Seaglider data

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Seaglider

Seagliders are small, reusable, long-range autonomous underwater vehicles designed to glide from the ocean surface to as deep as 1000 m and back while collecting profiles of temperature, salinity, and other oceanic variables. Gliders steer through the water by controlling attitude (pitch and roll) and can thus navigate between waypoints to execute survey patterns. Typical horizontal speed is about 20 km per day. Mission durations depend largely on ambient stratification, profile depth, and instrument power, sometimes extending to nearly a year. Because the vehicles are relatively small and light, special handling gear is not required and field teams typically consist of one or, at most, two individuals. Standard sensor suites include pressure, temperature, and conductivity.

Seagliders surfaced at the end of every dive cycle, downloading new commands and uploading data to a base station located at the University of Washington via Iridium satellite telemetry. Initial processing is performed in near real-time. The different responses of temperature and conductivity sensors are accounted for and corrected through an analytical physical model (Charles Eriksen, personal communication; Morison et al., 1994; Lueck and Picklo, 1990) integrated into the base station.

A hydrodynamical flight model (Bennett et al., 2019) uses data from the glider's attitude sensors and from the environment to estimate glider speed through the water, and thus location during the dive. The hydrodynamical model provides an estimate of the horizontal distance travelled through water in an ocean at rest, which, when compared to the actual positions at the beginning and end of the dive, provides and good estimate of the depth-averaged current (or, more accurately, ocean current averaged along the underwater trajectory of the glider). Repeated GPS fixes obtained during the surface drift, before and after every call to the base station, provides an estimate of ocean surface velocity.

Data Description

Level 1 data

Gliders record samples on a non-uniform time (and depth) grid, on both the down (dive) and up (climb) portion of a complete dive. Different sensors can be sample at different intervals, adjustable with depth. In our typically processing, we generate time series data of all the sampled variables, in geophysical units. In our nomenclature, these are level 1 data.

Variables included in this file are (if available):

z : depth [m]

time : date in seconds for every sample point [seconds since 1970-1-1T00:00:00Z]

T : in-situ temperature [degree C]

S : salinity [psu]

lat : latitude of every sample point, from the flight model when underwater

lon : longitude of every sample point, from the flight model when underwater

dissolved_oxygen: Dissolved oxygen recalculated from phase with salinity and pressure corrections [micromole per kg]

wlbb2fl_sig470nm_adjusted: backscattering at 470 nm using manufacturer-supplied dark counts [m-1 sr-1]

wlbb2fl_sig700nm_adjusted : backscattering at 700 nm using manufacturer-supplied dark counts [m-1 sr-1]

wlbb2fl_sig695nm_adjusted : chlorophyll-a concentration using manufacturer-supplied dark counts and scaling factor based on phytoplankton monoculture [ug-1 L-1]

wlbb2fl_time: date in for every sample point of the wetlab [seconds since 1970-1-1T00:00:00Z]

aa4831_time: date in for every sample point of the optode [seconds since 1970-1-1T00:00:00Z]

dive : Dive number for observations

gps_start_time: Time of the GPS fix at the start of the dive [seconds since 1970-1-1T00:00:00Z]

gps_end_time: Time of the GPS fix at the end of the dive [seconds since 1970-1-1T00:00:00Z]

gps_start_lat: Latitude of GPS fix at start of the dive

gps_end_lat: Latitude of GPS fix at end of the dive

gps_start_lon: Longitude of GPS fix at start of the dive

gps_end_lon: Longitude of GPS fix at end of the divw

u_dive : depth-average current in the east direction from the flight model [m/s]

v_dive : depth-average current in the north direction from the flight model [m/s]

surface_curr_east : surface drift in the east direction from the time at surface [m/s]

surface_curr_north : surface drift in the north direction from the time at surface [m/s]

lat_dive : averaged latitude of the dive

lon_dive : averaged longitude of the dive

Level 2 data

Data on a regular grid are easier to interpret and analyze. Time series data are gridded on a regular depth and separated by profile in our level 2 data. Fill_Value is used if no observation is present in that depth bin.

Variables included in this file are (if available):

z : depth [m]

time : date in seconds for every sample point [seconds since 1970-1-1T00:00:00Z]

T : in-situ temperature [degree C]

S : salinity [psu]

speed : forward speed of the glider through the water from the flight model [m/s]

lat : latitude of every sample point, from the flight model when underwater

lon : longitude of every sample point, from the flight model when underwater

dissolved_oxygen: Dissolved oxygen recalculated from phase with salinity and pressure corrections [micromoles/kg]

wlbb2fl_sig470nm_adjusted: total volume blue scattering coefficient using manufacturer-supplied dark counts and scaling factor [meter^-1 steradian^-1]

wlbb2fl_sig700nm_adjusted: total volume red scattering coefficient using manufacturer-supplied dark counts and scaling factor [meter^-1 steradian^-1]

wlbb2fl_sig695nm_adjusted: chlorophyll-a concentration using manufacturer-supplied dark counts and scaling factor based on phytoplankton monoculture [microgram/liter]

N_time : number of time observations in the bin

N_T : number of temperature observations in the bin

N_S : number of salinity observations in the bin

N_disssolved_oxygen: number of observations in the bin

N_wlbb2fl_sig470nm_adjusted: number of observations in the bin

N_wlbb2fl_sig700nm_adjusted: number of observations in the bin

N_wlbb2fl_sig695nm_adjusted: number of observations in the bin

dive : dive number

time_gps: Time of the GPS fix at start/end of the dive [seconds since 1970-1-1T00:00:00Z]

lat_gps: Latitude from GPS fix at start/end of the dive

lon_gps: Longitude from GPS fix at start/end of the dive

time_profile: Time of the 1/4 or 3/4 position between the starting and ending GPS position [seconds since 1970-1-1 00:00:00]

lat_profile: Latitude for the 1/4 or 3/4 position between the starting and ending GPS position

lon_profile: Longitude for the 1/4 or 3/4 position between the starting and ending GPS position

u_dive : depth-average current in the east direction from the flight model [m/s]

v_dive : depth-average current in the north direction from the flight model [m/s]

surface_curr_east : surface drift in the east direction from the time at surface [m/s]

surface_curr_north : surface drift in the north direction from the time at surface [m/s]

lat_dive : averaged latitude of the dive

lon_dive : averaged longitude of the dive

time_profile : Time of the 1/4 or 3/4 position between the starting and ending GPS position

lat_profile : Longitude for the 1/4 or 3/4 position between the starting and ending GPS position [seconds since 1970-1-1T00:00:00Z]

lon_profile : Latitude for the 1/4 or 3/4 position between the starting and ending GPS position

Level 3 data

Level 3 data is an interpolated version of Level 2 data, with the additional step of "despiking", where we remove data that are more than 2 standard deviations for a running mean. This is our best estimate to produce pretty figures.

Variables included in this file are (if available)::

z : depth [m]

time : date in seconds for every sample point [seconds since 1970-1-1T00:00:00Z]

T :corrected in-situ temperature with outliers removed, interpolated over gaps < 50 m [deg C]

S : corrected salinity with outliers removed, interpolated over gaps < 50 m [psu]

dissolved_oxygen: Dissolved oxygen recalculated from phase with salinity and pressure corrections interpolated over gaps < 50.0m [micromoles/kg]

wlbb2fl_sig470nm_adjusted: total volume blue scattering coefficient using manufacturer-supplied dark counts and scaling factor interpolated over gaps < 50.0m [meter^-1 steradian^-1]

wlbb2fl_sig700nm_adjusted: total volume red scattering coefficient using manufacturer-supplied dark counts and scaling factor interpolated over gaps < 50.0m [meter^-1 steradian^-1]

wlbb2fl_sig695nm_adjusted: chlorophyll-a concentration using manufacturer-supplied dark counts and scaling factor based on phytoplankton monoculture interpolated over gaps < 50.0m [microgram/liter]

speed : forward speed of the glider through the water from the flight model [m/s]

lat : latitude of every sample point, from the flight model when underwater

lon : longitude of every sample point, from the flight model when underwater

S_ref : low-pass filtered salinity, 3.0 days and 10 m

S_rms_ref : rms of salinity within smoothing window (high-freq variance). Despiker removes data more than 3 deviations for mean

T_ref : low-pass filtered temperature, 3.0 days and 10 m

T_rms_ref : rms of temperature within smoothing window (high-freq variance). Despiker removes data more than 3 deviations for mean

dissolved_oxygen_ref: low-pass filtered dissolved_oxygen, 3.0 days and 10.0 m

dissolved_oxygen_rms_ref: rms of dissolved_oxygen within smoothing window (high-freq variance). Despiker removes data more than 3.0 deviations for mean

wlbb2fl_sig470nm_adjusted_ref: low-pass filtered wlbb2fl_sig470nm_adjusted, 3.0 days and 10.0 m

wlbb2fl_sig470nm_adjusted_rms_ref: rms of wlbb2fl_sig470nm_adjusted within smoothing window (high-freq variance). Despiker removes data more than 3.0 deviations for mean

wlbb2fl_sig700nm_adjusted_ref: low-pass filtered wlbb2fl_sig700nm_adjusted, 3.0 days and 10.0 m

wlbb2fl_sig700nm_adjusted_rms_ref: rms of wlbb2fl_sig700nm_adjusted within smoothing window (high-freq variance). Despiker removes data more than 3.0 deviations for mean

wlbb2fl_sig695nm_adjusted_ref: low-pass filtered wlbb2fl_sig950nm_adjusted, 3.0 days and 10.0 m

wlbb2fl_sig695nm_adjusted_rms_ref: rms of wlbb2fl_sig695nm_adjusted within smoothing window (high-freq variance). Despiker removes data more than 3.0 deviations for mean

S_L2 : level-2 salinity [psu]

T_L2: level-2 temperature [deg C]

aanderaa4831_dissolved_oxygen_L2: level 2 disolved_oxygen (no despiker, not interpolated), recalculated from phase with salinity and pressure corrections

wlbb2fl_sig470nm_adjusted_L2: level 2 wlbb2fl_sig470nm_adjusted (no despiker, not interpolated)

wlbb2fl_sig700nm_adjusted_L2: level 2 wlbb2fl_sig700nm_adjusted (no despiker, not interpolated)

wlbb2fl_sig695nm_adjusted_L2: level 2 wlbb2fl_sig695nm_adjusted (no despiker, not interpolated)

T_flags : qc flag for temperature: 0 no data (interpolated), 1 outside despiker, 2 is good

S_flags : qc flag for salinity: 0 no data (interpolated), 1 outside despiker, 2 is good

dissolved_oxygen_flags: qc flag for dissolved_oxygen: 0 no data (interpolated), 1 outside despiker, 2 is good

wlbb2fl_sig470nm_adjusted_flags: qc flag for wlbb2fl_sig470nm_adjusted: 0 no data (interpolated), 1 outside despiker, 2 is good

wlbb2fl_sig700nm_adjusted_flags: qc flag for wlbb2fl_sig700nm_adjusted: 0 no data (interpolated), 1 outside despiker, 2 is good

wlbb2fl_sig695nm_adjusted_flags: qc flag for wlbb2fl_sig695nm_adjusted: 0 no data (interpolated), 1 outside despiker, 2 is good

P : pressure [dBar]

SA : Absolute Salinity [g/kg]

CT : Conservative Temperature (ITS-90) [deg C]

PD : Potential density [kg/m3]

dive : dive number

time_profile: Time of the 1/4 or 3/4 position between the starting and ending GPS position [seconds since 1970-1-1T00:00:00Z]

lat_profile: Latitude for the 1/4 or 3/4 position between the starting and ending GPS position

lon_profile: Longitude for the 1/4 or 3/4 position between the starting and ending GPS position

u_dive : depth-average current in the east direction from the flight model [m/s]

v_dive : depth-average current in the north direction from the flight model [m/s]

surface_curr_east : surface drift in the east direction from the time at surface [m/s]

surface_curr_north : surface drift in the north direction from the time at surface [m/s]

lat_dive : averaged latitude of the dive

lon_dive : averaged longitude of the dive

time_profile : Time of the 1/4 or 3/4 position between the starting and ending GPS position

lat_profile : Longitude for the 1/4 or 3/4 position between the starting and ending GPS position [seconds since 1970-1-1T00:00:00Z]

lon_profile : Latitude for the 1/4 or 3/4 position between the starting and ending GPS position

time_gps: Time of the GPS fix at start/end of the dive [seconds since 1970-1-1T00:00:00Z]

lat_gps: Latitude from GPS fix at start/end of the dive

lon_gps: Longitude from GPS fix at start/end of the dive

References

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