Data associated with Hughes and Moum (2024): Imaging thermocline microstructure in 2D with swaths traced by wave-pumped χpods

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Dataset summary

Location: 0°N, 140°W
Depth: 120 m
Period: 16-Sep-2014 to 19-Oct-2015

This data archive contains two types of data files:
`data_yymmdd.mat`
`grid_yymmdd.mat`
Each file contains 24 hours of data. There are 394 of each type.

Arrays in `data_yymmdd.mat` are single precision (except the `time` array) to keep file sizes small.

Contents of the data files

Each Matlab file contains a single struct. These structs include readmes, which are reproduced on the pages 2 and 3.

Files are grouped into months and zipped to ease downloading.

Reading the data file with Python

Example code to read the files into Python as dictionaries is given on page 4.

Matlab code to produce the processed data

The code to read in raw chipod data and process them is primarily contained in the file `swaths_paper_data_preparation.m`. This file calls three other files (`raw_load_chipod.m`, `deglitch.m`, and `bin.m`). All of these files are provided for completeness, but we are only archiving the processed outputs (not the raw voltage signals). Please email if more information is needed.

Matlab code for the convolutional neural network

See `chipod_swaths_convolutional_neural_network.m`.

Readmes

grid_yymmdd.mat

```
Gridded (swath) data from a 120m-deep chipod at 0, 140W (central equatorial Pacific).
The 'grid' struct contains the following variables:

  t (decimal days)       (1 x 8640)     : Center of the time grid, UTC, Matlab format
  z (m)                  (200 x 1)      : Center of the vertical grid
  tp1 (decimal days)     (1 x 8641)     : Edges of the time grid, UTC, Matlab format
  zp1 (m)                (200 x 1)      : Edges of the vertical grid
  dt (decimal days)      (1)            : 1.1574e-04 (=10s/86400s)
  dz (m)                 (1)            : 0.02
  T (deg C)              (200 x 8640)   : Temperature
  Tz (deg C/m)           (200 x 8640)   : Vertical temperature gradient
  log_chi (K^2/s)        (200 x 8640)   : Dissipation rate of temperature variance
  log_eps (W/kg)         (200 x 8640)   : Dissipation rate of turbulence kinetic
                                          energy
  zref (m)               (1 x 8640)     : Vertical position of an isotherm
                                          calculated from the swath
  t_10min (decimal days) (1 x 144)      : Center of a 10-minute time grid
  Reb_10min (-)          (1 x 144)      : Buoyancy Reynolds number - eps/(nu N^2)
  LO_10min (m)           (1 x 144)      : Ozmidov length scale - sqrt(eps/N^3)
  eps_10min (W/kg)       (1 x 144)      :
  chi_10min (W/kg)       (1 x 144)      :

Processed by Ken Hughes with his script
/home/hugke729/osu/data/swaths_paper/scripts/swaths_paper_data_preparation.m

Notes:
Data come from either
  chipod #712 on the TA014 deployment (< March 22, 2015)
  chipod #730 on the TA015 deployment (> March 23, 2015)
The differentiated temperature signal on T2 for Chipod 712 was faulty.
Hence, there are no log_chi, log_eps, and 10min turbulence values are calculated
from only the upper thermistor for datasets prior to March 22, 2015.'
```

data_yymmdd.mat

```
Calibrated data from a 120m-deep chipod at 0, 140W (central equatorial Pacific).
The 'data' struct contains the following variables:
(All variables are 4,320,000 x 1; i.e., 50Hz data for 24 hours)

  time (decimal days) : UTC, Matlab format
  T1 (deg C)          : Temperature from the upper thermistor (lowpassed 2Hz)
  T2 (deg C)          : Temperature from the lower thermistor (lowpassed 2Hz)
  depth (m):          : Depth (inferred; lowpassed 2Hz; see Notes)
  Tz1 (deg C/m)       : Vertical temperature gradient calculated with T1 and depth
  Tz2 (deg C/m)       : Vertical temperature gradient calculated with T2 and depth
  zref (m)            : Vertical position of an isotherm calculated from the
                        associated swath

Processed by Ken Hughes with his script
/home/hugke729/osu/data/swaths_paper/scripts/swaths_paper_data_preparation.m

Notes:
The pressure sensor during this deployment had a low-frequency drift.
This drift was removed from "depth" by highpass filtering the initial
depth signal (600-s cutoff) and adding back a nominal mean depth of 120m.

Data come from either
  chipod #712 on the TA014 deployment (< March 22, 2015)
  chipod #730 on the TA015 deployment (> March 23, 2015)
```

Python code to read processed files

```
from numpy import squeeze
from hdf5storage import loadmat

date_str = '141001'

grid_filename =  'grid_' + date_str + '.mat'
data_filename =  'data_' + date_str + '.mat'

gmat = loadmat(grid_filename)
dmat = loadmat(data_filename)

data = dict()
for quantity in dmat['data'].dtype.names:
    data[quantity] = squeeze(dmat['data'][quantity][0][0])

grid = dict()
for quantity in gmat['grid'].dtype.names:
    grid[quantity] = squeeze(gmat['grid'][quantity][0][0])
```