

## Correspondence

### Cleaner bunker fuel for ships in polar waters

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Recent oil spills in polar waters, coupled with possibilities of increasing maritime traffic in high latitudes, raise the question of whether polar ships' operators might be encouraged or required to use bunkering fuels that are environmentally safer. Most ships use a heavy residual fuel oil with specific gravity (SG) a little lower than that of water, a 4% sulphur content and usually no saturated hydrocarbons (paraffins and cycloparaffins). When spilled in polar waters, this fuel takes longer to degrade than certain other fuels that are commercially available, and could thus be more damaging to wildlife.

Possible alternative fuels include (a) gas oil, highly aromatic grade; (b) gas oil, highly paraffinic grade; (c) waxy distillate, highly paraffinic; (d) kerosine, highly

paraffinic; (e) naphtha, highly paraffinic; (f) liquid petroleum gas, completely paraffinic; (g) residual fuel oil, high SG (at 60/60°F 1.05 – 1.10). Of these (a) to (f) are of lower SG and contain more volatile fractions which evaporate quickly: the last, of higher SG, would tend to stay in ruptured tanks in the event of an accident without fire. We do not know if these fuels would cause less damage overall to the environment if spilled in polar waters, but there is a good chance that they would cause less damage than the currently-used residual fuel oil.

Quantities of fuels required for use in polar waters are so small relative to the total availability of possible alternatives that supplies would be readily available. The cost of double-bottomed tankers required by US legislation is high. The cost of fuel substitution for vessels in polar waters would be negligible in comparison. A major oil company has in fact recently decided to stop using residual fuel oil in its tankers trading only in UK waters.

Surely it is now sensible to examine the possibilities of using safer fuels in polar waters.

## Reviews

### SOUTHERN OCEAN ATLAS

THE FRAM ATLAS OF THE SOUTHERN OCEAN. Webb, D., Killworth, P. D., Coward, A. C. and Thompson, S. R. 1991. Swindon, Natural Environment Research Council. 67 p, illustrated, hard cover. ISBN 1 85531 036 8. £100.00. Obtainable from Library, IOSDL, Wormley, Godalming, Surrey GU8 5UB.

Published by NERC in association with the Institute of Oceanographic Science, this atlas, to quote from the foreword, is based on 'six years of assimilation of the archive of hydrographic data accumulated from oceanographic cruises over the last hundred years'. It differs from previous Southern Ocean atlases in treating the data, not as numbers to be analysed statistically, but '... as samples of a dynamical system which obeys the laws of nature', using computer modelling methods similar to those employed in weather forecasting. As the introduction explains, the model used is the UK Fine Resolution Antarctic Model (FRAM), which covers the Southern Ocean and neighbouring oceans. Depths are dealt with at 32 levels, ranging in thickness from 20.3 m near the surface to over 200 m deeper down. Horizontally the resolution is 0.25° N–S and 0.5° E–W, at 60°S providing a grid of 27 km in both directions — by any standard fine resolution indeed. Over the years this model has evolved to yield results which, even on the fine scale of ocean eddies and meanders, brings

reality gratifyingly close. The data sets are available in computer-readable form from the British Oceanographic Data Centre.

The colour plates are in two groups. Part 1, made up of polar projections, includes bathymetry, potential temperature, salinity, current velocity and pressure at seven levels from surface to 3990 m, temperature, salinity, velocity, depths and potential vorticity at two density levels, and the Levitus temperature and salinity fields at 10.3 m and 1726 m, which were used to initialize the model. Part 2 includes temperatures, salinities and cross-track velocities on a network of World Ocean Circulation Experiment hydrographic sections for each ocean, followed by brief explanatory notes. The final plate illustrates the transport stream function.

I am sure this is an excellent atlas of the Southern Ocean, and one capable of bringing a new level of visual understanding to those who can afford it. For whom is it intended? It is a large-format (60 x 43 cm) atlas, ring-bound under a plastic hinge, and lavishly produced. Several of the text pages are printed over a faint background of pack ice: the polar projections and sections are of generous size, larger than is essential for clarity, with much high-quality white paper surrounding them. It smacks of an eyecatcher at public expense. The public (who have already subsidized its production) are asked to pay £100