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ECHO Development Notes

Global Weather and Climate Information

Richard James

Richard James is a meteorologist who has worked in both the academic and private sectors. He is currently employed with Prescient Weather, a new company that provides weather and climate information for risk analysis. Richard is a native of the UK but now resides in Athens, Georgia; he can be reached at richard.james@prescientweather.com

Many in ECHO's network have taken on the responsibility of establishing an agricultural development project in a country far from home and mostly unfamiliar. Often they and others involved in agricultural development wish for a better understanding of local weather and climate patterns so that agricultural planning can be successful. Location-specific climate information is valuable for coping with rainfall extremes, choosing which crops to work with, and determining the best time of year to prepare fields for planting.

In recent years, global weather and climate monitoring has grown in sophistication, and detailed, up-to-date weather information has become increasingly accessible via the internet. This article documents some online sources of weather and climate information and provides some guidance concerning the interpretation of available data. Section 1 discusses climatological data, Section 2 addresses real-time weather monitoring, and Section 3 explains how the status of the 'El Niño' effect can help anticipate future rainfall trends.

1. Climatological Data

Weather observations over periods of at least several decades provide an understanding of the long-term average, or 'climatology,' of weather for any given location. Since the 1970s, global observations have been greatly improved by satellite monitoring, so that climatological information is available even for remote locations. A good source for climatological data worldwide is the website of the International Research Institute for Climate and Society (IRI): http://iridl.ldeo.columbia.edu/maproom/.Regional/

The 'climatology' links provide access to high-resolution maps showing the average monthly temperature and average monthly precipitation for various regions of the globe. After selecting "climatology" for one of the regions, the "select a point" links allow the user to obtain data at any location over land on a grid of points with spacing of 0.5 degrees latitude and longitude [this distance for latitudes is about 35 miles (56 km); the distance of 0.5 degrees for longitude depends on the distance from the equator, since longitudinal lines get closer together the farther you are from the equator]. For the selected grid point, the website provides charts showing the distribution through the year of precipitation, temperature, frequency of rain, and frequency of frost.

The "select a point" data can also be accessed from:
http://iridl.ldeo.columbia.edu/maproom/.Global/.Cl…
(http://iridl.ldeo.columbia.edu/maproom/.Global/.Climatologies/Select_a_Point/)

When using a 'gridded' climatology map such as the one provided by IRI, it is important to bear in mind that each grid point represents an average over a substantial area of the earth's surface, and therefore local effects may not be represented properly. For example, differences in elevation or proximity to water bodies may greatly alter the climate at a specific location, but a coarse grid will not capture these effects. In such instances, historical weather observations from the precise location are needed to accurately describe the local climate. Historical 'station' observations do exist for many of the more significant population centers globally. These records may sometimes be accessed via an online search, but unfortunately there is no comprehensive online source.

2. Real-time Monitoring

Meteorologists sometimes remark that "normal weather never occurs," meaning that weather is ever-changing and that weather observations rarely match the long-term climatological norm. Because significant departures of weather from 'normal' create important, and sometimes dramatic, effects on agriculture and society, up-to-date (real-time) monitoring is critical for understanding evolving global weather scenarios. To assist with interpretation, weather data from the recent past is often expressed in terms of both the weather that has occurred (temperature, precipitation, etc), and the weather 'anomaly,' which is the departure of these weather conditions from normal.

IRI provides a modest selection of maps of temperature and precipitation anomalies in the most recent 1 and 3 month periods, under the first URL listed on page 1.

A more comprehensive set of maps showing recent precipitation anomalies is provided by the Climate Prediction Center (CPC) of the U.S. NationWeather Service:www.cpc.noaa.gov/products/fews/global/ (http://www.cpc.noaa.gov/products/fews/global/)

After making the regional selection, click on the "rainfall estimates" link. Then you can choose monthly maps of precipitation, precipitation anomaly (i.e. departure from normal), and percent of normal precipitation. Note that these precipitation maps are obtained from geostationary satellites, which are located above the equator; consequently the data are only reliable between approximately 30°S and 30°N. Although the data are displayed up to 60 degrees of latitude, they should be regarded as unreliable between 30° and 60°.

An important caveat concerning 'percent of normal' precipitation maps is that many regions of the world experience dry seasons in which little or no rainfall occurs. In these months the 'percent of normal' is not well defined. In such instances, maps of 'percent of normal precipitation' may show apparently excessive dryness or wetness that is not truly meaningful. For this reason, precipitation anomaly maps should always be interpreted in light of the local climatology.

The CPC also supplies a more extensive series of precipitation monitoring maps for Africa and for South Asia: www.cpc.noaa.gov/products/fews/AFR*CLIM/afr*clim_s… (http://www.cpc.noaa.gov/products/fews/AFR_CLIM/afr_clim_season.shtml) www.cpc.noaa.gov/products/fews/SASIA/climatology.s… (http://www.cpc.noaa.gov/products/fews/SASIA/climatology.shtml)

Because these maps combine station observations with satellite data, they represent a higher quality of data than the satellite-only maps. At the bottom of the Africa page is a useful tool ("Time Series Plots") that provides up-to-date charts of recent precipitation observations from individual stations across Africa. These station observations may be compared with the maps to check consistency, or to obtain the 'ground truth' at selected locations.

3. Seasonal Forecasting

Although it is impossible to predict individual weather events beyond approximately 7 days into the future, it is sometimes possible to anticipate long-term weather trends that evolve slowly over periods of months or even years. Long-range or 'seasonal' forecasting depends on the fact that weather patterns are driven to some extent by patterns of temperature at the surface of the world's oceans. Phenomena such as El Niño, which consist of widespread changes in sea surface temperature, develop and persist over the course of months or years, and therefore provide useful predictability well beyond the range of conventional weather forecasts.

The 'El Niño – Southern Oscillation' (ENSO) is the most important ocean cycle for seasonal weather variability. It is defined by sea surface temperature anomalies [departures from normal temperatures] in the equatorial Pacific Ocean. Widespread ocean warming is observed in El Niño, but La Niña brings unusually cool sea surface temperatures. A figure in the online Supplement to this issue of *EDN* includes a historical analysis in the form of maps that show the effects of ENSO (in both the El Niño phase and the La Niña phase) on global precipitation in 3-month periods, for the years since 1948.

As a prediction tool, these maps indicate the percent likelihood that precipitation will be above normal for either ENSO phase. Some of the most notable effects of ENSO on global precipitation are:

• East Africa tends to be wetter than normal in El Niño between September and February; opposite for La Niña

• Northern South America tends to be drier than normal in El Niño in both northern Hemisphere winter and summer; opposite for La Niña

• El Niño tends to bring pronounced dryness in the vicinity of Indonesia at all times of the year, but especially from September to November; unusual wetness is more likely in La Niña

The current status of ENSO, and indications for the next few months, can be obtained from IRI at: http://iri.columbia.edu/climate/ENSO/currentinfo/Q… (http://iri.columbia.edu/climate/ENSO/currentinfo/QuickLook.html)

The online maps show the precipitation anomalies that are most likely to prevail if El Niño is presently occurring or is predicted to occur, or if the same is true of La Niña. Bear in mind, however, that these outcomes are not guaranteed to occur. In general, the stronger the El Niño or La Niña episode, the more likely the effects shown in the maps will emerge.

Further information about ENSO is available at:
http://iri.columbia.edu/climate/ENSO/globalimpact/…
(http://iri.columbia.edu/climate/ENSO/globalimpact/index.html)

Ocean cycles other than ENSO also impose significant long-term weather anomalies on certain regions across the globe, and some of these cycles persist for years or decades. The understanding and prediction of this naturally-occurring variability is an area of active scientific research, and it is likely that improved long-range forecast methods will eventually result.

Summary

Modern communications technology provides ready access to a wide variety of information concerning historical and recent weather conditions, along with limited tools for anticipating future weather trends.

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