Data associated with Hughes et al. (2021)

Stratified shear instabilities in diurnal warm layers

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There are three types of dataset included here:

1. Observations from SurfOtter
2. Output of the linear stability analysis
3. Output from the simulated day

Each will be described in turn on the following pages.

Most outputs are Matlab `.mat` files. If using Python, these can be read as

```
from hdf5storage import loadmat
loadmat(<matfile>)
```

1. SurfOtter observations

The naming convention for the three days discussed in the paper differs between the paper and the datasets. The following are equivalent:

Date	Name in paper	Dataset name
Sep 10	mixed	DWL1_ ...
Sep 22	moderate	DWL2_ ...
Sep 23	calm	DWL3_ ...

For each day, there are three types of file. All span 05:30 local time until 02:30 the following day, and all contain a readme with complete details. Here we provide a brief description. The following page shows a schematic of SurfOtter.

Temperature, salinity, position, and meteorology

The files `DWL[1,2,3]_T_S_fields_2s.mat` contain the struct `otter`. Within this are all of the directly measured water properties and derived properties such as temperature gradient. These are saved at 2s as the filename implies.

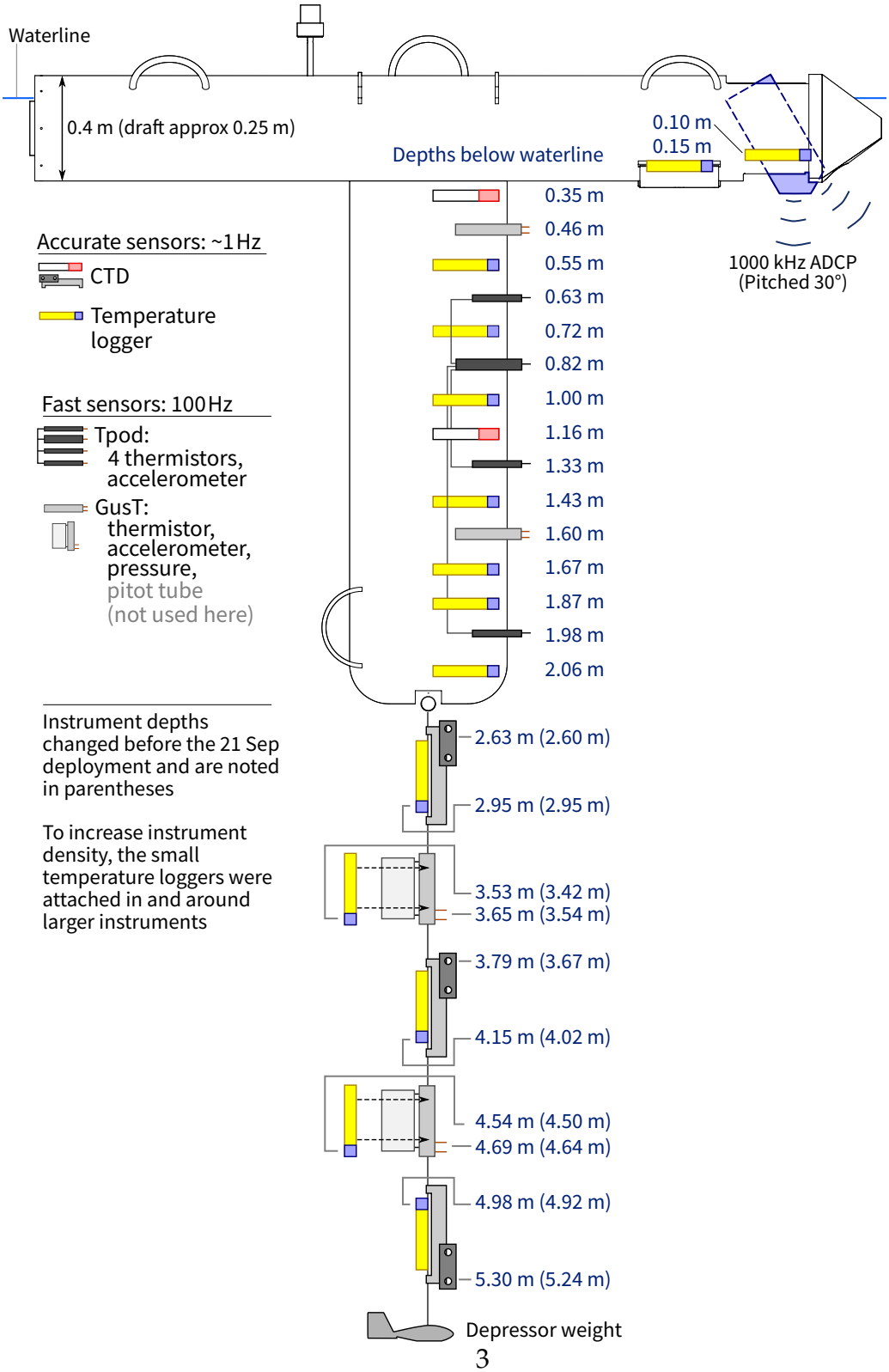
Winds and heat fluxes are recorded in the substruct `otter.met`.

Velocities

The files `DWL[1,2,3]_velocities.mat` contain the struct `sv` (named for the Sentinel V ADCP). Within this are 1-minute averaged velocities in both (east, north) coordinates and (along-wind, down-wind) coordinates. A substruct `sv.sp` contains 10-minute averages with spline smoothing (hence the `sp`). This also contains the various quantities associated with shear.

Turbulence

The files `DWL[1,2,3]_turbulence.mat` contain the struct `turb`. Within this are 10-minute values of turbulent quantities at 6 or 8 depths depending on how many fast thermistors worked for a given deployment.


Waterline
0.4 m (draft approx 0.25 m)
Depths below waterline
0.10 m
0.15 m
1000 kHz ADCP
(Pitched 30°)
Accurate sensors: ~1 Hz
CTD
Temperature logger
Fast sensors: 100 Hz
Tpod:
4 thermistors, accelerometer
GusT:
thermistor, accelerometer, pressure, pitot tube (not used here)
Instrument depths changed before the 21 Sep deployment and are noted in parentheses
To increase instrument density, the small temperature loggers were attached in and around larger instruments
0.35 m
0.46 m
0.55 m
0.63 m
0.72 m
0.82 m
1.00 m
1.16 m
1.33 m
1.43 m
1.60 m
1.67 m
1.87 m
1.98 m
2.06 m
2.63 m (2.60 m)
2.95 m (2.95 m)
3.53 m (3.42 m)
3.65 m (3.54 m)
3.79 m (3.67 m)
4.15 m (4.02 m)
4.54 m (4.50 m)
4.69 m (4.64 m)
4.98 m (4.92 m)
5.30 m (5.24 m)
Depressor weight

2. Linear stability analysis (LSA)

LSA was undertaken for two different reasons in this paper

1. Using the 14:00–15:00 profiles with a variable vertical shift (`lsa_22sep_downshifting.mat`)
2. For profiles throughout the moderate day (`lsa_22sep_results.mat`)

Note that these are not saved as structs. If using Matlab, consider loading these into a struct, say `lsa`, by using

```
lsa = load(<lsa_filename>)
```

3. Simulated day

Simulations were undertaken with checkpoint 67g of the MITgcm.

The `code` directory contains code modified specifically for our simulation. The `run.ideal.ML_60m` contains the inputs and outputs. The files of most interest will be two netCDF files `fields.0000000000.t00[1,2].nc`.

Note that the PP81 package was used here in the sense that we modified it to implement our own ad hoc convective mixing parameterization.