Surface Transport Charts for the North Pacific Ocean, 1959 - 1962

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FISHERIES RESEARCH BOARD OF CANADA

Biological Station, Nanaimo, B.C.

June, 1968
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Introduction

Monthly charts of surface transport vectors (synoptic pilot charts) for the North Pacific Ocean can be drawn using the 22 years of meridional and zonal components given in Fofonoff (1960, 1961), in Fofonoff and Dobson (1963), in Fofonoff and Ross (1962) and in Wickett (1966, 1967). Such charts are a useful tool for recognizing annual differences in ocean conditions.

The card output containing the above numerical output can serve as data input to a computer and plotter to make available, quickly and easily, a long series of charts. The problem was to plot on an azimuthal projection centred on the North Pole, similar to that used for meteorological charts, rather than to plot on a rectangular grid.

Method

The Fortran program, VECTR, written for use on an IBM 1130 computer with on-line plotter uses as input two matrices calculated by the program for Fofonoff's analysis (Froese, 1963), as modified by this laboratory. The matrices used contain (1) the calculated zonal component of surface transport and (2) the meridional component of surface transport for data points lying between 110°W longitude and 115°E longitude and between 20°N latitude and 60°N latitude. The program establishes an arbitrary location as the North Pole and plots latitude as a radius from the pole (scale is 0.15" per degree). Longitude is defined by calculating the value of the angle THETA in radians such that 180° longitude equals 270° in polar terms.

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With the data point defined, the meridional component (scaled by 0.04) is added with sign retained to the radius. The zonal component is then used to calculate a new angle (THETA 1) in radians; THETA 1 = zonal component times 0.04 divided by radius (corrected). A correction value is then applied to the new radius which is defined as the radius times the exsecant of THETA 1. The new radius and angle thus define the location of the end of the vector of surface transport. The scale is $10 \, \text{m}^3/\text{sec/km} = 0.006''$.

(As the computer lettering is 0.1" wide, the width of 3 letters and spaces in the title "SURFACE TRANSPORT" is 500 $\, \text{m}^3/\text{sec/km}$.)

The above procedure expresses closely the surface transport vector in terms of a rectangular grid starting from a point defined by polar coordinates. Since the vector should be considered as a measure of transport at the grid points, the plotted output stresses the starting point or data point rather than the end of the vector.

A year's data (12 charts) takes 60 minutes to run on the computer and plotter.

Results

The following pages give monthly vectors on an azimuthal equidistant projection centred on the North Pole. The plotter output is photographed through a plastic overlay carrying the coastline and grid of latitudes and longitudes. Ocean Station P is indicated by a black dot at $50^\circ\text{N} 145^\circ\text{W}$.

The vectors are point values at the asterisks which form the origins of the vectors. Certain cautions concerning the numerical output must be kept in mind, namely, that the monthly mean pressure values used as the original input may give values of transport different from mean transport calculated from daily pressure values, and the calculated values of transport have not been checked against observations at sea.

Charts for the remaining years in the series are being produced as time permits.

Acknowledgement

We are indebted to the Extended Weather Forecast Division of the U.S. Weather Bureau for supplying copies of Mean Monthly Sea Level Pressure Data cards each month.
References


SURFACE TRANSPORT MARCH 1961
SURFACE TRANSPORT FEBRUARY 1960