

Accepted Manuscript

The Abyssal and Deep Circulation of the Northeast Pacific Basin

Susan L. Hautala

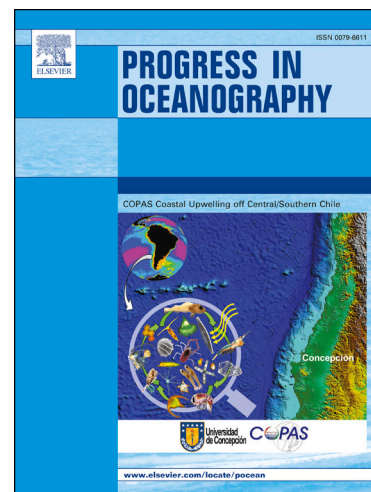
PII: S0079-6611(17)30004-6
DOI: <https://doi.org/10.1016/j.pocean.2017.11.011>
Reference: PROOCE 1882

To appear in: *Progress in Oceanography*

Received Date: 7 January 2017
Revised Date: 25 November 2017
Accepted Date: 29 November 2017

Please cite this article as: Hautala, S.L., The Abyssal and Deep Circulation of the Northeast Pacific Basin, *Progress in Oceanography* (2017), doi: <https://doi.org/10.1016/j.pocean.2017.11.011>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



The Abyssal and Deep Circulation of the Northeast Pacific Basin

Susan L. Hautala

School of Oceanography, University of Washington

ABSTRACT

Three-dimensional abyssal and deep circulation of the region to the east and north of the Emperor Seamount Chain / Hawaiian Ridge is determined from a compilation of CTD and Argo float data, using a new overdetermined inverse technique for the geostrophic reference velocity and diapycnal/lateral mixing coefficients. The Northeast Pacific Basin is primarily sourced from its northern boundary, at a rate of 3.5 Sv across 47°N below 3000 m. Bottom water in the western subarctic gyre recirculates cyclonically between the Emperor Seamount Chain and 155°W. Bottom water east of 155°W takes a more direct path southward along the flank of a broad topographic slope. In the deep water, a ridge of potential vorticity lying along the Mendocino Fracture Zone separates circulation systems north and south of ~40°N. The region has very weak diapycnal and lateral mixing, and an aspect ratio for the overturning circulation that is correspondingly flat, with bottom water parcels rising less than 1 km during their long transit from the Aleutian Trench to the latitude of Hawaii.

1. Introduction

The upwelling limb of the global thermohaline circulation in the North Pacific is one of its least understood aspects. Tracer indicators of water "age" are intensified at mid-depth in the northeast, and this region has been likened to a cul-de-sac of the planetary vertical overturning cell. Early schematics show a simple upwelling loop connecting bottom water to upper ocean levels (Broecker, 1991). In the 1980s and 1990s (see Schmitz, 1995), the picture shifted from a two-layer abyssal to upper ocean connection, to a four-layer schematic with an overturning circulation between the abyssal and deep water masses distinct from the intermediate and thermocline layers, and with deep water moving back into the Southern Ocean between these two circuits. Schmitz's review literally left a question mark for the transport of the Northeast Pacific Basin (NEPB) abyssal to deep overturning unknown, because of both of a lack of data and the relatively subtle differences between deep water mass properties in the interior North Pacific.

A seminal treatment of the lateral pattern of circulation on basin scales in the deep Pacific was the analysis of Reid (1997), based on the data available before the World Ocean Circulation Experiment (WOCE). This monograph was published at about the same time as research at the other end of the spectrum of length-scales revealed the patchiness of turbulent diapycnal mixing (e.g., Polzin, et al. 1997). Reid's work became part of a conceptual revision towards greater complexity in the deep ocean. Instead of quasi-uniform meridional and upwelling flow originally envisioned in theory (e.g., Stommel and Arons, 1960; Kuo and Veronis, 1973) that formed the underpinning of many of the early global overturning schematics, Reid's observationally-based circulation consists of distinct regions of meridional transport in

Download English Version:

<https://daneshyari.com/en/article/8886719>

Download Persian Version:

<https://daneshyari.com/article/8886719>

[Daneshyari.com](https://daneshyari.com)