ATMOSPHERIC SCIENCES

Atmospheric sciences study the atmosphere, its processes, the effects from other systems, and the effects of the atmosphere on these other systems. Meteorology includes atmospheric chemistry and atmospheric physics with a major focus on weather forecasting. Climatology is the spatio-temporal study of atmospheric changes (both long- and short-term) that define average climates, their variability and drivers, and their change over time, which include natural climate and anthropogenic climate processes. Meteorologists study the atmosphere's physical characteristics, motions, and processes, and how these factors affect the environment, with a strong focus on forecasting of the weather. In addition to predicting the weather, atmospheric scientists attempt to identify and interpret climate trends, understand past weather, and engage in scenarios of future changes. Weather information and meteorological research are also applied in air-pollution control, agriculture, forestry, air and sea transportation, defense, and the study of possible trends in the Earth's climate, which include droughts, ozone depletion, and global warming. Meteorologists use sophisticated computer models to make long- and short-term forecasts of the world's atmosphere and tailor forecasts to local areas. Computer models, satellite data, and climate theory are used by meteorologists and climatologists to interpret research results to make better local weather predictions. Forecasts inform the general public and industries that need accurate weather information for both economic and safety reasons, such as in shipping, air transportation, agriculture, fishing, forestry, and utilities. Physical meteorologists study chemical and physical properties of the atmosphere; the transfer of energy in the atmosphere; and the transmission of light, sound, and radio waves. In addition, they examine factors that affect clouds, rain, and snow; air pollutants in urban areas; and weather phenomena such as the severe storms. Synoptic meteorologists constantly work at discovering new ways to forecast weather. Climatologists study climactic variations spanning thousands of years. They collect, interpret, and analyze past records of surface and upper air observations of many variables including temperatures, humidity, wind, rainfall, and radiation. Climate studies are used to design buildings, plan heating and cooling systems, and in planning as well as in agricultural production. Meteorologists study problems in order to evaluate, analyze, and report on air quality for environmental impact assessments. Research meteorologists also examine and present effective ways to control or diminish air pollution. Because atmospheric science is a small field, relatively few universities specifically offer degree programs in meteorology or atmospheric science, although many departments of earth science, geography, geophysics, and similar disciplines offer atmospheric science and related coursework. Entry level operational meteorologists in the US Federal Government usually are placed in intern positions for training and experience. During this period, they learn about the Weather Service's forecasting equipment and procedures and rotate to various offices to learn about weather systems and other operations and programmes. After completing the training period, these interns are assigned to a permanent station with more specific assignments. Farmers, commodity investors, radio and television stations, as well as transportation,

utilities, and construction firms greatly benefit from additional weather information more closely meeting their needs than the general information provided by the US National Weather Service. Research on seasonal and other long-range forecasting has yielded positive responses, demonstrating the immediate need for atmospheric scientists to interpret forecasts and advise climate-sensitive industries. Because many customers for private weather services are in industries sensitive to fluctuations in the economy, the growth and development of private weather services in turn depend on the health of the economy.

See also: CLIMATOLOGY, METEOROLOGY, MICROCLIMATE

Further reading

Fleming, J.R., 1990. *Meteorology in America, 1800–1870*. Johns Hopkins University Press, Baltimore.

Hewitt, C.N. and Jackson, A., 2003. *Handbook of atmospheric science principles and applications*. Blackwell, Oxford.

Wallace, J.M. and Hobbs, P., 2006. *Atmospheric science: an introductory survey.* Elsevier Academic Press, Burlington, MA.

Useful Resources for learning about the Atmospheric Sciences

American Geophysical Union

Find links to information about AGU's meetings, publications, news items, or access its archives which includes journal table of contents, a complete index to all AGU journals, books, and publications, a meetings database, and a FTP dataset archive.

American Meteorological Society

Information about services, programs, publications, meetings, and policies.

Committee for the National Institute for the Environment

Site includes information on the origin of the NIE, its accomplishments, its current activities, as well as sections on membership, fund-raising, and financial and legislative sponsors.

International Global Atmospheric Chemistry

Provides links to IGAC's field efforts, programs, conferences, meetings, workshops, and its structure. http://www.igac.noaa.gov/

Resources of Scholary Societies – Environmental Sciences

Access to websites and gophers maintained by or for scholarly environmental science societies around the world.

Royal Meteorological Society

Includes information on publications, journals and awards.

World Meteorological Association

This U.N. organization site offers a News Centre, official weather forecasts from around the world, and information for members.

Canada – Meterological Service (MSC)

Canada's Source for Meteorological Data.

United Kingdom Meteorological Office

UK's biggest weather information provider; includes links to other weather sites.

World Meteorological Organization – member list of National Weather Services

Lists National Weather Services or National Hydrological Services for almost 187 member states and territories. (Select 'WMO Members' from right side of page.)

BIOGEOGRAPHY

Biogeography is the science of the distribution of plants and animals. Starting from synoptic pictures of those distributions (usually in the form of maps) it investigates the processes which have brought about those patterns. In that sense it has mostly been a historic science but in recent years some engagement with predictability has emerged. An increasing preoccupation with biodiversity is also characteristic of recent years. It starts inevitably with a concern for classification (taxonomy) for if the basic units of the distributions (be they sub-species, species, genera, families or even larger classification units, or taxa) are not defined then the portrayal of distributions is meaningless.

The distribution of biological taxa involves different spatial scales and is also concerned with time: some species' distributions are the result of continental drift many millions of years ago whereas others reflect recent transfer due to human activity. The distributions of species reflects both their evolutionary history and current interactions with other species as well as the environment. Physical forces have a strong impact on species distributions. For example, continental drift has both allowed interchange and movement of species in the past and prevented it as the continents changed positions. There are similar species of organisms on both sides of the Atlantic in Africa and South America. Continental is responsible for the similarity and for the process of speciation that occurred when the continents separated. Continental drift and the presence of other natural boundaries such as deserts and mountains in combination with evolution have resulted in a number of broad distinctive plant and animal associations over the earth.