

Ministry of Earth Sciences

Name of the key initiative/ Flagship scheme: Polar Science and Cryosphere (PACER)

- **Objective:** To improve our understanding of Polar Science and cryosphere system.
- **Target Beneficiary:** R&D Scheme
- **No. of Beneficiaries:** R&D Scheme
- **Achievements (Year wise):**
 - Three (34th, 35th and 36th) Indian Scientific expedition to Antarctica was launched and executed successfully.
 - Deployed India's first multi-sensor moored sub-surface observatory (IndARC) at a water depth of ~180m in the Arctic.
 - Established a high altitude research station in Himalaya called HIMANSH at a remote region in Spiti, Himachal Pradesh.
 - IXth Southern Ocean Expedition was launched successfully.
- **Performance in last three years: 2014-17 (each years' budget allocation and achievement):**

Budget allocation
2014-15- Rs. 200 crores
2015-16- Rs. 294 crores
2016-17- Rs. 165 crores
- **Compare with Performance during UPA government in 2011-14:**
 - Deployed India's first multi-sensor moored sub-surface observatory (IndARC) at a water depth of ~180m in the Arctic.
 - Established a high altitude research station in Himalaya called HIMANSH at a remote region in Spiti, Himachal Pradesh.

Name of the key initiative/ Flagship scheme: Ocean Science, Technology, Observations, Resources, modeling and Services (O-STORMS)

- **Objective:** To conduct front ranking research for provide best possible ocean services and develop relevant ocean technology.

- **Target Beneficiary:** Fishermen, offshore industry, navy, coast guard, coastal and island states.
- **No. of Beneficiaries:** Fisherman, offshore industry, navy, coast guard, coastal and island states and other countries of the Indian Ocean.
- **Achievements (Year wise):**
 - Launched International Indian Ocean Expedition-2 (IIOE-2) towards promotion of ocean science in the Indian Ocean Region.
 - Ocean State Forecast service extended for neighbouring countries, Seychelles and Sri Lanka for providing 3-day forecasts on winds, waves, currents, temperature.
 - Operationalization of International Training Centre for Operational Oceanography at Hyderabad.
 - Provided a suite of advisory services on 24x7 basis, such as Tsunami early warning, Potential Fishing Zone, Ocean State forecast, coral bleach alert to cater to various sectors.
 - Augmented Ocean Observing Systems in the Indian Ocean through national and international efforts.
 - Periodical assessment of health of Coastal Seas of India
 - Established Ornamental Fish culture Centre at Agatti, Lakshadweep
 - Developed 500m depth rated shallow water/polar remotely operated vehicle (PROVe).
 - Signed a 15-year contract with the International Seabed Authority (ISA), for exploration of Poly-metallic Sulphides (PMS) in Indian Ocean.
 - Submitted an application to International Seabed Authority (ISA) for extension of contract for exploration of Poly-metallic Nodules (PMN) for a further period of 5years (2017-22).
 - Signed a MoU with Japan Agency for Marine-Earth Science and Technology (JAMSTEC), Japan.
 - India became a member of the International Energy Agency-Ocean Energy Systems (IEA-OES).
 - 65% of deep water topographic surveys of Exclusive Economic Zone beyond 500m water depth were completed.
 - Developed backward bent ducted buoy to generate power from sea waves, drifter buoy, deep ocean bottom pressure recorder, and autonomous passive acoustic monitoring system.
 - Beach nourishment technique was demonstrated at Pondicherry coast leading to gain of 60m wide beach.

- **Performance in last three years: 2014-17 (each years' budget allocation and achievement):**

Budget allocation

2014-15- Rs. 375 crores

2015-16- Rs. 300 crores

2016-17- Rs. 355 crores

- **Compare with Performance during UPA government in 2011-14:**
 - Developed 500m depth rated shallow water/polar remotely operated vehicle (PROVe).
 - Launched International Indian Ocean Expedition-2 (IIOE-2) towards promotion of ocean science in the Indian Ocean Region.
 - Ocean State Forecast service extended for neighbouring countries, Seychelles and Sri Lanka.
 - Operationalization of International Training Centre for Operational Oceanography at Hyderabad.
 - The fishermen have reaped enormous economic benefits from the Fishery Advisory Services provided by MoES. The economic benefit has been estimated by NCAER at approx. 34,000 crores per year.

Name of the key initiative/ Flagship scheme: Atmospheric and Climate Research, Observations Science Services (ACROSS)

- **Objective:**
 - Provide weather and climate forecasts for different users like agriculture, aviation, water resources, power, tourism, transport etc.
 - Provide early warnings and alerts regarding cyclones, severe weather events, heavy rainfall, heat waves etc.
 - Development of relevant numerical weather prediction and climate models.
 - Development of Earth System model for climate change scenarios.
- **Target Beneficiary:** Farming community, Various stakeholders
- **No. of Beneficiaries:**
 - Presently around 2.06 crores farmers are directly benefitted by this service.
 - Accurate forecasts of the recent cyclones, Phailin, HudhHud and Vardah saved thousands of human lives.

- Heat wave forecasts helped state governments to implement state action plans successfully.
- **Achievements (Year wise):**
 - Expansion of State level Agro-meteorological Advisories to 130 Agromet Field Units (AMFUs).
 - Noteworthy improvement was made in track and intensity forecast of the tropical cyclones (24 hour forecast error in track prediction reduced from 141km to 97km and Landfall error from 99km to 56km during 2006 to 2015).
 - A high resolution global deterministic weather prediction model has been commissioned for generating operational weather forecasts at a horizontal resolution of 12km.
 - Operational dynamical model systems have been implemented for extended range and seasonal forecasts.
 - Developed regional climate change scenarios which will be useful for impact studies and mitigation purposes.
- **Performance in last three years: 2014-17 (each years' budget allocation and achievement):**

Budget allocation

2014-15- Rs. 257 crores

2015-16- Rs. 335 crores

2016-17- Rs. 360 crores
- **Compare with Performance during UPA government in 2011-14:**
 - Presently around 2.06 crores farmers are directly benefitted by this service.
 - Accurate forecasts of the recent cyclones, Phailin, HudhHud and Vardah
 - Improvement in track and intensity forecast of the tropical cyclones
 - The farming community have reaped enormous economic benefits from the Agromet Advisory Services provided by MoES. The economic benefit has been estimated by NCAER at approx. 50,000 crores per year.

Name of the key initiative/ Flagship scheme: Seismology and Geoscience Research (SAGE)

- **Objective:**
 - Provide information on earthquakes occurring over different parts of the world.
 - Maintain the seismological network and upgradation
 - Organize micro-zonation of various cities
 - Carry out research in basic geosciences, seismology
- **Target Beneficiary:** Various stakeholders
- **No. of Beneficiaries:** R&D Scheme
- **Achievements (Year wise):**
 - The Scientific Deep Drilling Project at Koyna, Maharashtra started with the aim of setting up of borehole observatory at 3.0 to 5.0km depths for directly measuring parameters in the near fields of earthquakes- before, during and after their occurrence.
 - Micro-zonation of Delhi has been completed based on Probabilistic Seismic Hazard Analysis (PSHA).
- **Performance in last three years: 2014-17 (each years' budget allocation and achievement):**

Budget allocation

2014-15- Rs. 154 crores

2015-16- Rs. 175 crores

2016-17- Rs. 150 crores
- **Compare with Performance during UPA government in 2011-14:**
 - Started Scientific Deep Drilling Project at Koyna
 - Prepared micro-zonation map of Delhi.
 - Improved the seismological observational network