Eastern Antarctica with its surrounded sea ice is exposed to the vast southern ocean on the northern side
which extends into the equatorial region of Indian Ocean. The Antarctic Ice area changes are seasonal
due to freezing in winter and melting in summer because of the extension of the sea ice to open ocean
environment heat flux variations. The available data shows that the sea ice cover in Antarctica varies
between winter to summer with a maximum of about 19 million km 2 and to a minimum of just 3 million
km 2 respectively. Apart from seasonal fluctuations, strong westerly winds along with high waves and
frequent storms are the prime factors which shape up the sea ice cover in Antarctic regions.
The thickness of the Antarctic sea ice is getting restricted in thickness due to high surface heat flux and
heat supplied from the warm circumpolar deep water currents. Even though the extent and variability of
the Antarctic sea ice coverage has been studied over the decadal time period through satellite
oceanography, a reliable estimate on thickness of ice is lacking to understand the variability of the climate
forcing mechanism and its impact. To understand further, it is important to know about pole ward
westerly winds, tropospheric ozone depletion, mechanisms like Ekman transport, upwelling etc to
establish the coupling of atmosphere, ocean and polar ecosystem. Apart from ice shelf observations,
shallow lakes in the Antarctic continent are least explored to understand the algal mats characteristics at
the lake beds to understand the biotic environment in the extreme climates.
In order to quantify such phenomena, it is imperative to develop suitable technologies for taking
measurement for the advancement of ice sheets, snow cover, thickness of icebergs, thickness of ice shelf,
Lake Floor observations etc. Tethered and un-tethered underwater vehicles plays major role in
observations with the recent development in underwater sensor and vehicle technologies. It is possible to
understand the ice thickness by continuous measurement and air-ice- ocean interaction studies are now
becoming possible by using these vehicles. Hence, autonomous and remotely operated vehicles are to be
developed for reliable operation in the challenging low temperature environment of Antarctic. These
platforms have the potential to modernize our understanding of this remote and under sampled sea ice
environment. In the Indian scientific context, this will be the starting step of technologies towards
sustained observation of Antarctic ice and shallow lakes to decipher the climate forcing mechanism which
will be highly beneficial for polar research community. These types of field-based measurements will
bring out the state of ice cover and the potential impact on biota in extreme environment and its
surrounding eco-system. This will also facilitate to increase our understanding of Antarctica and also to
build our country&#39;s engineering capability towards polar science.
In the process of technology demonstration, NIOT has developed a proto-type system of Remotely
Operable Vehicle for polar temperature and successfully tested in Antarctic ice shelf and lakes. Critical
challenges such as material engineering to cater for low temperature environment, under ice navigation,
light attenuation characteristics in different continental ices, optimum vehicle design, handling systems
etc were noted for further development or optimization. Special variant of ice coring tools were also
developed to get interfaced with underwater water vehicle for ice core sampling below the ice shelf.
Quantitative measurements are possible from the underwater vehicle variants to monitor the ice shelf
dynamics, Lake Floor observations and also changes in associated biota assemblages to decipher the
influence of climate in Antarctica.