



WORLD OCEAN CIRCULATION

ALGORITHM THEORETICAL BASIS DOCUMENT FOR SURFACE STOKES DRIFT (THEME 3)

customer	ESA/ESRIN
ESA contract	ESA Contract No. 4000130730/20/I-NB
document reference	WOC-ESA-ODL-NR-009_ATBD_T3_SSD_V1.0
Version/Rev	1.0
Date of issue	13/12/2021.

Issued by	Mickaël Accensi (Ifremer)
Approved by	
Approved by	

Distribution List

	Name	Organization	Nb. copies
Sent to :	M.H. rio	ESA/ESRIN	ESA-STAR
Internal copy :	Project Manager	OceanDatalab	1 (digital copy)

Document evolution sheet

Ed.	Rev.	Date	Purpose evolution	Comments
1	0	13/12/2021	Creation of document	

Contents

1 Introduction	3
1.1 Products summary	3
1.2 Scope & Objectives	3
1.3 Document structure	3
1.4 Applicable & Reference documents	3
1.5 Terminology	4
2 Surface Stokes Drift	4
2.1 Overview	4

List Of Images

List Of Tables

1 Introduction

1.1 Products summary

This document provides the algorithm theoretical basis for the products developed by Ifremer in the framework of the ESA World Ocean Circulation project.

1.2 Scope & Objectives

This document is the Algorithm Theoretical Basis Document (ATBD) which is dedicated to the description and justification of the algorithms used in the generation of:

- WOC-SSD

1.3 Document structure

In addition to this introduction, this document includes the following chapters:

Chapter 2: Surface Stokes Drift (WOC-SSD)

1.4 Applicable & Reference documents

- [RD-1] ESA WOC2019: <http://woc2019.esa.int/index.php>
- [RD-2] Synthesis of the WOC2019 User Consultation Meeting recommendations http://woc2019.esa.int/files/WOC2019_summary_synthesis.pdf
- Alday, M., Accensi, M., Ardhuin, F., Dodet, G., 2021. "A global wave parameter database for geophysical applications. Part 3: improved forcing and spectral resolution". Ocean Modelling [in press].<https://www.essoar.org/doi/abs/10.1002/essoar.10505476.1>
- The WAVEWATCH III ® Development Group, 2019. User manual and system documentation of WAVEWATCH III ® version 6.07. Tech. Note 333, NOAA/NWS/NCEP/MMAB, College Park, MD, USA, 465 pp. + Appendices.

1.5 Terminology

ATBD	Algorithm Theoretical Basis Document
CCI	Climate Change Initiative
IFREMER	Institut Français de Recherche pour l'Exploitation de la Mer
NOAA	National Oceanic and Atmospheric Administration
PUM	Product User Manual
WOC	World Ocean Circulation

2 Surface Stokes Drift

2.1 Overview

The following product of surface stokes drift is retrieved from the wave energy spectrum discretized in wave numbers and directions and the water depth at each location. It is estimated at the sea surface and expressed in m.s-1. The eastward and northward components are defined by the following equation :

$$(U_{ssx}, U_{ssy}) = \iint \sigma \cosh 2kd \frac{(k \cos(\theta), k \sin(\theta))}{\sinh^2 kd} F(k, \theta) dk d\theta$$

with

d : depth [m]

σ : pulsation [rad/s]

k : wave number [rad/m]

θ : propagation direction [rad]

$F(k, \theta)$: wave energy spectrum [m².s.rad-1]

The surface stokes drift is computed by the spectral wave model WAVEWATCH-III (r), under NOAA license. This model solves the random phase spectral action density balance equation for wavenumber-direction spectra.

Please refer to the WAVEWATCH-III User Manual for fully detailed description of the wave model equations and numerical approaches.

