The NRCS PRISM Climate Mapping Project

The Need for a New Technology to Map Climate

The most common lament of climate analysts, hydrologists and many natural resource managers is the lack of climate observations just where they are needed most--often in mountainous regions, or remote areas away from weather stations. Unfortunately, while most observations are made in lower elevations (where people live), the greatest precipitation falls in higher elevations. Spatially representative climate depiction in these mountainous areas using traditional methods produces unsatisfactory results because of the complex nature of climate in those regions. Even in non-mountainous regions, climate may be quite spatially variable, and difficult to estimate. These realities, and the growing demand for spatial climate data, provided the impetus for the development of a modeling system capable of producing representative climate fields.

Maps Developed Using PRISM

PRISM (Parameter-elevation Regressions on Independent Slopes Model) was developed by Dr. Christopher Daly of Oregon State University, and is a hybrid statistical-geographic approach to mapping climate. PRISM uses point measurements of climate data and a digital elevation model (DEM, a digital gridded version of a topographic map) to generate estimates of annual, monthly and event-based climatic elements. These estimates are derived for a horizontal grid, and are compatible with Geographic Information Systems (GIS). PRISM is not a static system of equations; rather, it is a coordinated set of rules, decisions and calculations designed to mimic the decision-making process an expert climatologist would invoke when creating a climate map. PRISM was originally developed in 1991 for precipitation estimation, but more recently has been generalized and successfully applied to other climate elements and derived variables, including temperature, snowfall, degree-days (heat units) and frost dates.

Map, GIS Issues

Each PRISM layer is available in a variety of formats to suit the user's needs. First, gridded fields of values are derived over the domain of interest using the PRISM system, currently at a horizontal resolution of approximately 800 meters. Output data are made available to users for both ARC/INFO and GRASS GIS systems in latitude-longitude (GEO) format. Additionally, contour lines (in both GEO and Albers Equal Area (AEA) projections) produced for each layer.

PRISM Project Structure, and Contact Personnel

Project oversight and funding have been and continue to be provided by the NRCS National Water and Climate Center (NWCC) in Portland, Oregon. General questions about PRISM products for USDA use, and current PRISM projects should be directed to Jan Curtis, PRISM project manager for the NRCS. Contact information is listed on the back of this sheet. Specific requests for additional products, including hardcopy mean

annual precipitation maps should be directed to the NRCS Climate Data Liaison (CDL) in each state.

PRISM Products: On the web, on CD-ROM, and Hardcopy

Much more information about technical aspects of PRISM, as well as the capability to directly download PRISM data layers in a variety of formats can be obtained from the PRISM Internet web page at:

http://www.prismclimate.org

This web site is maintained by Oregon State University's PRISM group, which serves as the primary contact center for all PRISM products worldwide. At this site users also may view and download PRISM images (mostly in .gif format) of various maps. Also available are metadata files for each layer. Users also can link to this site through an NRCS climate web page (*http://www.ftw.nrcs.usda.gov/climate_data.html*).

How PRISM works--An Example using Mean Annual Precipitation

The PRISM system determines climate at grid cells by calculating linear relationships between the climate element in question (such as precipitation) and elevation. The slope of these linear regression lines changes locally with elevation, as dictated by the available point climate data. Each grid cell estimate is then achieved by determining a separate regression function using data from many nearby climate stations. Each station in the multiple-regression is weighted based on five factors: Distance, elevation, vertical layer, topographic facet, and coastal proximity. In short, the closer a given station is to a target grid cell in distance and elevation, and the more similar that station is in its climatology to the cell (given by the other three factors), the higher the weight the station will have on the final, predicted value for that cell. A technique within PRISM determines the lowest possible prediction error for the map as a whole (all cells).

Mean annual precipitation maps were developed by first using PRISM to calculate mean monthly precipitation layers, and then summing these 12 layers. Each monthly precipitation layer was derived using all available and appropriate climate station data. Station data sources included the National Weather Service Cooperative Observing Network (NWS Coop), the Natural Resources Conservation Service's SNOTEL network, and local, state, regional and Federal networks.

PRISM Contacts

For more information about PRISM and access to these climate data layers and maps users within the USDA should contact:

Jan Curtis, Applied Climatologist
NRCS - National Water & Climate Center
1201 NE Lloyd Blvd., Suite 802

Portland 0R 97232
email: jan.curtis@por.usda.gov
phone: (503)414-3017 fax: (503)414-3101

Users outside the USDA community should contact:

George Taylor
Oregon Climate Service
326 Strand Ag. Hall
Oregon State University
Corvallis OR 97331
email: taylor@oce.orst.edu
phone: (541)737-5705 fax: (541)737-2540