Fact Sheet

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Langley Research Center
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Atmospheric Sciences at NASA Langley

By investigating atmospheric processes from the air, land, sea and space, NASA Langley Research Center's atmospheric scientists have developed new technologies and made scientific discoveries that have revolutionized how scientists study and understand Earth's atmosphere. These scientific advancements are critical at a time when growing concerns about global climate change are forcing policy makers to decide upon mitigation strategies. Climate models, or computers that simulate climatic processes, are a key tool that officials use to make decisions now that will affect the environment years into the future.

However, the degree of accuracy of climate models is uncertain, making it essential that scientists gain a better understanding of climate change and increase confidence in climate models. The researchers in the Atmospheric Sciences Competency at NASA Langley have taken on this challenge. The Competency's mission is to understand how natural and human-induced actions are impacting Earth's atmosphere and global climate change.

The Atmospheric Sciences Competency

Two research branches, specializing in different areas of atmospheric science, comprise the Competency. They are the Chemistry and Dynamics Branch and the Radiation and Aerosols Branch. Scientists in these branches participate in field campaigns, conduct experiments to validate Earth-orbiting satellites, and study information gathered by satellite instruments for a better understanding of Earth's atmosphere and current climate models. Data from these instruments are available worldwide through the Atmospheric Sciences Data Center. People working in the Data Center process, archive, and distribute Earth science data. Educational outreach projects within Atmospheric Sciences also strive to engage the public in atmospheric and Earth sciences.

Atmospheric science projects

While researchers search for a better understanding of climate change, they also make significant contributions to other areas of atmospheric science. Scientists often advance remote sensing technologies to help achieve atmospheric science goals. They also work to improve hurricane predictions and estimates of biomass burning emissions and convert NASA's global satellite data into measurements useful to the renewable energy community.

Most projects in Atmospheric Sciences are a part of NASA's Earth Science Enterprise, which is dedicated to understanding the whole Earth system and the effects of humans on the global environment. Brief overviews of major NASA Langley projects are listed below:

CERES

The Clouds and the Earth's Radiant Energy System experiment, or CERES, is a part of NASA's Earth Observing System (EOS) program. CERES instruments aboard the Terra and Tropical Rainfall Measuring Mission satellites (and on the future Aqua satellite) measure cloud properties and the Earth's energy balance for a better understanding of global climate change. CERES is helping to answer long-standing questions regarding the uncertainty of determining cloud physics and how they affect climate models. The international CERES science team is now completing an integration of satellite data over the entire planet from space-borne instruments on seven different spacecraft to test the accuracy of energy flows in global climate models, a task never before attempted.

FIRE

International scientists participate in FIRE (First International Satellite Cloud Climatology Project Regional Experiment), a series of field experiments that focus on climatically important cloud systems around

the world. The goals of FIRE, a project in NASA's Radiation Sciences Program, are to gain a better understanding of the radiative and physical processes of cloud systems and of the interactions between clouds and solar radiation, atmospheric moisture, and other environmental factors. FIRE data will also help improve climate models and satellite monitoring of clouds.

ESSP3

The Earth System Science Pathfinder Three (ESSP3) satellite mission, currently under development, aims to help answer significant questions about climatic processes and improve climate models. Researchers want to learn more about how aerosols (airborne particles) and clouds interact with each other and how they affect the overall warming and cooling of the Earth. ESSP3 will use a space-based lidar (laser radar) and imagers to study the Earth's atmosphere for three years, beginning in 2004.

LIDAR

Scientists in the Lidar Applications Group (LAG) develop and apply advanced lidar systems to many atmospheric investigations including ozone layer and hurricane studies. They developed a Differential Absorption Lidar (DIAL) system that operates in the ultraviolet (UV) spectrum called UV DIAL to measure ozone and the Lidar Atmospheric Sensing Experiment (LASE) system to measure water vapor. The UV DIAL and LASE systems are used in many aircraft-based field campaigns to measure ozone, water vapor, aerosols, and clouds.

SAGE

The Stratospheric Aerosol and Gas Experiment II mission, or SAGE II, has monitored aerosols, ozone, and other trace gases from space since 1984. A major contribution of this instrument is the long record of ozone data it has provided. These data have proven to be an invaluable asset to the United Nations Environment Program for assessing ozone trends. The SAGE III mission, an EOS program, will build upon the success of SAGE II, with an initial launch scheduled during 2001. SAGE III aims to make accurate long-term measurements of the vertical structure of aerosols, ozone, water vapor, and other important trace gases for a better understanding of atmospheric processes.

SABER

The Sounding of the Atmosphere using Broadband Emission Radiometry instrument or SABER is a part of the Space Science Enterprise's TIMED (Thermosphere, Ionosphere, Mesosphere, Energetics and Dynamics) Mission. SABER, scheduled to launch in late 2001, will measure infrared or heat radiation emitted by the upper atmosphere over a broad altitude and spectral range. This measurement technique has never before been used to study this atmospheric region in such detail. SABER will provide new, groundbreaking measurements of the Earth's upper atmosphere.

GTE

The Global Tropospheric Experiment (GTE) is a program of field experiments dedicated to improving the knowledge of global tropospheric chemistry and its implications for the biosphere, climate, and stratosphere. The latest GTE mission, the Transport and Chemical Evolution over the Pacific (TRACE-P) experiment, occurred in the spring of 2001 in the western Pacific off the coast of Asia. TRACE-P researchers studied the chemical evolution of air as it moved from Asia across the Pacific Ocean.

GIFTS

The Geosynchronous Imaging Fourier Transform Spectrometer project or (GIFTS), a part of the New Millennium Program, will test advanced technologies for future Earth science missions from space in geosynchronous orbit (22,000 miles above Earth). GIFTS' key technical advancement will allow tracking of the movement of water vapor through the atmosphere in all three spatial dimensions. GIFTS, scheduled to launch in 2005, will give scientists the ability to observe the space and time distribution of atmospheric temperature, water vapor, and wind. GIFTS will provide measurements necessary to improve weather forecasting.

For more information about Atmospheric Sciences, please contact:
NASA Langley Research Center
Office of Public Affairs
Mail Stop 115
Hampton, VA 23681-2199
757-864-6121

Or see the Atmospheric Sciences Competency Home Page:
http://asd-www.larc.nasa.gov/ASDhomepage.html