TECHNICAL DETAILS

The Optical Telescope

The telescope is a vacuum refractor with a 25 cm objective lens. It automatically tracks the Sun and directs light to instruments which collect data under computer control. Subsystems include a white light projection board, an H-alpha filter for chromospheric patrol, a spectrograph with a Zeeman magnetograph, a digital camera, and a digital image processing system. H-alpha filtergrams are digitised into brightness-area histograms for automated flare patrol. A computer controls the telescope allowing interesting solar regions to be scanned at least twice per minute. Magnetic contour maps are produced to determine the flare potential of each active region on the Sun.

The Radio Telescope

Three parabolic dish antennae feed eight, single frequency, radio telescopes. The largest antenna, 8.5 metre diameter, is used to monitor 245, 410 and 610 MHz. A 2.4 metre dish is used to monitor the microwave frequencies of 1415, 2695, 4995 and 8800 MHz. A small 1 metre dish monitors the high microwave frequency of 15400 MHz. A Solar Radio Spectrograph (SRS) with antennas of 25 -180 MHz monitors solar coronal activity. Radio telescope outputs are digitised (1 Hz sampling rate), collected by computer, processed, analysed for burst activity and stored digitally for archive purposes.

The Magnetometers

A triaxial fluxgate magnetometer monitors the three perpendicular components of the Earth's magnetic field.

A proton precession magnetometer records the total field value to better than one nanotesla.

The Ionosonde

The Digital Ionospheric Sounding System uses digital technology to provide information about ionospheric critical frequencies, layer heights, wave polarisation, reflection points and doppler motions. Routine soundings sweep the frequency range of 1 to 20 MHz. The ionosonde monitors frequencies for interference before transmitting.

New Equipment

Observatory equipment is subject to continuous upgrade.

A major change is planned in the next few years to improve and further automate the observatory.

We also look after the GONG network which studies helioseismology and provides H-alpha images. See http://gong.nso.edu/

CONTACT DETAILS

Data from Learmonth Observatory is available from:

Space Weather Services
PO Box 1386
Haymarket NSW 1240

Telephone: +61 2 9213 8000
Facsimile: +61 2 9213 8060
E-mail: sws_office@bom.gov.au
World Wide Web: www.sws.bom.gov.au

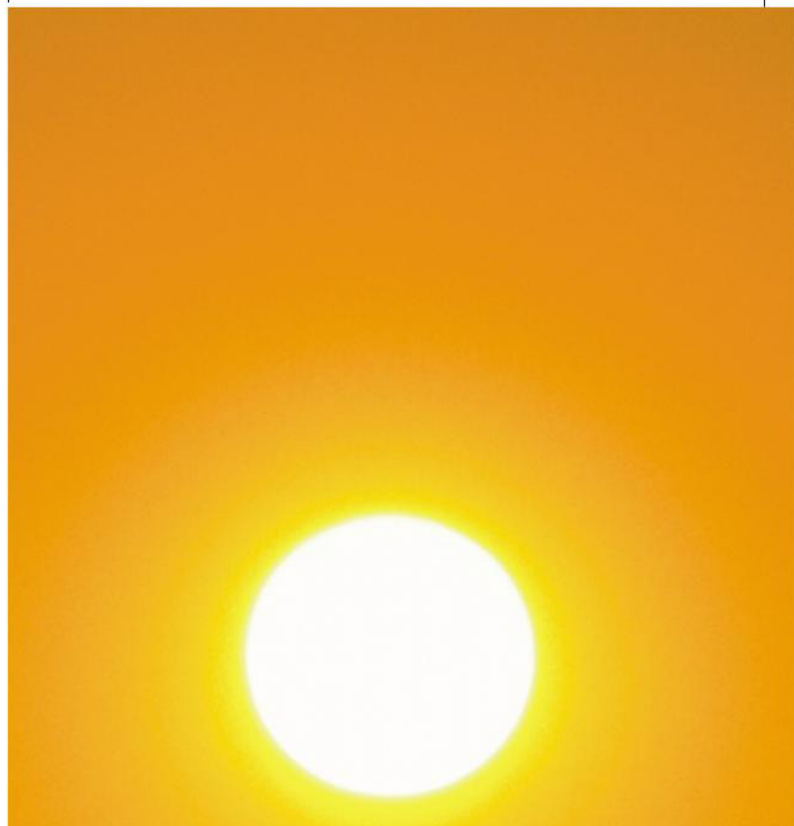
Subject to operational constraints, access may be made available to groups for research and educational purposes. Under special circumstances, arrangements may be made with Observatory staff for real-time assistance.

Several international projects are currently hosted on site.

For further information, contact the Observatory:

The Bureau of Meteorology SWS
PO Box 199
Exmouth WA 6707

Telephone: +61 8 9949 1472
World Wide Web:
http://www.sws.bom.gov.au/Solar/3/1



LEARMONTH SOLAR OBSERVATORY

LEARMONTH SOLAR OBSERVATORY

INTRODUCTION

The Sun is the lifeblood of our planet. It provides us directly with heat, light, and indirectly with food and most of our energy. It is the driving force of all our weather. Movement of air masses, formation of clouds, and severe weather hazards all result from the input of solar energy into the troposphere, the lowest region of our atmosphere. All these things are readily apparent in our daily life on the planet.

However, another mostly unseen aspect to the Sun's influence is its effect on the Earth's upper atmosphere and the near-space environment. This space weather is becoming increasingly apparent as society becomes more technologically dependent. Areas as diverse as radio communication and navigation, satellites and space exploration, geophysical prospecting and submarine detection, long pipelines and large electrical grid networks, aurora and animal migration are affected.

It is the task of Learmonth Solar Observatory to monitor the variability of the Sun, the source of these natural effects on a diverse range of human activity.

ESTABLISHMENT AND OPERATION

The Observatory was established by agreement between the Australian and United States Governments in October 1977 and operations commenced in April 1979. Joint operation is conducted by IPS Radio and Space Services, an Australian government agency, and the United States Air Force (USAF).

Located on North-West Cape, Western Australia (22.2°S, 114.1°E), the site overlooks Exmouth Gulf to the east and Cape Range to the west. It is part of a network of solar observatories (the Solar Electro-Optical Network, SEON) established by the USAF around the world, and one of two solar patrol observatories in Australia. Chosen for clear skies, the site averages over 9 hours sunshine per day.

The Observatory is staffed seven days a week, from sunrise to sunset, by IPS Radio and Space Services, the USAF Weather Agency (AFWA), 15th Communications Squadron, and the US National Oceanic and Atmospheric Administration (NOAA). Staff include analysts (to monitor and interpret observations), maintenance technicians, scientists and administrators.

Learmonth Observatory operates optical and radio telescopes to monitor the Sun. In collaboration with the Australian Geological Survey Organisation, magnetometers are operated to sense geomagnetic effects of solar activity. An ionosonde is also used to probe the state of the Earth's upper atmosphere.

DATA COLLECTION, DISTRIBUTION AND USE

Information collected at Learmonth is reported directly to forecast centres in both Australia and the USA. The IPS Australian Space Forecast Centre, in Sydney, provides space environment forecasts to customers within the Australasian area. In the USA, the (NOAA) Space Environment Center at Boulder, Colorado, and AFWA at Colorado Springs and Omaha, Nebraska receive data. Data produced at the Observatory is also archived at IPS in Sydney and the World Data Center in Boulder, from whence it is available to researchers anywhere in the world.

MONITORING THE SPACE ENVIRONMENT

The Sun is the primary source of variations in the space environment through which the Earth moves. It not only emits large quantities of light and heat, but other electromagnetic radiation such as radio waves, ultraviolet light and X-rays.

A solar wind of high speed, but very tenuous material, is constantly flowing from the Sun. Huge eruptions occurring on the Sun often eject large clouds of plasma into space (Coronal Mass Ejections). These, possibly preceded by shock waves, may impinge on the Earth's magnetic field and inject plasma particles, creating a geomagnetic storm.

The Learmonth optical telescope monitors solar surface features. These include sunspots, plage, filaments, fibrils, prominences and magnetic fields. These features change constantly and may appear and disappear on time scales from minutes to months. A most spectacular event to be viewed on the Sun is a flare, an explosive release of incredible amounts of constrained magnetic energy. The optical telescope includes many subsystems to monitor all the above phenomena for any potential impact that they might have on, or around, the Earth.

The radio telescopes monitor emissions from the Sun to complement information from the optical side. Different radio frequencies indicate different potential effects on the Earth. Mid-microwave frequencies indicate the emission of X-rays from the Sun. This affects the Earth's ionosphere which supports HF (high frequency) radio communication. Variations in X-ray emissions control the range of frequencies HF radio communicators may use. The radio telescopes can also track ejected material as it travels up through the Sun's atmosphere. This is useful in selecting which events are likely to have an impact on the Earth.

The magnetometers monitor very small changes in the Earth's magnetic field, detect interplanetary shock waves and monitor the course of geomagnetic storms. The ionosonde is a vertically directed HF radar providing information on the ionosphere. This data is useful to support radio communications and navigation, both ground and satellite based.

WHY WE NEED LEARMONTH OBSERVATORY

Continuous monitoring of solar activity is vital to ensure the maximum benefit of many of our technological activities. Reliable HF communications are maintained and affected by solar ultraviolet and X-ray output. Satellites are affected by changes in solar activi-ty. Spacecraft charging can cause component failure. Atmospheric density changes can reduce satellite lifetimes. Computer memory upsets can cause control problems.

Geophysical exploration uses vari-ations in the Earth's magnetic field to identify mineral deposits. Surveys can be disrupted or data may be impaired by geomagnetic storms and micropulsations.

Power lines and pipelines may be affected by surges in electric current induced by geomagnetic events arising from solar activity.

Many more areas are affected at least indirectly. As technology develops, especially in space-related activities, the need to monitor the Sun and the space environment becomes ever more important.