GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES
LOK SABHA
UNSTARRED QUESTION NO. 3383
TO BE ANSWERED ON WEDNESDAY MARCH 22, 2017

RESEARCH IN ANTARCTICA

3383. SHRI KESINENI NANI:

Will the Minister of Earth Sciences be pleased to state:

(a) the details of research areas being focussed on at India's base in Antarctica;
(b) the number of scientists and other people working at Indian base in Antarctica;
(c) the financial outlay for the base; and
(d) whether any breakthrough scientific research has been achieved at Indian base in the Antarctica and if so, the details thereof?

ANSWER
MINISTER OF STATE FOR MINISTRY OF SCIENCE AND TECHNOLOGY AND MINISTRY OF EARTH SCIENCES
(SHRI Y. S. CHOWDARY)

(a) Research areas of current focus at India's base in Antarctica include Climate Change through proxies in the ice cores, sediments and biological materials; Meteorology and Atmospheric Sciences; Earth science and Geology, Biology and Environmental Sciences, etc.
(b) About 100 to 120 members including Scientists, Engineers, Doctors and Tradesmen are deputed, in batches, every year in Indian expedition to Antarctica between November and January. During the austral winter season (March – November) 25 personnel are stationed at Maitri and 23 at Bharati station.
(c) There is no separate financial outlay for the research bases, however stations are maintained within the total outlay for the Indian Antarctic programme of the Ministry. Annual financial outlay for the Antarctic programme is about 120 crores.
(d) Indian scientists have made significant contributions in Antarctic research. The details are furnished in Annexure-I.

Annexure-I

Significant contributions in India's Antarctic Research

(i) Continuously monitoring of atmospheric parameters using Automatic weather station (AWS) coupled with synoptic weather observations, monitoring of the ozone hole and greenhouse gases have improved our understanding of the variations in the Antarctic atmospheric circulation patterns and its effect on monsoon.

(ii) Moveable Atmospheric Radar for Antarctica (MARA), Canadian Advanced Digital Ionosonde (CADI), Imaging Riometer, etc. working at Maitri have been successfully used to probe different regions of the polar atmosphere.

(iii) Maitri boasts of a permanent Geomagnetic Observatory, a Seismic Observatory and a Dynamic Global Position System (D-GPS) Base Station. All these observatories have generated uninterrupted record of past few decades; which significantly contributes to the global network.

(iv) Magnetic observations are vital for understanding the electromagnetic changes in the near-Earth environment due to internal or external origin. Different types of magnetometers (Digital Fluxgate magnetometer (DFM), Proton Precision Magnetometer (PPM), Induction Coil magnetometer (ICM)) are continuously monitoring terrestrial magnetic field at Maitri and Bharati.

(v) Maitri has a permanent seismic observatory and is part of the global network which records ground vibrations in the frequency range of 0 to 500 Hz. Mainly used for studying the seismic waves, earthquakes and deep interior of earth and has improved our capability to understanding of earthquakes.

(vi) Bio-optical and biogeochemical properties of the southwest sector of the Southern Ocean are not quite well understood. Continuous monitoring of vertical profile of bio-optical and biogeochemical component in the southwest sector of the Southern Ocean, by deploying the PROVOR BIO Argo floats will enhance the understanding many folds. All these floats are equipped with Dissolved Oxygen and chlorophyll sensor along with CTD for traditional temperature, salinity and depth measurements and drifts at 2000m depth.

(vii) As of now, about 120 new species of bacteria have been identified from the frozen continent. India has added 20 new species to this list. Pharmaceutical company Nicholas Piramal India Ltd (NPIL) in partnership with National Centre for Antarctic and Ocean Research (NCAOR) patented two drug leads for antibiotics and cancer developed from live microbes from Antarctica.

(viii) About 20,000 sq km area of the Wohlthat mountain chain has been geologically mapped by Indian scientists and four geological maps have been published.

(ix) National Remote Sensing Centre (NRSC), a constituent of Indian Space Research Organisation maintains an Antarctic Ground Station for Earth Observation Satellites (AGEOS) at Bharati Station that receives data from IRS satellites in X/S-band. This ground station supports Tracking and Tele Command support for satellites.

(x) Around 13,000 to 20,000 years ago, the Sea Surface Temperature (SST) decrease between 17°S and 20°S in the central Great Barrier Reef region was 1 to 2°C more than present. It implies northward expansion of cooler subtropical waters due to a weakening of the East Australian Current and shows that coral reefs can withstand large temperature changes provided sufficient time of the order of thousands of years is provided for adaptation.

(xi) Developed a first generation accurate digital elevation models (DEMs) for Larsemann Hills and Schirmacher Oasis, East Antarctica, using interferometric and photogrammetric techniques.

(xii) An Ice Core Laboratory was established at NCAOR, Goa. The Ice Core Laboratory provides a safe and controlled environment to preserve and undertake various studies. Study based on instrumental data from Halley station as well as an ice core from coastal Dronning Maud Land revealed regional atmospheric circulation changes associated with a reversal in the sign of the relationship between the southern annular mode (SAM) and near-surface temperatures in coastal parts of East Antarctica.

(xiii) Biogeochemical analysis of Antarctic snow samples revealed that elevated nutrient concentrations snow may be responsible for the observed enhanced growth of microalgae in snow with subsequent production of bromo-carbons which explains the high bromide concentration in snow.

(xiv) The nitrate (NO_3-) records in ice core (IND-22/B4) revealed synchronous changes with records of solar activity, showing relatively enhanced nitrate concentration during periods of reduced solar activity like the Dalton Minimum (~1790-1830 AD) and Maunder Minimum (~1640-1710 AD). The study suggest that the nitrate concentrations in Antarctic ice cores appears to be influenced by production rates, processes in the atmosphere, as well as the temperature at the site of precipitation.

(xv) Ice core based temperature reconstructions during the past five centuries also revealed substantial warming by 0.6-1°C per century, with greatly enhanced warming during the last few decades (~0.4°C per decade).

(xvi) The dust profile of the ice core (IND-25/B5) revealed that that dust influx to the East Antarctica was nearly doubled during the late 20th century, in parallel with increasing wind speed of westerlies in southern hemisphere associated with the positive Southern Annual Mode and widespread desertification in Patagonia.

(xvii) High resolution records of deuterium excess (d-excess), methane sulfonic acid (MSA) and ss-Na+ flux in an ice core from coastal Antarctica revealed dramatic increase in self-induction effect (SIE) in the Weddell Sea sector during 1940-1980. The study supports a role of SAM and its teleconnection to El Niño–Southern Oscillation (ENSO) in controlling moisture transport as well as SIE in oceanic regions surrounding Antarctica.

(xviii) ENSO-driven Polar Cell variability plays a crucial role influencing Antarctic sea ice as it interacts with other climate modes, which has a combined impact at the inter-annual time scale.

(xix) A recent work using petrological and geochronological data shows landward extension of East African Oorogen in east Antarctica in the Wohlthat Mountains in central Dronning Maud Land.

(xx) Significant findings from expeditions in the Southern Ocean include identification of the zones of sink and ventilation of CO_2; the fast degree of warming and freshening of the Antarctic Bottom Water due to glacier melting and the influence of melt water on productivity in the coastal and open ocean.