Title of the database:

GulfFLow: Statistics of the surface flow of the Gulf of Mexico based on surface drifters

Summary:

This dataset is comprised of mean and variance of the surface velocity field of the Gulf of Mexico, obtained from a large set of historical surface drifter data from the Gulf of Mexico—3761 trajectories spanning 27 years and more than a dozen data sources— which were, uniformly processed and quality controlled, and assimilated into a spatially and temporally gridded dataset. A gridded product, called GulfFlow, is created by averaging all available data from the GulfDrifters dataset within quarter-degree spatial bins, and within overlapping monthlong temporal bins having a semimonthly spacing. The data set runs from August 16, 1992 to August 1, 2019, for a total of 648 overlapping time slices. Odd-numbered slices correspond to calendar months, while even-numbered slices run from halfway through one month to halfway through the following month. A higher spatial resolution version, GulfFlow-1/12° is created in the identical way but using 1/12 degree bins instead of quarter-degree bins. In addition to the average velocities within each 3D bin, the count of sources contributing to each bin is also distributed, as is the subgridscale velocity variance discussed in the next section. The count variable is a four-dimensional array of integers, the fourth dimension of which has length 30. This variable gives the number of hourly observations from each source dataset contributing to each three-dimensional bin. Values 1–15 are the count of velocities from drifters from each of the 15 experiments that have not been flagged as having lost their drogues, while values 16–30 are for observation from drifters that have been flagged as having lost their drogue. Values above 15 are only populated for the GDP, HARGOS, LASER and some of the DWDE drifters, as a drogue presence flag is not always available. It is useful at this stage to introduce notation for different types of averages. For convenience we represent the velocity as a vector, $\mathbf{u} = [u \ v]^T$, where the superscript "T" denotes the transpose. Let an overbar, $\overline{\mathbf{u}}$ denote an average over a spatial bin and over all times, while angled brackets, $<\mathbf{u}>$, denote an average over a spatial bin and a particular temporal bin. Thus, $<\mathbf{u}>$, is a function of time while $\overline{\mathbf{u}}$ is not. We refer to $<\mathbf{u}>$, as the local average, $\overline{\mathbf{u}}$ as the global average, and $\overline{<\mathbf{u}>}$ as the double average. Given the inhomogeneity of the drifter data, turns out the global average is biased towards intensive but short duration programs, hence the double average results in a much better representation of the true mean velocity field. The dataset includes the global average $\overline{<\mathbf{u}>}$, the local covariance defined as
$$\boldsymbol{\varepsilon} = <(\mathbf{u} - <\mathbf{u}>)(\mathbf{u} - <\mathbf{u}>)^T>$$
and ε^2 which is the trace of $\overline{\boldsymbol{\varepsilon}}$
$$\varepsilon^2 = \mathrm{tr}\{\overline{\boldsymbol{\varepsilon}}\}$$

The data is distributed in two separate netcdCDF files, one for each grid resolution.

The metadata and description of the variables are listed below.

Global Attributes

Discover and Identification

Site Code	Gulf of Mexico
Platform Code	drifters_gridded_velocity_fields
Title	Gulfflow gridded velocity product, **1/4deg or 1/12 deg**
Summary	gridded surface velocity product for the Gulf of Mexico derived from surface drifters, **1/4deg resolution or 1/12 deg resolution**
Project	Implementación de redes de observación oceanográficas (físicas geoquímicas, ecológicas) para la generación de escenarios ante posibles contingencias relacionadas a la exploración y producción de hidrocarburos en aguas profundas del Golfo de México Consorcio de Investigación del Golfo de México (CIGoM)
Naming Authority	cigom.org
ID	gridded_surface_velocity_fields
Source	drifters
Principal Investigator	Paula Perez Brunius
Principal Investigator Email	brunius@cicese.mx
Principal Investigator URL	https://giola.cicese.mx
Institution	Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE)

Global Attributes

Provenance

Date Created	05-May-2020 12:51:10
Date Modified	05-May-2020 12:51:10
History	
Processing Level	processed quality controlled by J. M. Lilly
Creator Type	Group
Contributor Name	Jonathan M. Lilly (80%), Paula Pérez Brunius (20%)
Contributor Email	j.m.lilly@theissresearch.org, brunius@cicese.mx
Contributor Institution	Theiss Research Inc., CICESE

Global Attributes

Conventions Used

Instrument	drifters
CDM Data Type	grid
Data Type	grid data
Conventions	CF-1.6, ACDD-1.3
Netcdf version	4.3
Standard Name Vocabulary	CF Standard Name Table

Global Attributes

Publication Information

Publisher Name	Sistema de Manejo Integral de Datos CIGOM
Publisher Email	smid@cigom.org
Publisher URL	http://smid.cigom.org
Acknowledgement	Esta investigación ha sido financiada por el Fondo Sectorial CONACYT-SENER-Hidrocarburos, proyecto 201441. Esta es una contribución del Consorcio de Investigación del Golfo de México (CIGoM). Reconocemos a Pemex por promover ante el Fondo la demanda específica sobre los derrames de hidrocarburos y el medio ambiente.. Research funded by the National Council of Science and Technology of Mexico - Mexican Ministry of Energy - Hydrocarbon Trust, project 201441. This is a contribution of the Gulf of Mexico Research Consortium (CIGoM). We acknowledge Pemex specific request to the Hydrocarbon Fund to address the environmental effects of oil spills in the Gulf of Mexico that made this project possible. S
Keywords	drifters, velocity, gulfflow, gridded fields, Gulf of Mexico, surface circulation

DATA

Dimensions

Dimension Name	Dimension Size 1/4 resolution	Dimension Size 1/12 resolution
time	648	648
lon	74	222
lat	52	156
N	30	30
Exp_Strlen	8	8
Datasets	15	15

DATA

Variables

Name	Size	Data Type	Attribute Name	Attribute Value
N	N	Int32	standard_name	= drogue_id
			long_name	= Identifier for drogued and undrogued drifters for each dataset, used for count and total_count
			units	= No units
ExpName	Exp_Strlen, Datasets	char	standard_name	= dataset_ID
			long_name	= Name of drifter dataset from which the data comes from
num	time	double	standard_name	= serial_date_num

Name	Size	Data Type	Attribute Name	Attribute Value
			long_name	= serial date number, Matlab datenum
			units	= days
			axis	= T
			calendar	= standard
time	time	double	standard_name	= time
			long_name	= time of observations
			units	= seconds since 1900-01-01 00:00:00
			axis	= T
			calendar	= standard
lat	lat	double	standard_name	= latitude
			long_name	= central latitude of the grid
			units	= degrees_north
			axis	= Y

DATA
Variables continued

Name	Size	Data Type	Attribute Name	Attribute Value
lon	lon	double	standard_name	= longitude
			long_name	= central longitude of the grid
			units	= degrees_east
			axis	= X
u	time,lon,lat	double	standard_name	= eastward_sea_water_velocity
			long_name	= monthly mean surface current east component
			units	= m/s
			_FillValue	= -9999
v	time,lon,lat	double	standard_name	= northward_sea_water_velocity
			long_name	= monthly mean surface current north component
			units	= m/s
			_FillValue	= -9999
um	lon,lat	double	standard_name	= mean_eastward_sea_water_velocity
			long_name	= global mean surface current east component
			units	= m/s
			_FillValue	= -9999
vm	lon,lat	double	standard_name	= mean_northward_sea_water_velocity
			long_name	= monthly mean surface current north component
			units	= m/s
			_FillValue	= -9999
epsuu	time,lon,lat	double	standard_name	= u_autocovariance
			long_name	= local autocovariance of eastward velocity component
			units	= m^2/s^2
			_FillValue	= -9999
epsvv	time,lon,lat	double	standard_name	= v_autocovariance

Name	Size	Data Type	Attribute Name	Attribute Value
			long_name	= local autocovariance of northward velocity component
			units	= m^2/s^2
			_FillValue	= -9999
epsuv	time,lon,lat	double	standard_name	= U_V_covariance
			long_name	= trace of the time-mean of the local covariance, representing variability unresolved by the gridded field
			units	= m^2/s^2
			_FillValue	=-9999
eps2	lon,lat	double	standard_name	= subgridscale_variability
			long_name	= local covariance of northward and eastward velocity components
			units	= m^2/s^2
			_FillValue	= -9999

DATA
Variables continued

Name	Size	Data Type	Attribute Name	Attribute Value
count	time,N,lon,lat	double	standard_name	= number_observations_dataset
			long_name	= number of hourly observations of each source dataset (ExpName). Values 1-15 are the count of velocities from drifters from each of the 15 experiments that have not been flagged as having lost their drogues, while values 16-30 are for observation from drifters that have been flagged as having lost their drogue
total_count	time,lon,lat	double	standard_name	= number_observations
			long_name	= number of hourly observations of each source dataset (see ExpName). Values 1-15 are the count of velocities from drifters from each of the 15 experiments that have not been flagged as having lost their drogues, while values 16-30 are for observation from drifters that have been flagged as having lost their drogue