

2 weeks before leg 3, and returned during the middle of leg 3 for another 2-week survey. A note on the frontal eddy formation and structure is in preparation. During leg 3 we were able to measure the transfer process at the Polar Front Zone on scales from 50 kilometers horizontal, 2.5 kilometers vertical (cold ring), to 20 centimeters vertical, a dynamic range of over 10^4 .

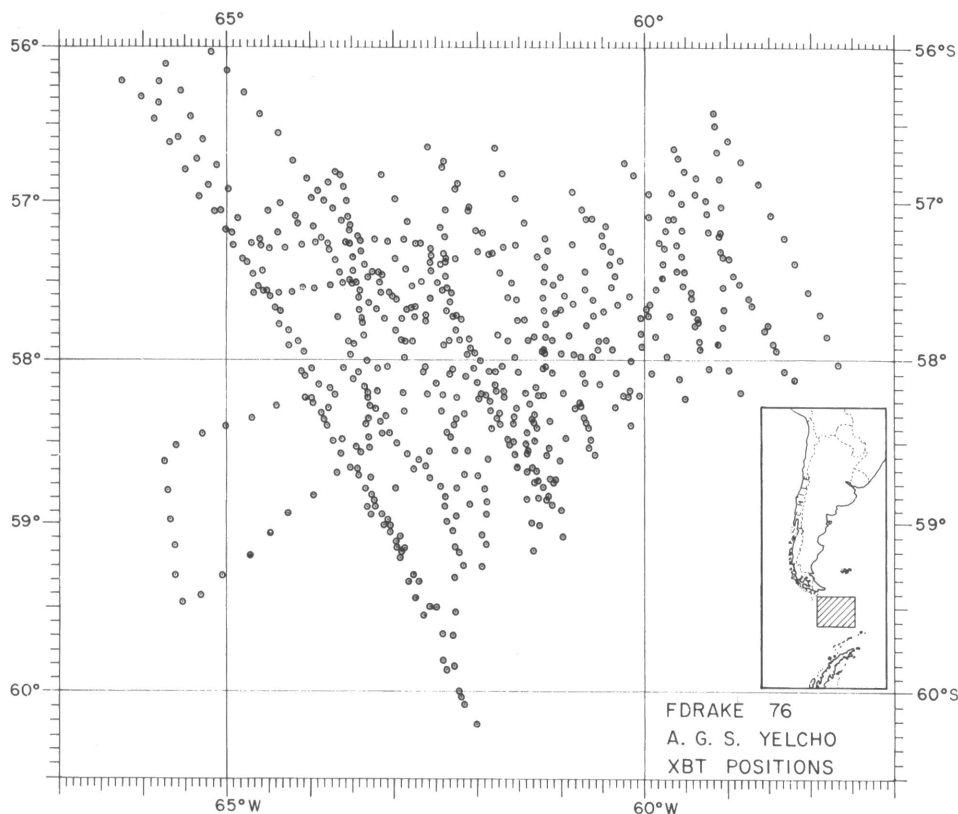
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Contributions of AGS *Yelcho* to FDRAKE, 1976

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On 27 February 1976 the Chilean naval ship *AGS Yelcho* departed Punta Arenas, Chile, to begin its participation in the second phase of the First Dynamic Response and Kinematics Experiment (FDRAKE 1976) of the International Southern Ocean Ocean Studies. The mission of *Yelcho* was to conduct an expendable bathythermograph (XBT) survey to describe the large-scale thermal structure of the waters in the vicinity of the Polar Front Zone (PFZ) in Drake Passage. This work was done in support of, and in cooperation with, a study of the



Positions of the 571 expendable bathythermograph observations of AGS *Yelcho* obtained during FDRAKE, 1976, in Drake Passage.

small-scale structure of the PFZ done aboard R/V *Thomas G. Thompson* of the University of Washington between 13 March and 9 April (Joyce, 1976).

Scientific operations aboard *Yelcho* were under the direction of Hellmuth A. Sievers, Instituto Hidrográfico de la Armada de Chile, and Steven L. Patterson, Texas A&M University. The remainder of the scientific party consisted of six from the Instituto and two from Texas A&M. Repeated surveys of the PFZ were made during each of two legs aboard *Yelcho*. The first leg lasted from 27 February to 13 March, and the second from 22 March to 8 April. Each began and ended in Punta Arenas.

Preliminary information obtained during leg 1 about the PFZ was passed to scientists aboard *Thompson* before they departed Punta Arenas on 13 March. While at sea the two ships communicated regularly via the Applied Technology Satellite (ATS-3), which is in geostationary orbit over the equator at 70°W.

The figure shows positions of the 571 xBT stations occupied by *Yelcho*. These stations are mostly along and to the east of a line 15 nautical miles northeast of the current meter moorings that were deployed during the first leg of *Thompson* activities (Nowlin *et al.*, 1976). Both T-4 and T-7 type xBT probes, which profile the water temperature to a nominal depth of 450 and 750 meters, respectively, were used in the surveys. The profiles were recorded on a standard Sippican analog recorder and were calibrated with thermometer-determined sea surface temperatures. At most stations surface water samples were collected to be analyzed for salinity and silicate concentration. Standard meteorological observations were made hourly, and bathymetry was continuously monitored using an EDO model 185 echo-sounder. Navigation was by Magnavox model 702A satellite navigation system.

During the 10 days of leg 1 that *Yelcho* was in the survey area, the PFZ remained relatively stationary. It had a west-southwest to east-northeast orientation (centered about an average latitude of 57°40'S.) except for a sharp deflection to the southeast at about 57°50'S. 62°30'W. Between legs 1 and 2 *Yelcho* was absent from the survey area for about 15 days. The initial survey of leg 2 revealed that the deflection, or meander, had grown considerably in size. Subsequently, *Thompson* reported that a cyclonic ring had been shed to the north of the Front. *Yelcho's* first survey of this ring showed that its radius, measured from the cold water (below 0°C) core, located at 57°26'S. 63°38'W., to the 2°C isotherm, ranged from 13 to 22 nautical miles. The feature extended deeper than 750 meters. A survey 3 days later indicated that the ring had grown in size and had become more deformed in shape, with its radius now ranging from 15 to 38 nautical miles. The center had drifted to the north-northeast at

approximately 0.2 knots. South of the ring the Front had resumed its west-southwest to east-northeast orientation and was passing within 20 nautical miles to the north of the cluster of three current meter moorings deployed by *Thompson* near 59°06'S. 63°43'W. These moorings appear to be ideally located to monitor current velocities associated with PFZ.

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Tidal currents in the sea beneath the Ross Ice Shelf

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We studied the ocean tide beneath the Ross Ice Shelf in conjunction with the Ross Ice Shelf Project. Robinson *et al.* (1975) report tidal water level fluctuations in the southern part of the Ross Sea for the six locations indicated in figure 1. Interpolated cotidal and corange lines indicate the nature of the principal diurnal constituents O_1 and K_1 P_1 of the ocean tide beneath the Ross Ice Shelf.

The association of tidal water level fluctuation and horizontal components of the tidal current for a particular harmonic constituent is expressed in the Laplace tidal equations (Doodson, 1958). If the