



UNDERSTANDING AND RESPONDING TO CHANGING CLIMATE

From the poles to the tropics, researchers from Australia and the US are working together to watch and understand our changing natural world.

America's constellation of earth observation satellites plays a critical role in monitoring Australia's changing climate and land use. **During bushfire, flood and cyclone emergencies the information they provide is critical to Australia's emergency response.** The air sampled at remote Cape Grim on Tasmania's northwest coast and Australia's ice core research are two examples of Australia's contribution to NASA and the US National Oceanic and Atmospheric Administration (NOAA) efforts to understand and predict the planet's changing climate. **Australia and the US both encompass a huge range of terrestrial and marine ecosystems.** Australia's experiences in dealing with fire, drought and natural disasters are helping to give US researchers a different perspective on some of the challenges of America's changing climate and environment.



Remote sensing in natural disasters

Emergency response managers are able to track the course of natural disasters such as fires, floods, earthquakes and storms and plan with increased accuracy thanks to software developed by Associate Professor Linlin Ge and his team at the University of New South Wales in Sydney. The software allows data from interferometric synthesis aperture radar (INSAR) satellites to be pulled together rapidly and automatically to generate high-resolution maps. The maps reveal ground movements, and predict likely damage to vital infrastructure such as buildings, roads, railways and bridges.

The team's work has led to the establishment of an international network of national remote sensing agencies that collaborate in times of emergency management. The network began spontaneously in 2008 when Associate Professor Ge and his team, confronted by the enormity of the Sichuan earthquake in China, helped local rescue workers by providing satellite images constructed from Japanese data.

Cape Grim's clean air—monitoring global climate change

Australia provides baseline climate data to the rest of the world through its monitoring station at Cape Grim at the extreme northwest tip of Tasmania. As well as monitoring carbon dioxide, methane and a range of atmospheric trace gases, scientists at Cape Grim measure concentrations of natural and pollutant particles. Because of Cape Grim's remoteness from population centers (Argentina is the only landmass west of the Cape), the collected data represents as close as scientists can measure to a global average. The monitoring station is managed jointly by Australia's Bureau of Meteorology and CSIRO.

Keeping a weather eye out

In addition, CSIRO has made a long-term contribution to improved climate prediction through monitoring the Southern Ocean since 1994. The world's largest current, the Antarctic Circumpolar Current, flows around the Southern Ocean connecting the three major ocean basins—Pacific, Indian and Atlantic—redistributing heat, affecting temperature and rainfall, and making a huge impact on the world's climate.

Through agreements with NOAA, NASA, and the Scripps Institution of Oceanography in San Diego, a ground station in Hobart in the southern island state of Tasmania, operated by the Australian Centre for Remote Sensing, has been downloading climate-relevant data from passing US polar orbit satellites.

One thousand new species found—understanding coral reefs

In the tropics, researchers at the Australian Institute of Marine Science (AIMS) are working with counterparts in the US to discover and document life on coral reefs and monitor the impact of climate change. AIMS, NOAA and the Smithsonian Institution lead the three nodes of CReefs, the coral reef component of the Census of Marine Life. CReefs aims to discover and explain the diversity, distribution, and abundance of life in coral reef ecosystems, and improve access to and unify this information. Already, more than 1,000 previously undocumented species have been discovered on Australia's Great Barrier Reef, along the east coast, and Ningaloo Reef, off the west coast, as part of the project.

Fixing the plumbing—water conservation

Along with susceptibility to forest fires, large areas of Australia and the US also are prone to drought and water shortages and the two countries have long collaborated on water research. The recent development of a Memorandum of Understanding on Environmental Water Cooperation between the two countries tackles an interesting consequence of water conservation. As the water efficiency of plumbing fixtures increases, there has been a significant reduction in the flows moving through the sewer system, increasing the concentration of waste and creating challenges for existing processing facilities. The memorandum covers joint research to be conducted in this area.

Elvis to the rescue

Each year, the 'Elvis' air-crane and other giant firefighting helicopters migrate south from America to Australia, where they have saved many Australian lives and properties. American fire fighters and fire investigators have also been helping on the ground, especially following Victoria's Black Saturday bushfires in 2009. And the cooperation works both ways, with Australia contributing both firefighting expertise and research support in response to recent Californian wildfires. A meeting organized by Australia's Bushfire Cooperative Research Centre in June 2010 has helped to broaden and formalize this collaboration, as researchers and fire managers from the US, New Zealand and Australia came together to share their knowledge and plan future collaborative work.

People

Fishy business

Dr Beth Fulton, based at CSIRO Marine and Atmospheric Research in Hobart and a former winner of the Prime Minister's Life Scientist of the Year award, is a world leader in modeling marine ecosystems. Dr Fulton works regularly with researchers from NOAA and US universities. Together they have developed management models for marine life along much of the west and east coasts of continental US, and now are studying the Gulf of Mexico and Hawaii.

Snow complications

The US and Australia maintain significant collaborative research programs in Antarctica, drilling ice cores that provide a detailed historical record of climate, and measuring the extent and thickness of the sea-ice, which has a major impact on climate. Fulbright scholar and University of Tasmania PhD student Ms Natalia Galin has been collaborating with researchers at the University of Kansas to measure snow thickness from a helicopter. An error in snow measurements above the water can be magnified by eight or nine times in estimating ice thickness below the water. However, the team's specialized radar equipment provides accurate readings of snow thickness on sea ice—information that will be used to calibrate satellite remote sensing data.

The long-term view

An Australian paleontologist, who uncovered the earliest fossil of live birth in fishes, a key to our understanding of reproduction in animals with backbones, is now Vice-President Research and Collections at the Natural History Museum of Los Angeles County. Dr John Long was formerly Head of Sciences at Museum Victoria.

IMAGE CREDITS: ANU'S CHRIS FULTON MEASURING REEF FISH AT LIZARD ISLAND, NEAL CANTIN; ANTARCTIC RESEARCH AND RESUPPLY SHIP *AURORA AUSTRALIS*, NATALIA GALIN; TROPICAL CYCLONE YASI, NASA GSFC/ JEFF SCHMALTZ; EXPERIMENTAL BUSHFIRE SET IN MCCORKHILL, WESTERN AUSTRALIA, CSIRO.

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