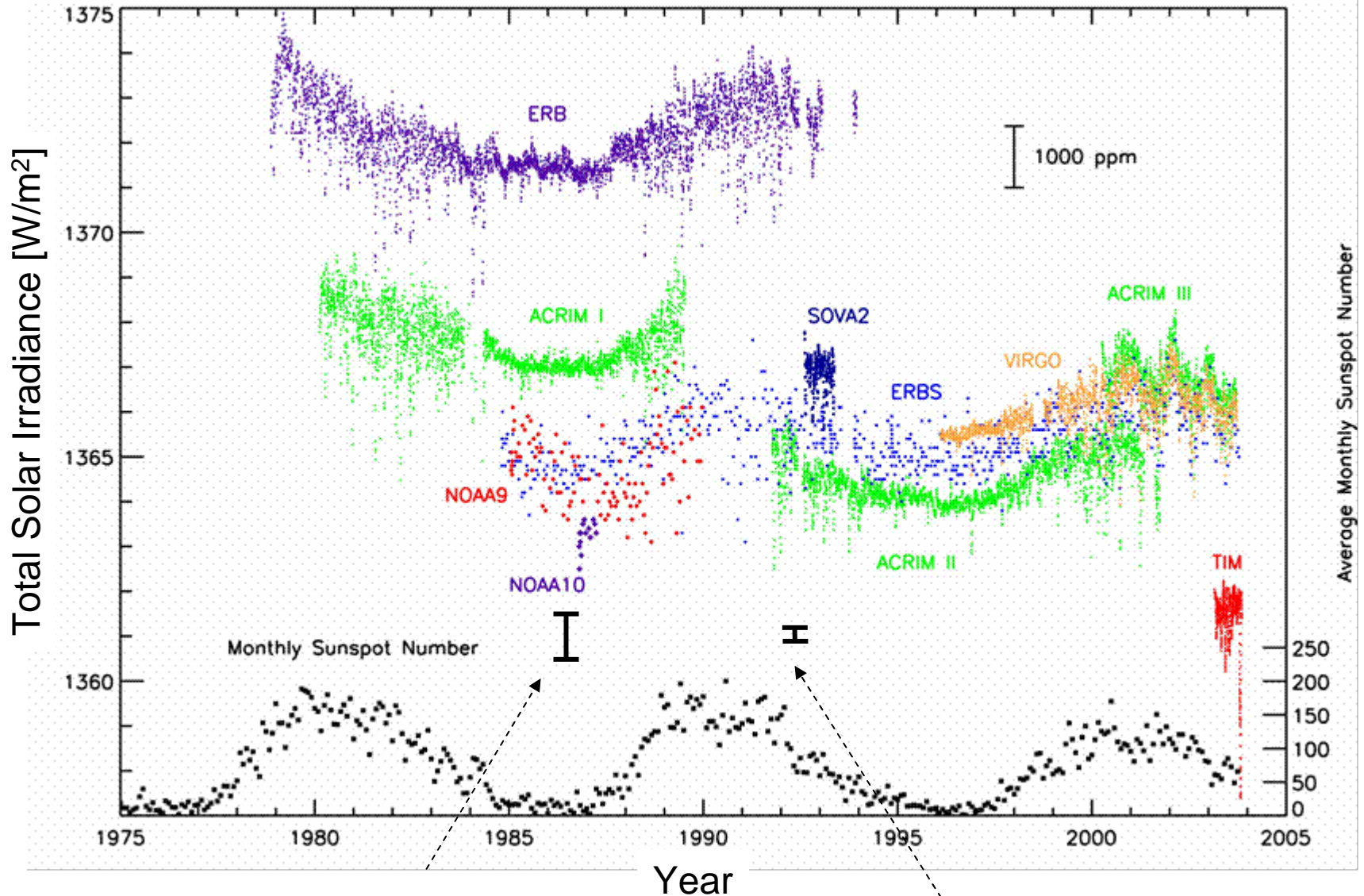
Examples

Variable	Accuracy	Stability (Decadal)
TOA Incoming Solar Irradiance	1 W m ⁻²	0.3 W m ⁻²
TOA Outgoing Longwave Radiance	1 W m ⁻²	0.2 W m ⁻²
Surface Albedo	0.01	0.002
Sea-Surface Temperature	0.1 K	0.04



Requirements are not being met!

Example: Total Solar Irradiance



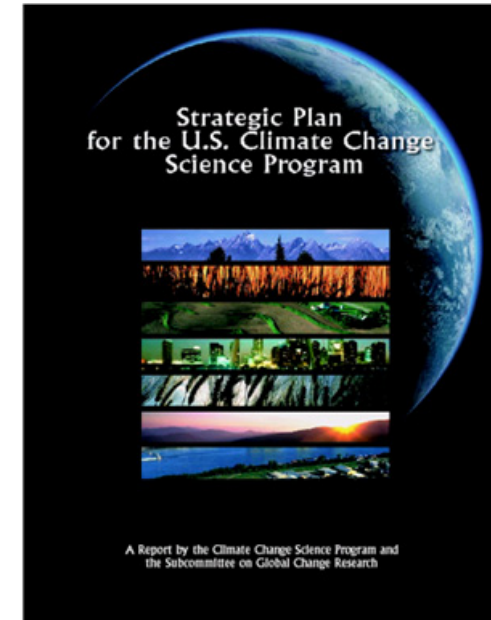
Target Accuracy 1 W m⁻²

Target Precision 0.3 W m⁻²

The Role of National Metrology Institute

Role in Climate Research Articulated in the *Strategic Plan for the U.S. Climate Change Science Program*:

... Instrument calibration, characterization, and stability become paramount considerations. Instruments must be tied to national and international standards such as those provided by the National Institute of Standards and Technology (NIST)...



WMO-CIPM Agreement Recognizes Role



**World Meteorological
Organization (WMO)**



**International Committee for
Weights and Measures (CIPM)**

“...have agreed to work together to ensure that data related in particular to measurements of state and composition of atmosphere and water resources, coming from the programmes organized under the auspices of the WMO, are properly based on units traceable to the SI through the procedures of the CIPM MRA and the Technical Regulations of the WMO.”

The Approach Used by the NMIs Provides a Model for the Remote Sensing Community

Measurements are

- Compared
- Validated by Independent Approaches
- Rigorously Assigned Uncertainties
- Carefully Documented through Quality Systems and in Peer-Reviewed Reports and Publications

Benefits to the User Community

- Increased accuracy and confidence in climate change observations and predictions
- Improved weather prediction
- Improved short-term climate forecasts
- Accelerated delivery of the nine societal benefits of the Global Earth Observation System of Systems (GEOSS)
- Improved government and private sector planning/response to weather and climate