

## **The Ice-Tethered Profiler program: Making a contribution to the ocean observing system at polar Latitudes**

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In the 6+ years since the first prototype Ice-Tethered Profiler was deployed, the ensemble of 42 ITPs fielded by researchers from 6 countries have returned more than 30,000 upper-ocean temperature and salinity profiles from the central Arctic, significantly increasing the number of high-quality upper-ocean water property observations available from the central Arctic. In addition, two systems have been deployed in the Southern Ocean. Here, the instrument technology is reviewed and a status report on performance is provided, along with several examples of the science that ITPs and companion instrumentation are supporting. The ITP system consists of three main components: a surface instrument package that typically sits atop an ice floe (but can float in open water), a weighted, wire-rope tether of arbitrary length (up to 800 m) suspended from the surface package, and an instrumented underwater unit that travels up and down the wire tether transporting a sensor package through the water column. Full resolution data are telemetered to shore, making the instruments expendable. Of the 30,000+ profiles attempted, approximately 80% returned usable temperature and salinity data over a vertical interval greater than 700 m. Including those systems still operational (and thus biasing the following mean estimates low), the average lifetime of the ITP surface buoy (time over which telemetry is received) is 500 days; the average number of CTD profiles longer than 700 m received per instrument deployment is 741. Surface buoy over-rafting by convergent sea ice and tether dragging in shallow water are the most common termination modes. As frequently as possible, ITPs are deployed together with other autonomous buoy systems to sample a wide range of variables characterizing the Arctic ocean-ice-atmosphere-eco- system. We term such collection of buoys an Ice-Based Observatory (IBO). In total, 24 of the 42 ITP systems deployed thus far in the Arctic have been accompanied by at least one companion instrument; 16 of these IBOs included 3 or more instrument systems. Prototypical IBOs, deployed annually in conjunction with the North Pole Environmental Observatory program, included NOAA-Pacific Marine Environmental Laboratory Web Cams and Polar Area Weather Stations, Cold Regions Research and Engineering Laboratory Ice Mass Balance Buoys, Naval Postgraduate School Autonomous Ocean Flux Buoys and ITPs. The data from such IBOs are proving valuable for investigating local processes influencing the atmosphere-ice-ocean boundary layer systems as well as contributing to the larger-scale observing system. ITP systems and companion instruments are continuing to be deployed under the banners of the US Arctic Observing Network (AON) and internationally under SAON (Sustaining Arctic Observing Networks) and country-specific programs. Like the international Argo float program, continuing effort is necessary to sustain the deep Arctic sampling effort and to initiate a more extensive program in the Southern Ocean.