

Satellite Contributions to Global Change Studies

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By providing a global view with a level playing field (no region missed because of unfavorable surface conditions or political boundaries), satellites have made major contributions to improved monitoring and understanding of our constantly changing planet. The global view has allowed surprising realizations like the relative sparsity of lightning strikes over oceans and the large-scale undulations on the massive Antarctic ice sheet. It has allowed the tracking of all sorts of phenomena, including aerosols, both natural and anthropogenic, as they move with the atmospheric circulation and impact weather and human health. But probably nothing that the global view allows is more important in the long term than its provision of unbiased data sets to address the issue of global change, considered by many to be among the most important issues facing humankind today. With satellites we can monitor atmospheric temperatures at all latitudes and longitudes, and obtain a global average that lessens the likelihood of becoming endlessly mired in the confusions brought about by the certainty of regional differences. With satellites we can monitor greenhouse gases such as CO₂ not just above individual research stations but around the globe. With satellites we can monitor the polar sea ice covers, as we have done since the late 1970s, determining and quantifying the significant reduction in Arctic sea ice and the slight growth in Antarctic sea ice over that period. With satellites we can map the full extent and changes in the Antarctic stratospheric ozone depletions that were first identified from a single ground station; and through satellite data we have witnessed from afar land surface changes brought about by humans both intentionally, as with wide-scale deforestation, and unintentionally, as with the decay of the Aral Sea. The satellite data are far from sufficient for all that we need in order to understand the global system and forecast its changes, as we also need sophisticated climate models, in situ process studies, and data sets that extend back well before the introduction of satellite technology. Nonetheless, the repetitive, global view provided by satellites is contributing in a major way to our improved recognition of how the Earth is changing, a recognition that is none too soon in view of the magnitude of the impacts that humans can now have.