

The race to understand a changing planet

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NASA/GSFC

The Earth's climate is changing rapidly. In some respects, the rate of change is outpacing the predictions of only a few years ago. The challenge to Earth Science is to put forward credible projections of possible future climates so that the public and policy makers can make science-based decisions about energy development strategies.

Models, observations and experiments all play strong roles in improving knowledge and increasing confidence in our predictions. The models have progressed from simple, coarse-resolution descriptions of atmospheric dynamics and physics only twenty years ago, to full-up Earth System models (ESMs) that include complete descriptions of the oceans and cryosphere. It has been convincingly argued that such complexity – the construction of realistic “toy” Earths – is necessary to address the complex processes involved in climate change, including not only the physical atmosphere, oceans and cryosphere, but also the carbon cycle – both its natural and anthropogenic components - and the biosphere. Observations, particularly satellite observations, have more or less kept pace with the demands of the modelers, being able to observe progressively more and different facets of the Earth system, but the global satellite fleet is in need of an overhaul very soon. Lastly, field experiments and process studies confront the models with facts and allow us to develop more sophisticated and accurate satellite data algorithms.

The challenges facing our relatively small Earth and planetary science communities are considerable and the stakes are significant. The stakeholders, now numbering 7 billion but soon to be 10 billion, will be relying on our results and capabilities to guide them into the future.