Discrete Global Grids -- One User's Perspective

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I study climate, primarily by analyzing remote sensing data from satellites. So I am a user, though not a developer, of techniques related to discrete global grids. In December 1999 we launched Terra, the first in NASA's series of Earth Observing System (EOS) satellites. The EOS program is aimed at detecting, understanding, and eventually helping predict climate change on global and regional scales. With the polar-orbiting Terra satellite, we begin collecting planet-wide data over long enough time scales, and with sufficiently stable calibration, to address truly global problems.

Retrieval algorithms convert the "Level 1" measured radiances into "Level 2" geophysical quantities, such as aerosol amount, cloud height, and surface reflectivity. The spatial and temporal sampling pattern for Level 1 and 2 data, determined by the satellite orbit and instrument characteristics, is usually highly non-uniform. Discrete global grids are used to create "Level 3" data sets, uniformly sampled in space and/or time, from the Level 2 data. Techniques routinely employed for this purpose are primitive, in part because available data sets were adequate to addressing only the simplest global climate change problems.

Whenever data taken at different resolutions are used together to calculate a new quantity, grids are likely to play a role. The global radiation balance, for example, is assessed by combining measurements of visible and infrared fluxes with those of latent and sensible heat contributed at the surface. More sophisticated global grids than the ones traditionally used are needed to calculate finite-difference quantities, such as the horizontal gradients of energy, momentum, and material. And there is the need to "validate" data taken from orbit over the long term and at many places, by comparing it with measurements made near-simultaneously by aircraft-borne and ground-based instruments. Since the data taken from different platforms vary widely in their spatial sampling, having appropriate grids and associated data processing techniques would be a great asset. This talk will summarize, from one climate researcher's view, the hopes, needs, and limitations in the application of discrete global grids to the new Earth observations.

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