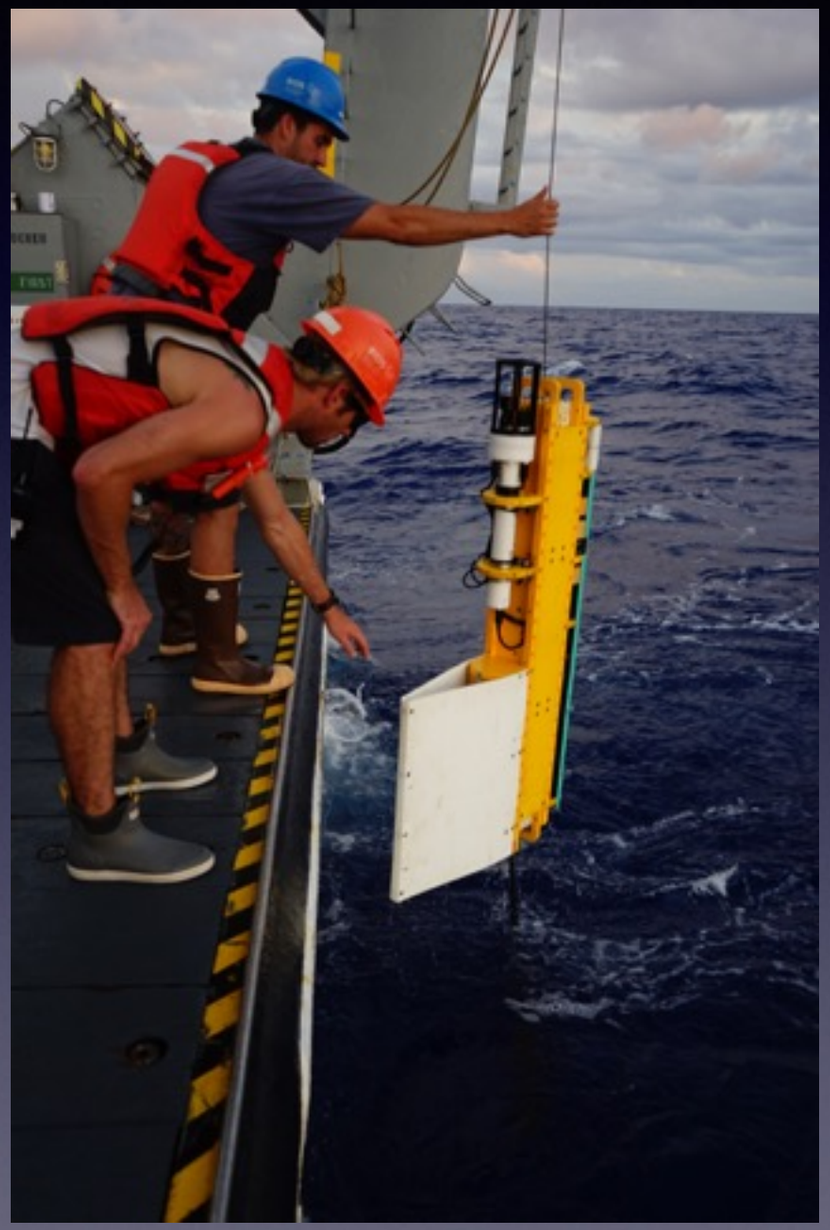
WireWalker data processing

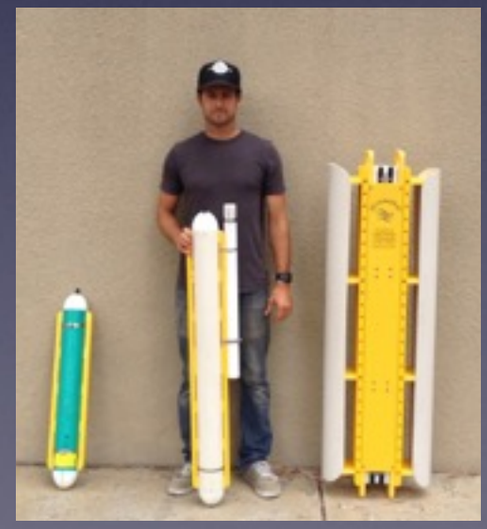
Wirewalker Operations



Recovering the Wirewalker profiler from the fantail of the Aquarius Test Research Vessel.

- The Wirewalker system uses energy from ocean surface waves to drive a profiling body vertically.
- Rapid profiling at zero energy cost.
- Battery power conserved for onboard instrumentation.
- Large field-modifiable payload, indefinite profiling, low cost, simple and robust mechanical design.
- >400K cycles and ~20,000 km of Wirewalker profiles in the global ocean in the past 10 years.

Low-cost, flexible, easily deployable instrument platform



A range of sizes for a range of operational goals

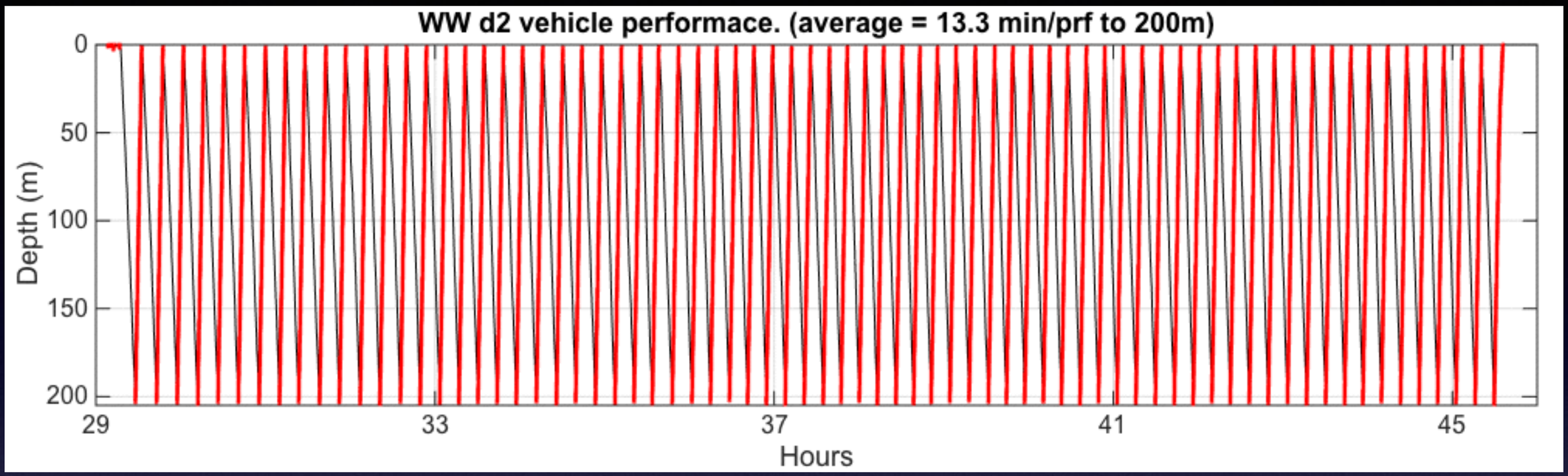
Instruments :

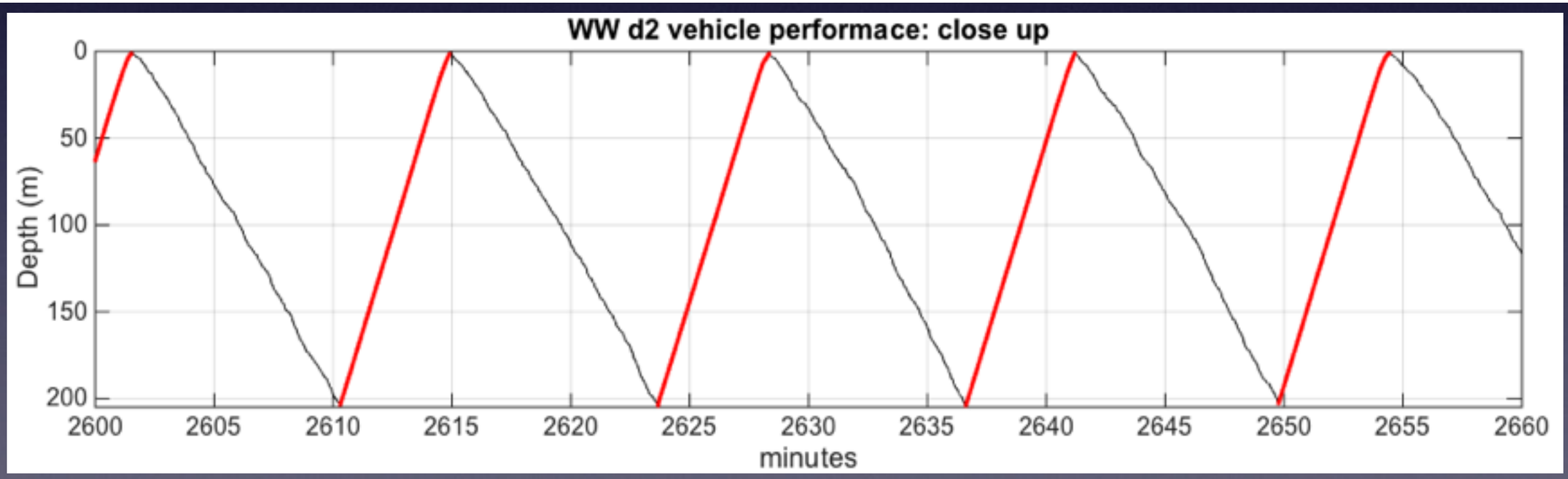
CTD (rbr) :
Conductivity
Temperature
Pressure
Dissolved O
Backscatter
Chlorophyll
Phycoerythrin
Sea pressure
Depth
Salinity
…

Aquadop (Nortek):
Pressure
Beam velocities
Beam correlation
Beam amplitude
Magnetometer
Accelerometer
Heading
Pitch
Roll
…

NB: fields changes with instrument versions

At sea: measurements





4-6’ wind waves, confused seas = ideal WW profiling conditions. This is close to optimal performance for the system. (red is upcast, buoyancy driven and decoupled from wave field allows for high quality data collection). During deploy. **2, roundtrip to 200m in ~13.3 minutes**.

<u>Data storage</u>:
User should define variable root_data
path to store aquadopp (aqd) and ctd (rbr) data

root_data/Cruise_name / WW / WW_name / deployment

Exemple

root_data='/Users/aleboyer/ARNAUD/SCRIPPS/WireWalker/'
Cruise_name='quipp';
WW_name='quipp';
deployment='d1';

```
aleboyer@alb-workbook:~/ARNAUD/SCRIPPS/WireWalker/quipp/WW/quipp/d1$ ls
aqd rbr rt
```

Matlab Processing: download Github repository

URL of the github repository

https://github.com/modscripps/Wirewalker.git

User should define variable root_script . Path to downloaded repository

root_script='/Users/aleboyer/Desktop/Wirewalker-master/'

Aquadopp raw to mat files: MIDAS

Github repo: *NortekMIDAS_V1.33_R3312_16-04-01-15.zip*

Watch out: Midas is a windows software

User have to do minor changes in MIDAS

Program Files > Nortek > Nortek MIDAS > NortekMIDAS.l4j
change -Xmx2048M, -Xmx4000M, or -Xmx10000M instead of -Xmx1024M.

Program Files > Nortek > Nortek MIDAS
add MatlabExpansion Factor

Midas transform “file.ad2cp” in matlab files (“file.mat”)

Matlab Processing: main.m

Variable exemple

root_data ='/Users/aleboyer/ARNAUD/SCRIPPS/WireWalker/';
root_script = '/Users/aleboyer/Desktop/Wirewalker-master/';
Cruise_name ='quipp';
WW_name ='quipp';
deployment ='d1';
name ='quipp'; %name used for the final product and output files

main.m calls :

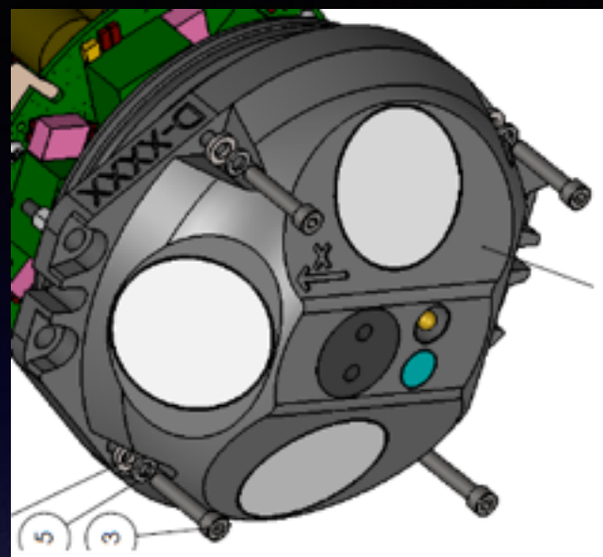
prelim_proc_aqdII_interp_prh: pre-process aquadopp data

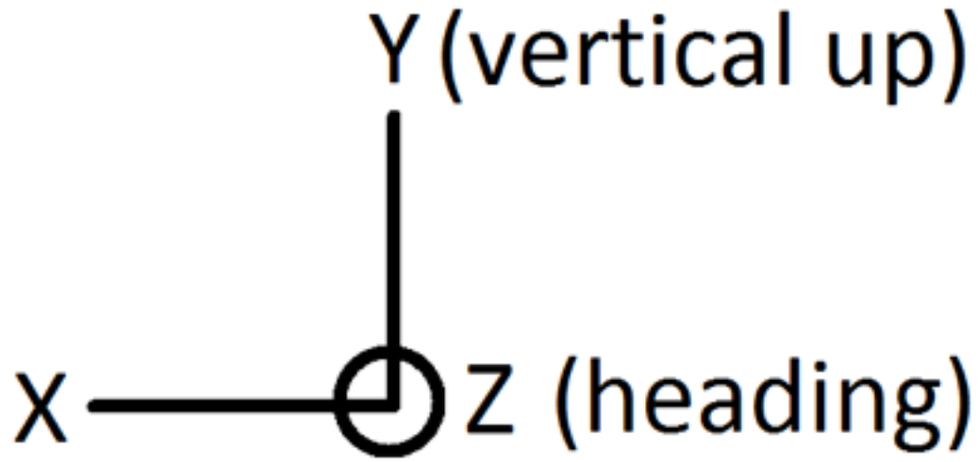
process_WW: process RBR data and project RBR and aquadopp data on the same grid (vertical grid defined by user)

wavelet_filter_v3: attempt to remove surface wave signature from the signal

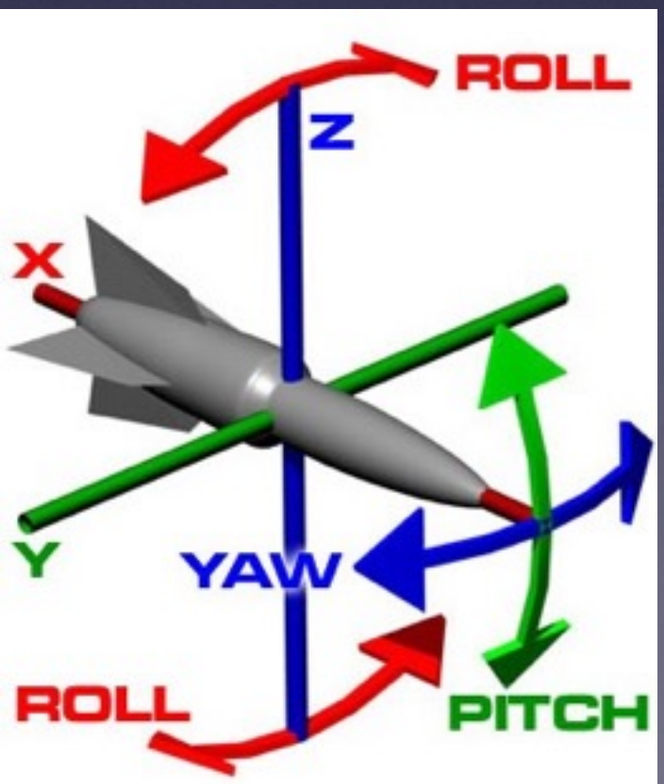
prelim_proc_aqdII_interp_prh: pre-process aquadopp data

From beam velocities to XYZ velocities,
Beam Velocity * Aqd matrix = XYZ velocities






```
Aqd_matrix = [    0.6782     0          -0.6782     0;      ...
                 -0.2644    -0.3546     -0.2644    -0.3546;...
                  0          1.1831     0          -1.1831 ...
];
```



From XYZ velocities to ENU velocities
XYZ velocities * [Heading, Pitch, Roll]= ENU velocities

Heading Pitch and Roll from accelerometer and Magnetometer

(ENU: East, North, Up= Earth coordinate)

process_WW: process RBR data and project RBR and aquadopp data on the same grid

- User is asked to define the vertical grid (zgrid), by default zgrid= 0:.25:110
- Upcasts are identified in the routine (get_upcast.m)
- The time grid is defined by the time average of the upcast
- RBR data is projected on the grid (make_standard_profilesRBR.m)

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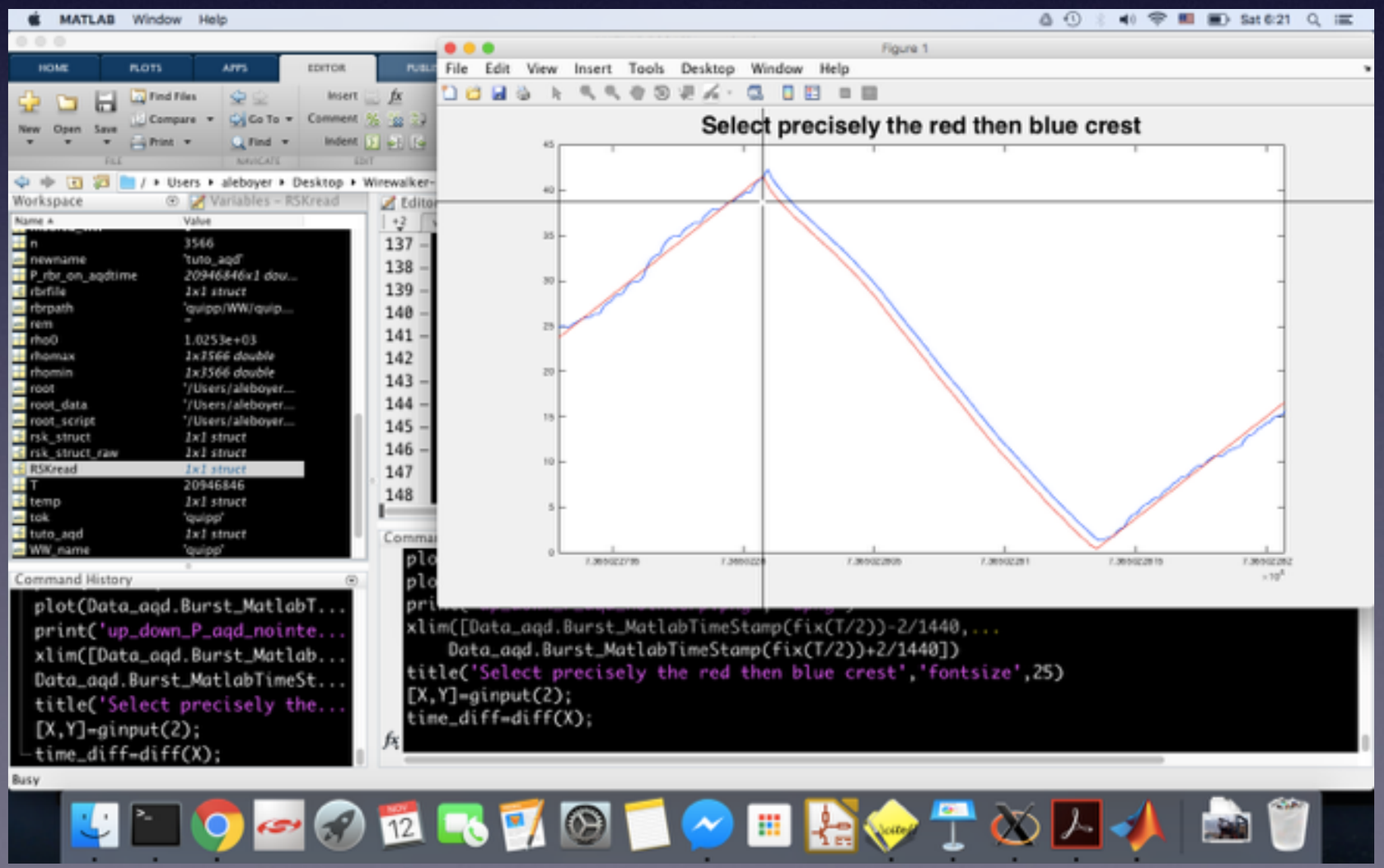
- Check if RBR and aquadopp times are similar (defined by user on the plot below)



process_WW: process RBR data and project RBR and aquadopp data on the same grid

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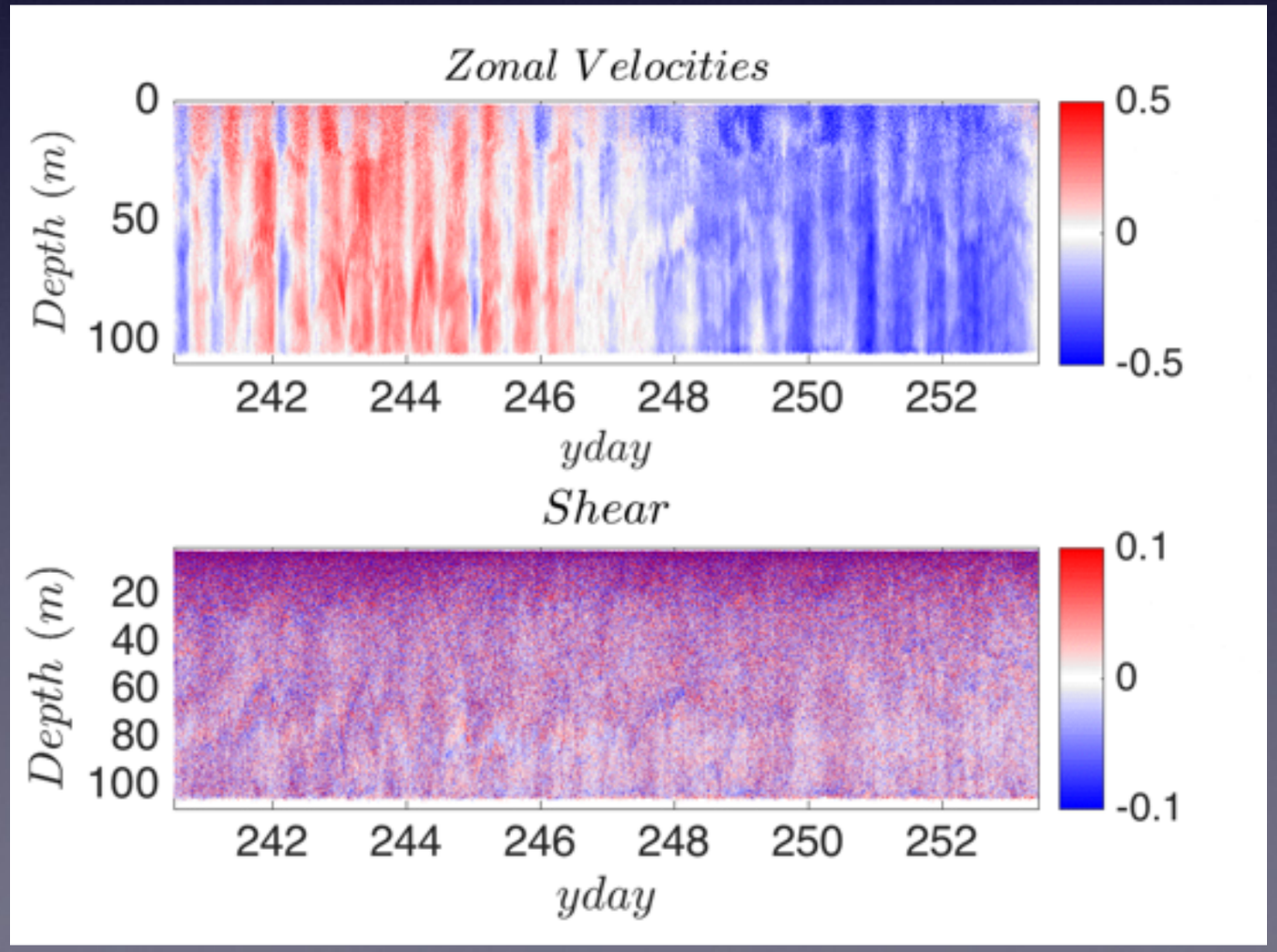
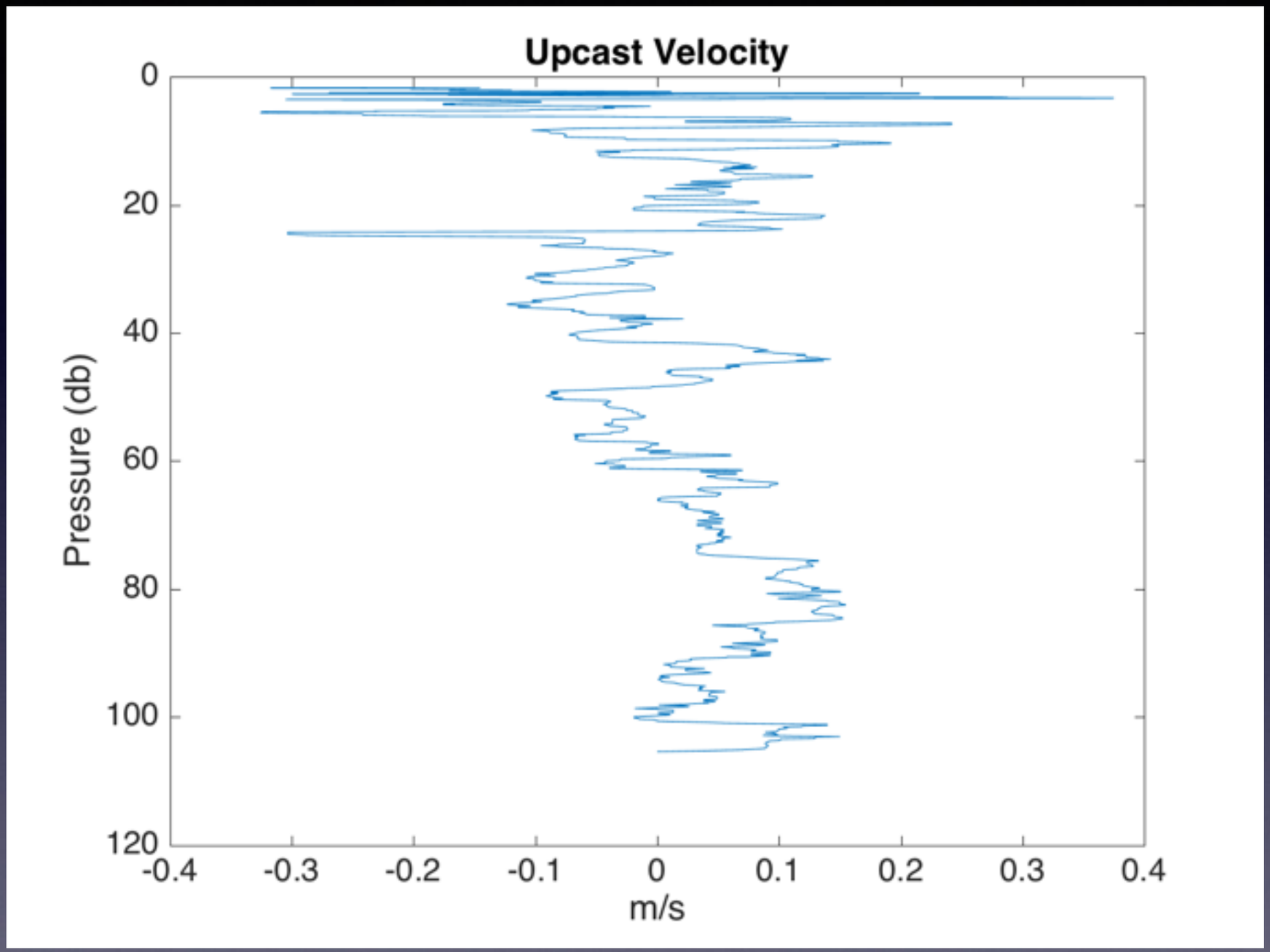
- Upcasts are identified in the routine (get_upcast.m)
- The time grid is defined by the time average of the upcast
- RBR data is projected on the grid (make_standard_profilesRBR.m)
- Check if RBR and aquadopp times are similar (defined by user on the plot below)
- Project aquadopp data on RBR time
- Project aquadopp data on the time-vertical grid (make_standard_profiles_AQDII)

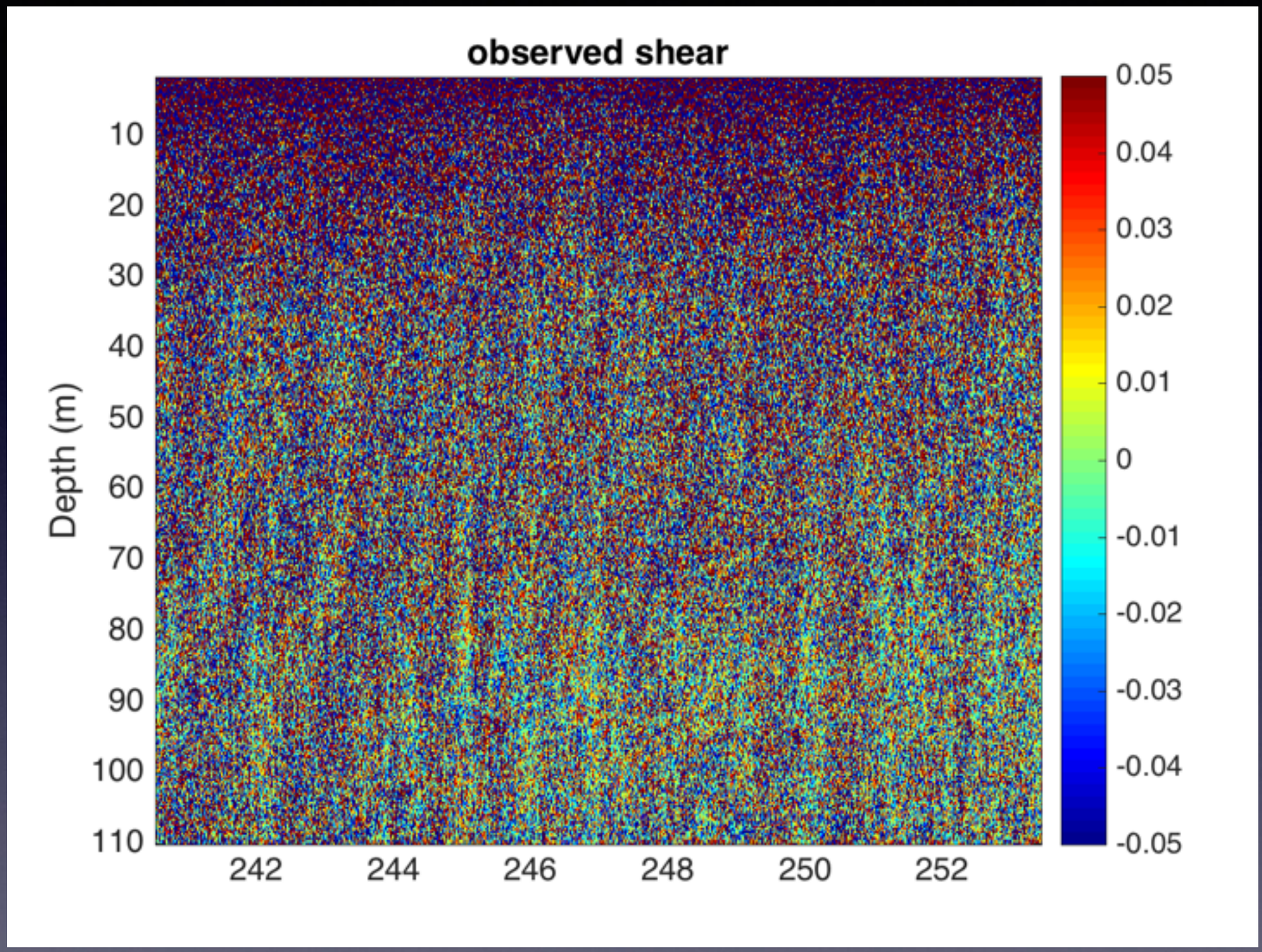


wavelet_filter_v3: attempt to remove surface wave signature from the signal



At the surface oscillations driven by the motion of the buoy,

-> surface wave signature



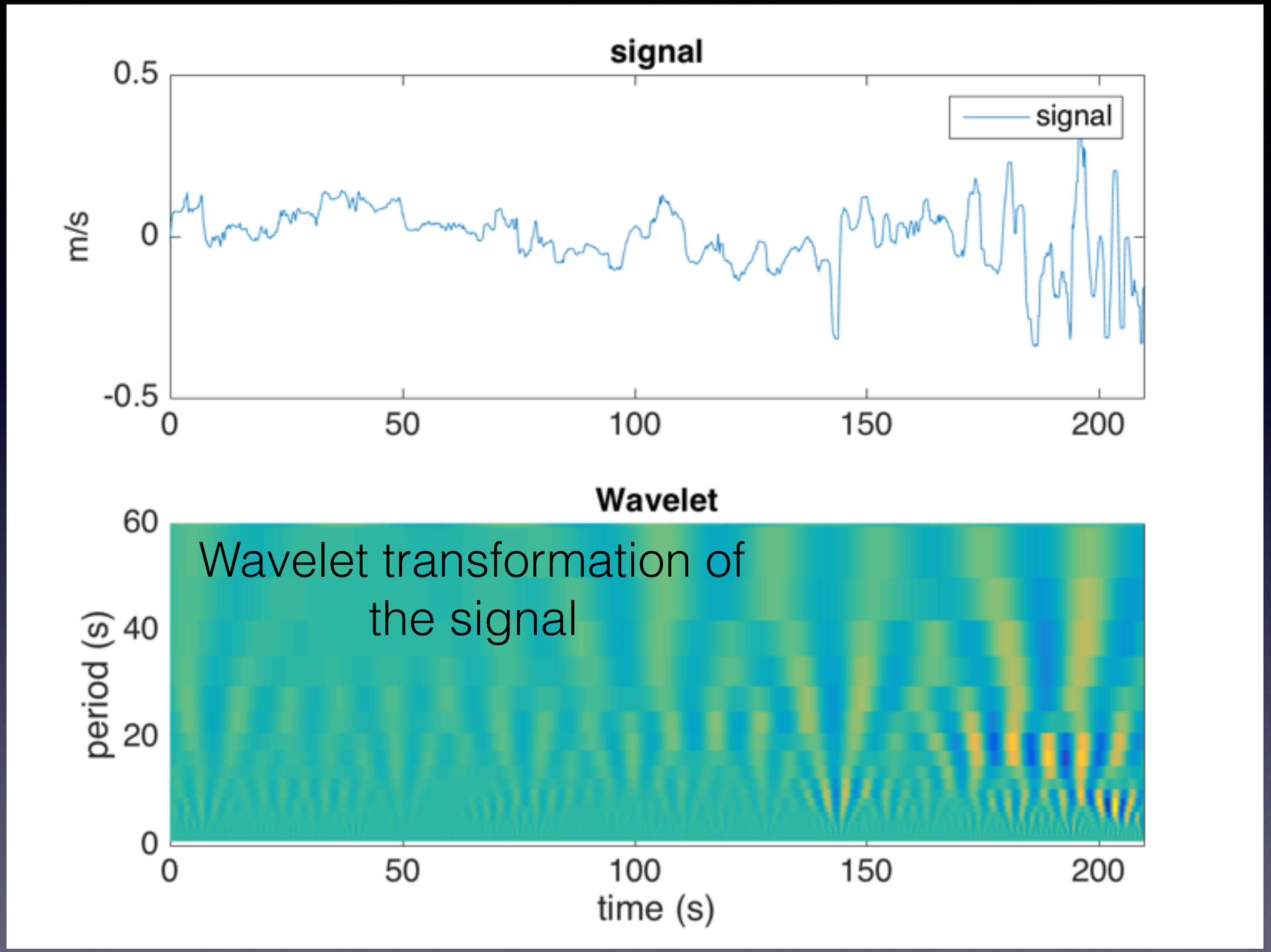
Very noisy signal

Filtering process: 2 options

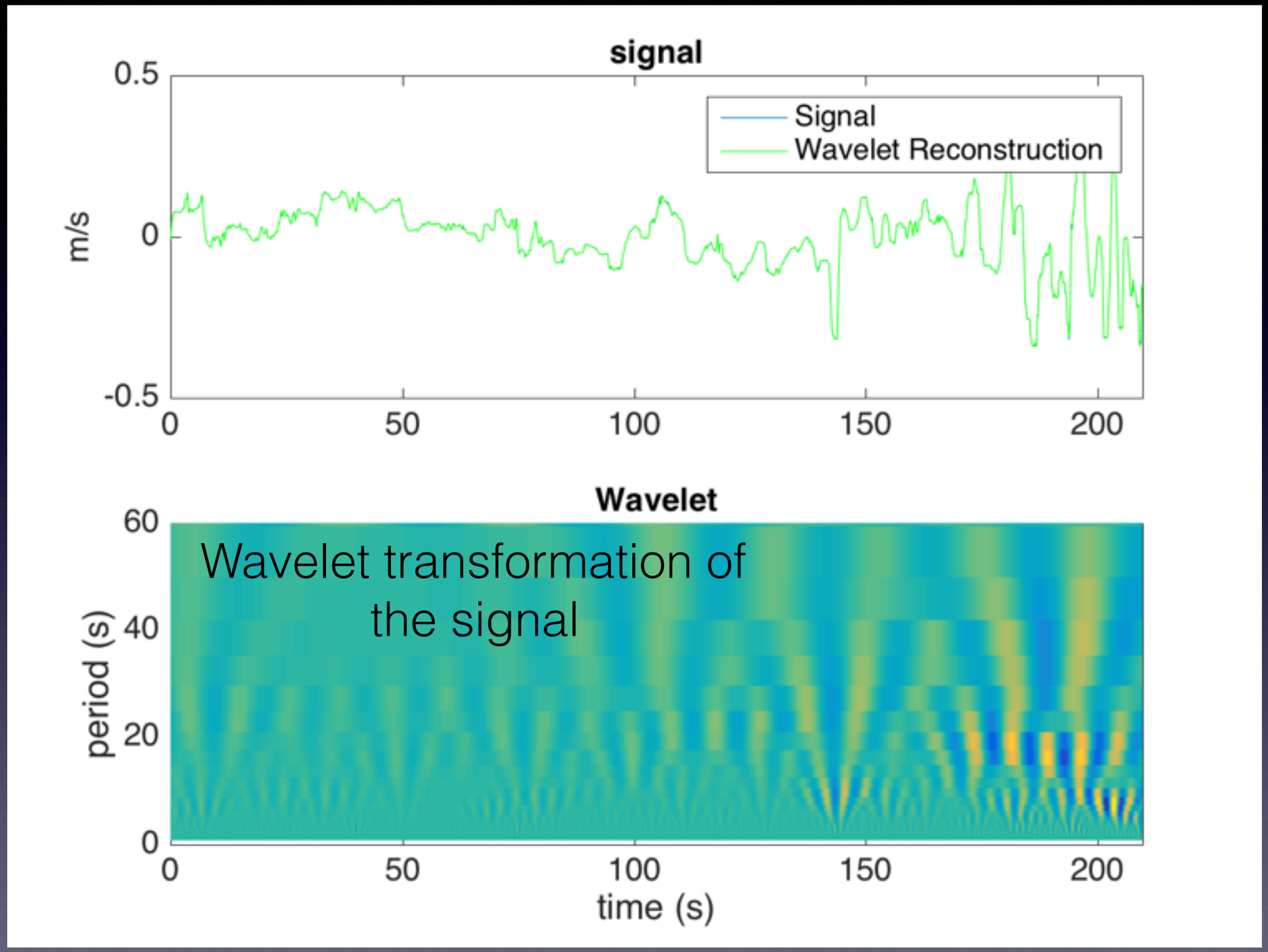
- Grid upcasts and filter high frequency

- Filter the upcasts and grid upcast

Filter the Upcasts



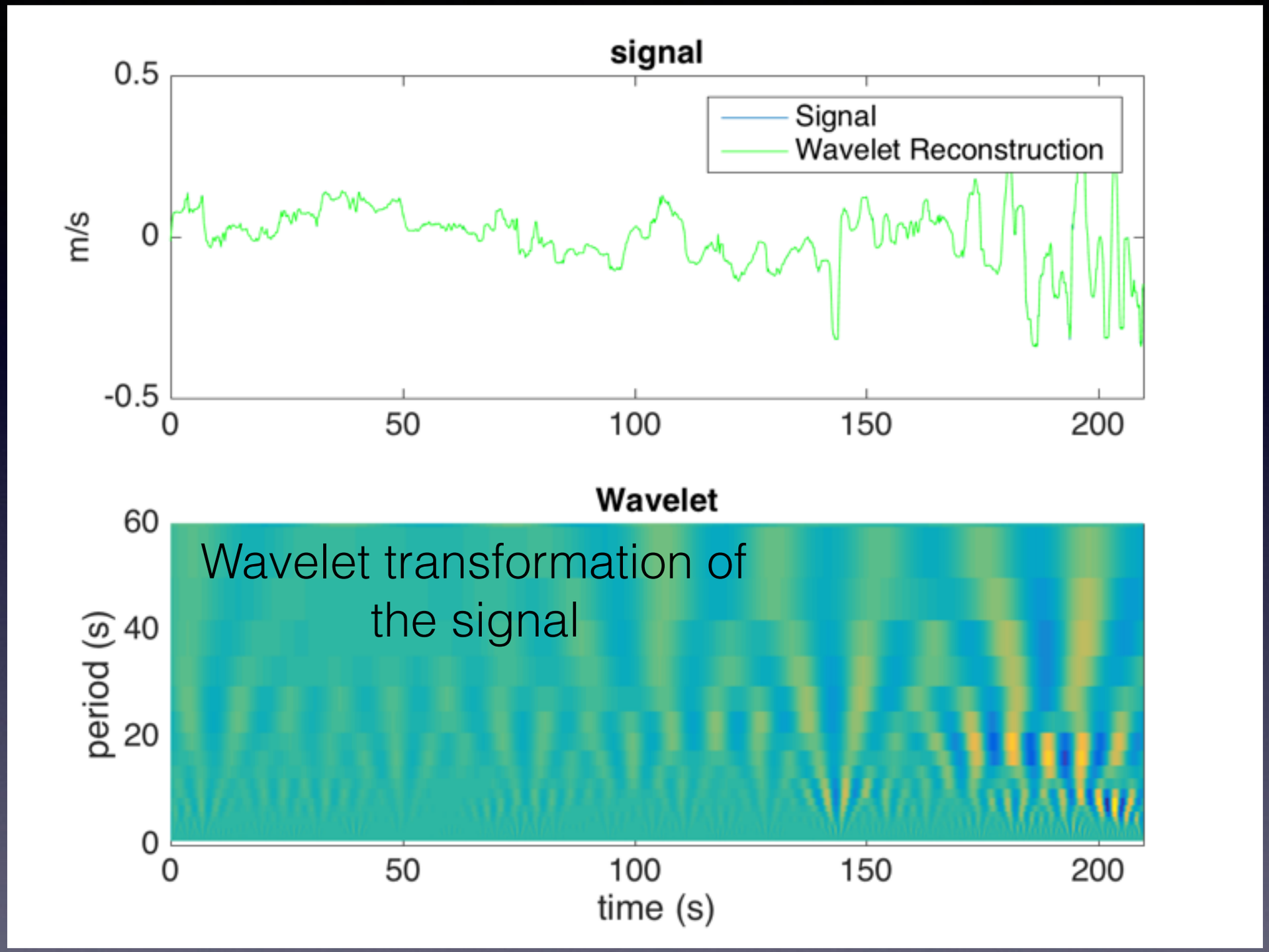
Filter the Upcasts



Wavelet Reconstruction of the signal is accurate

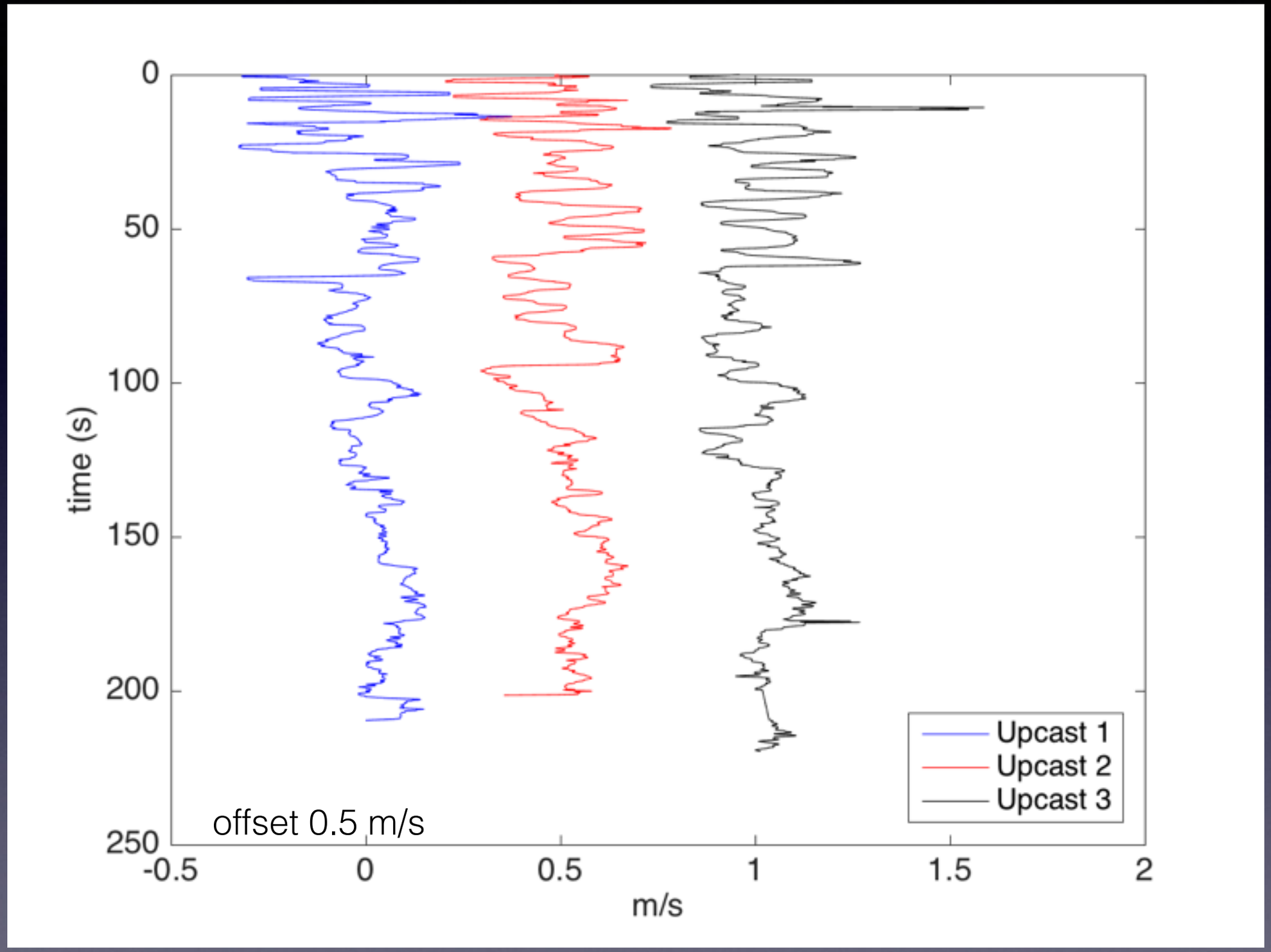
time - period domain allow an accurate filtering of the signal

Filter the Upcasts



Strong high frequency signal → Surface wave signal

Filter the Upcasts



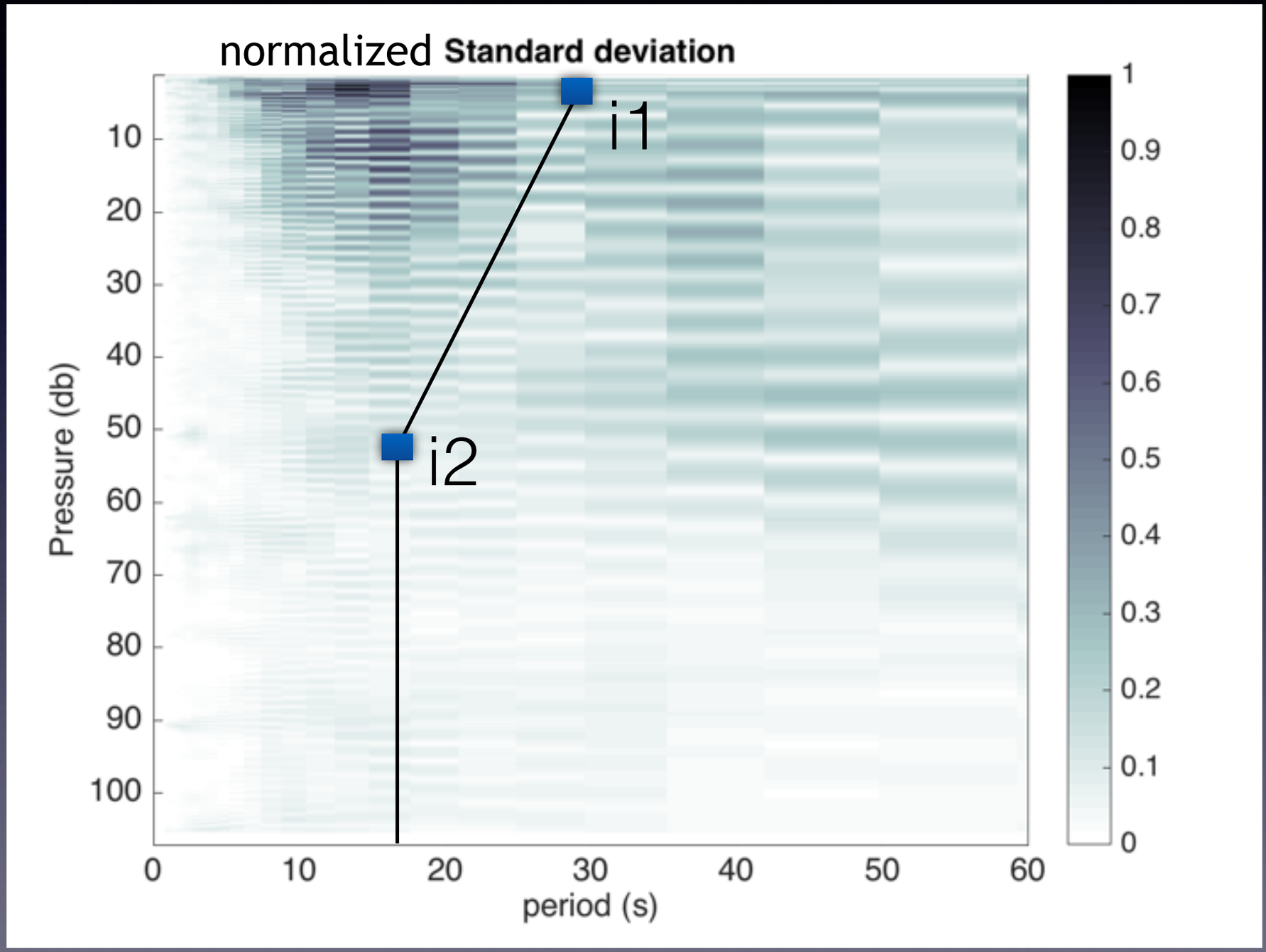
Wavelet transform of different upcasts gives the time-period areas with high variability= likely to be the surface wave signal

Filter the Upcasts

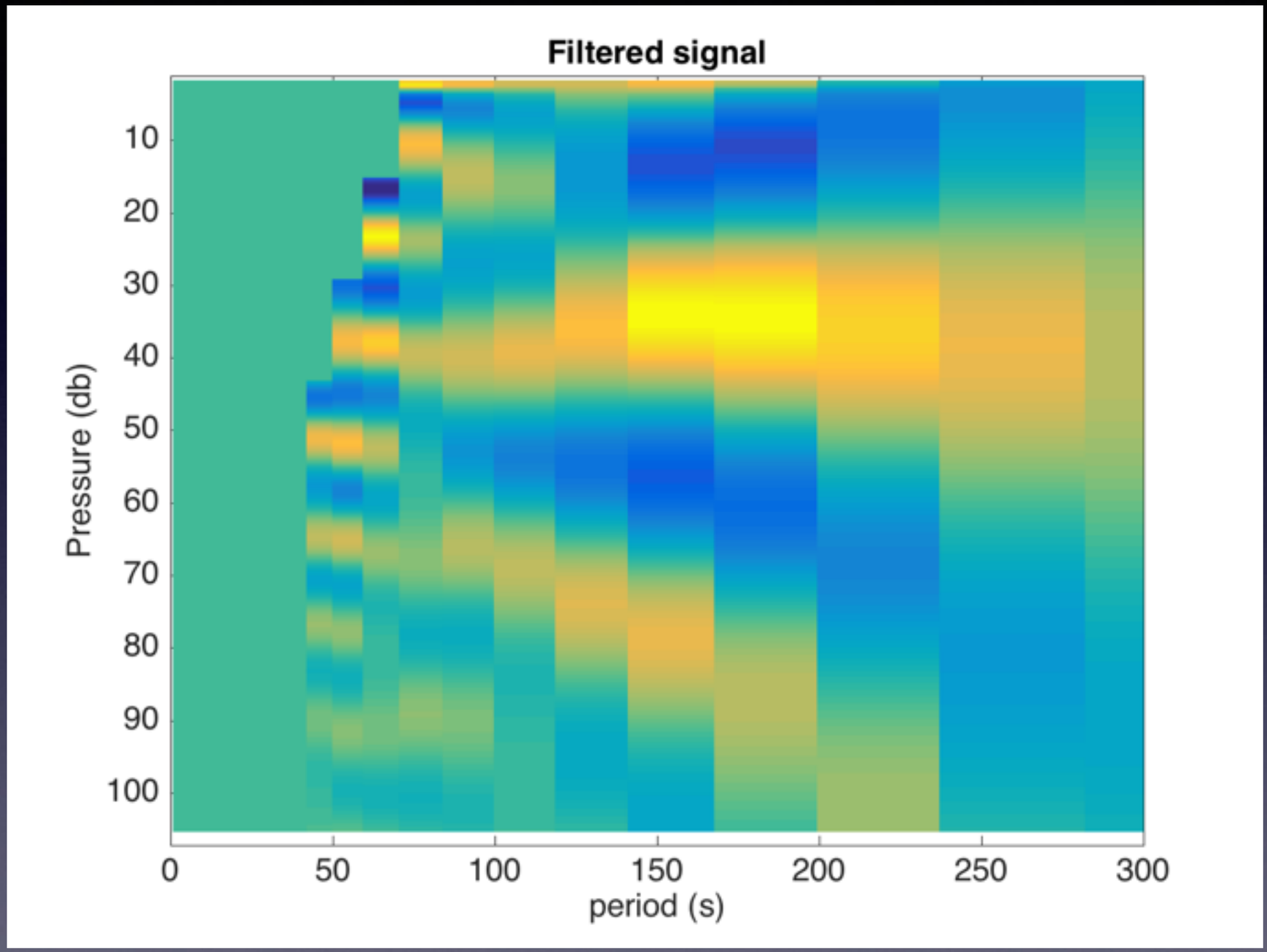
Processing needs 2 parameters : coef1 and coef2

Coef1 = % of std

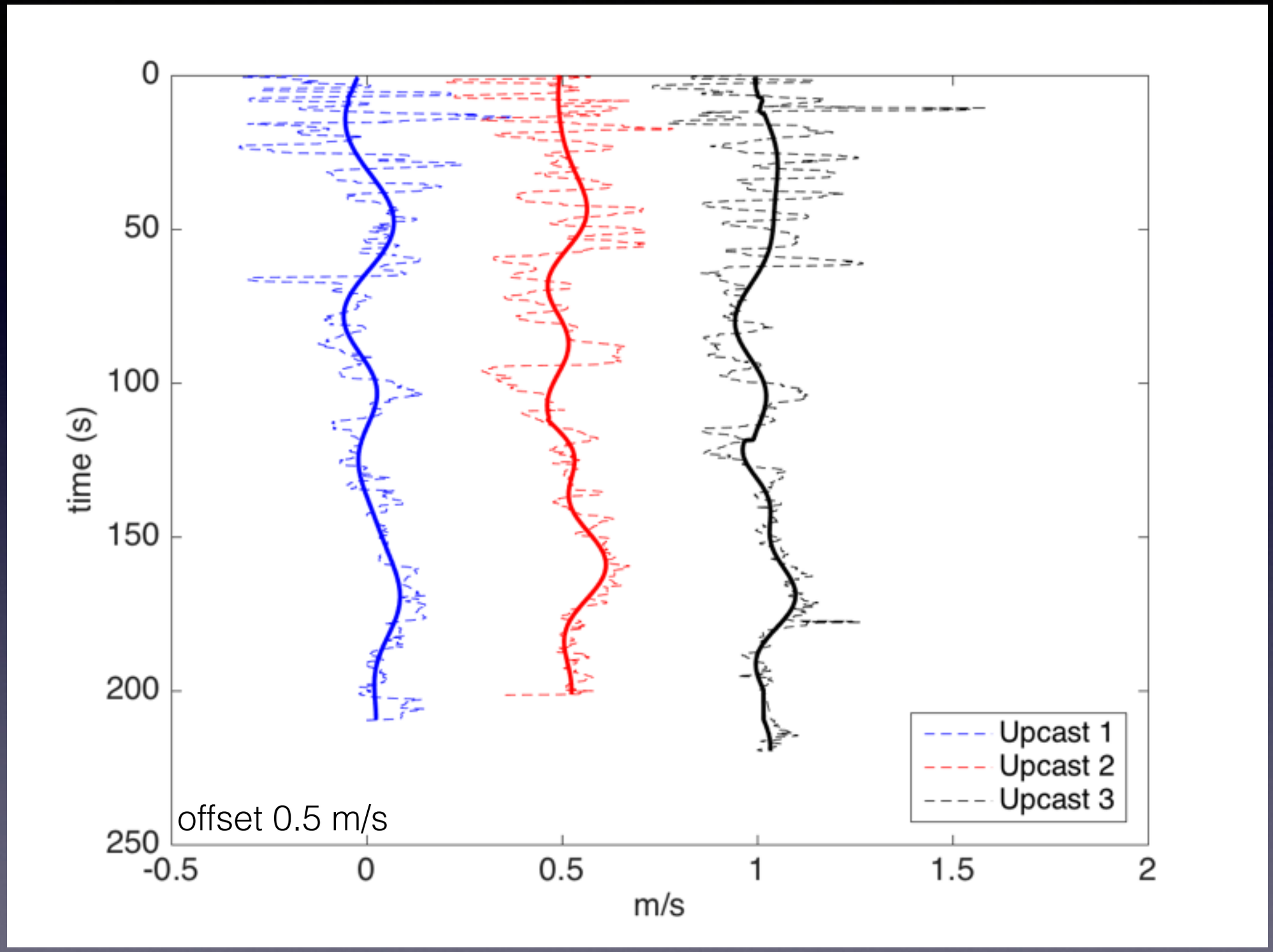
defines 1 and 2



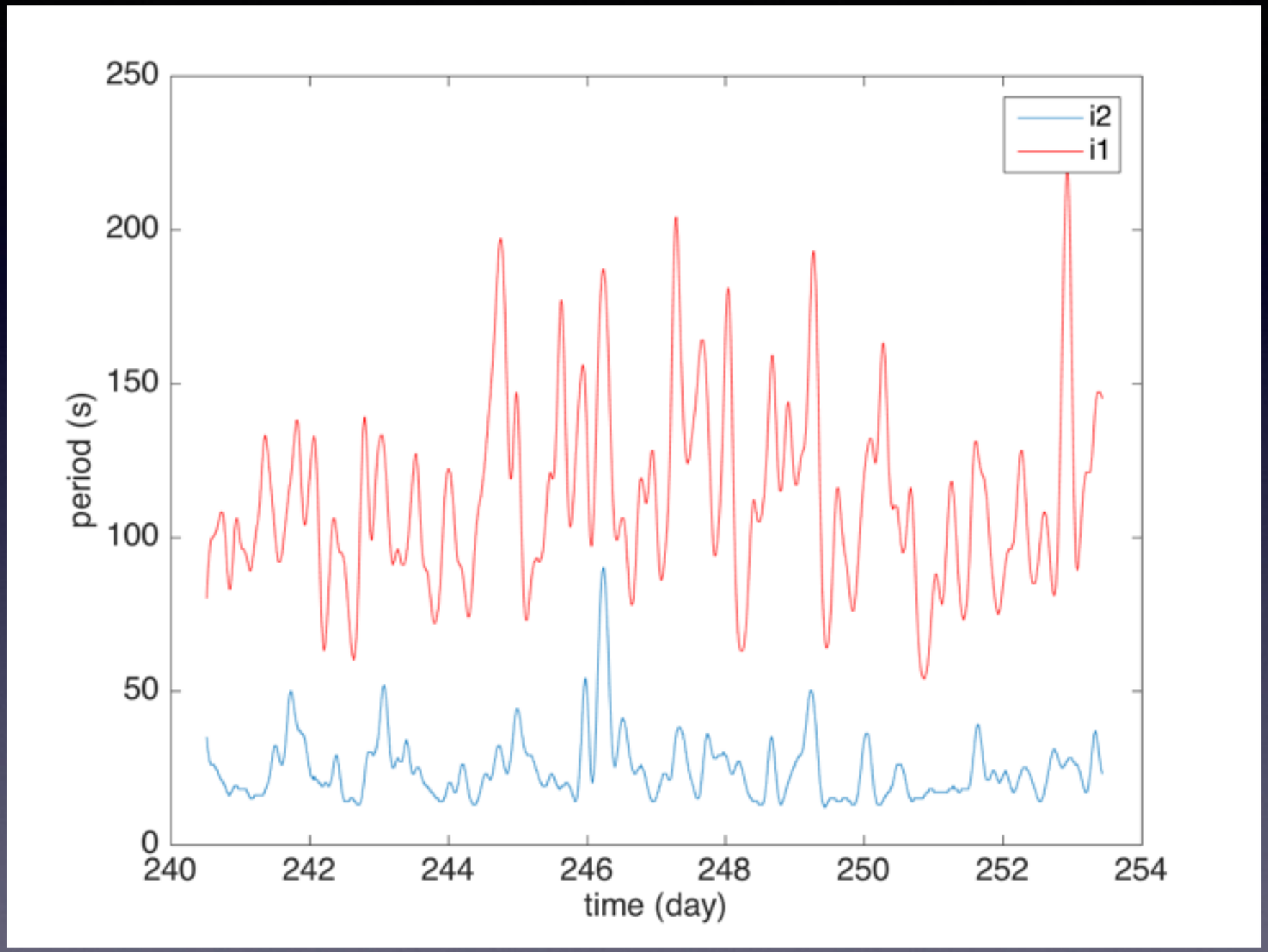
Filter the Upcasts



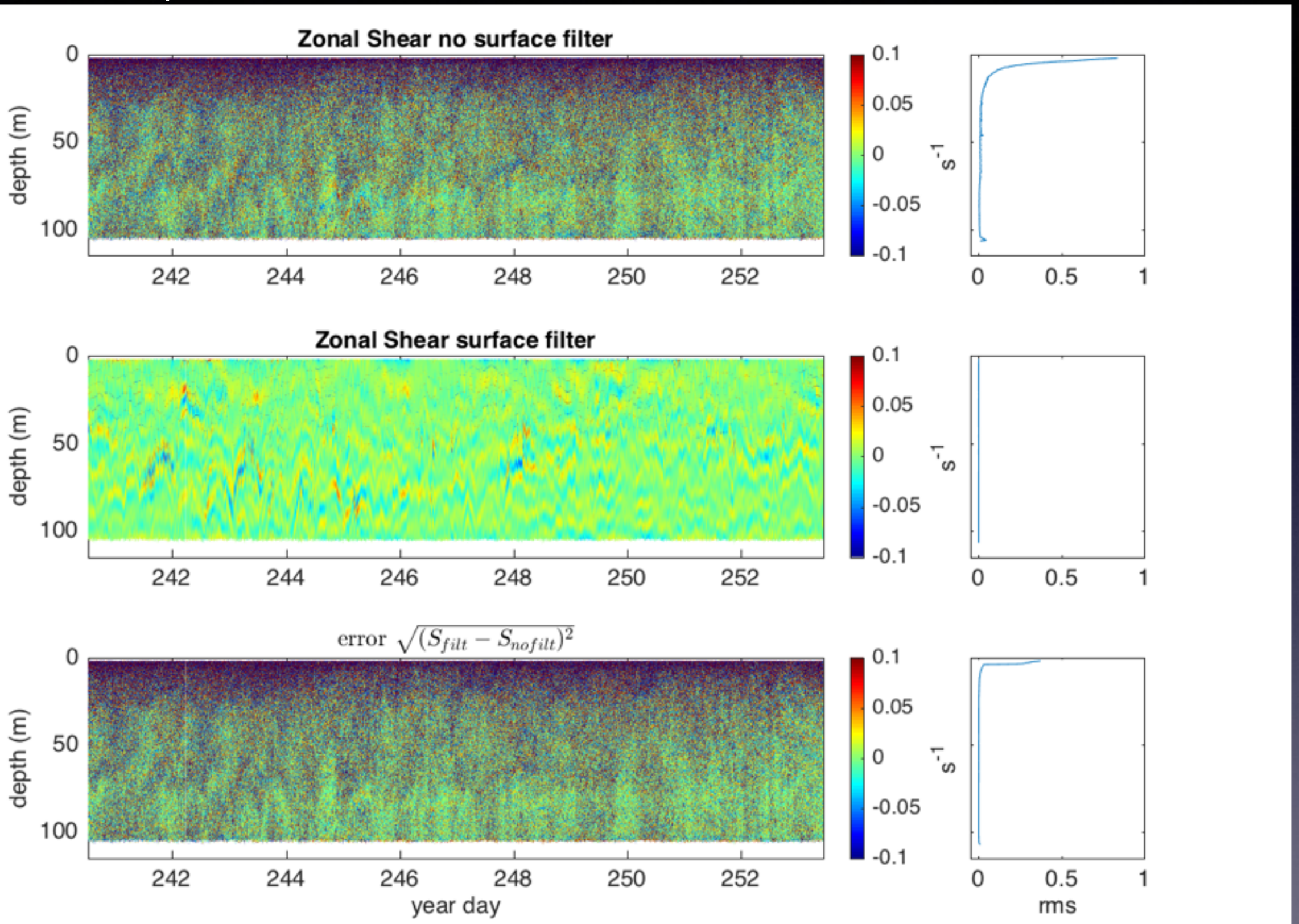
Filter the Upcasts



Filter the Upcasts

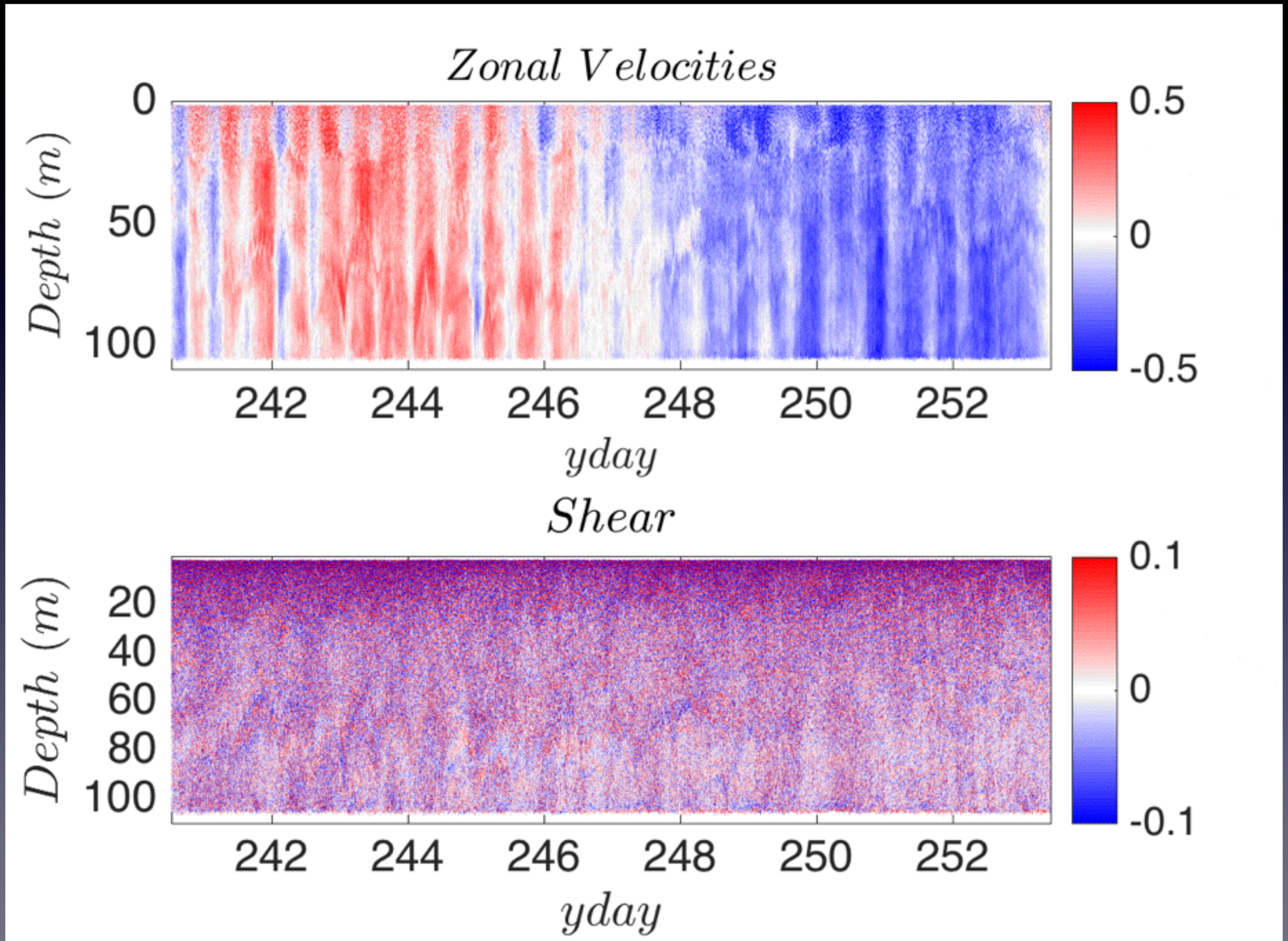


Filter the Upcasts



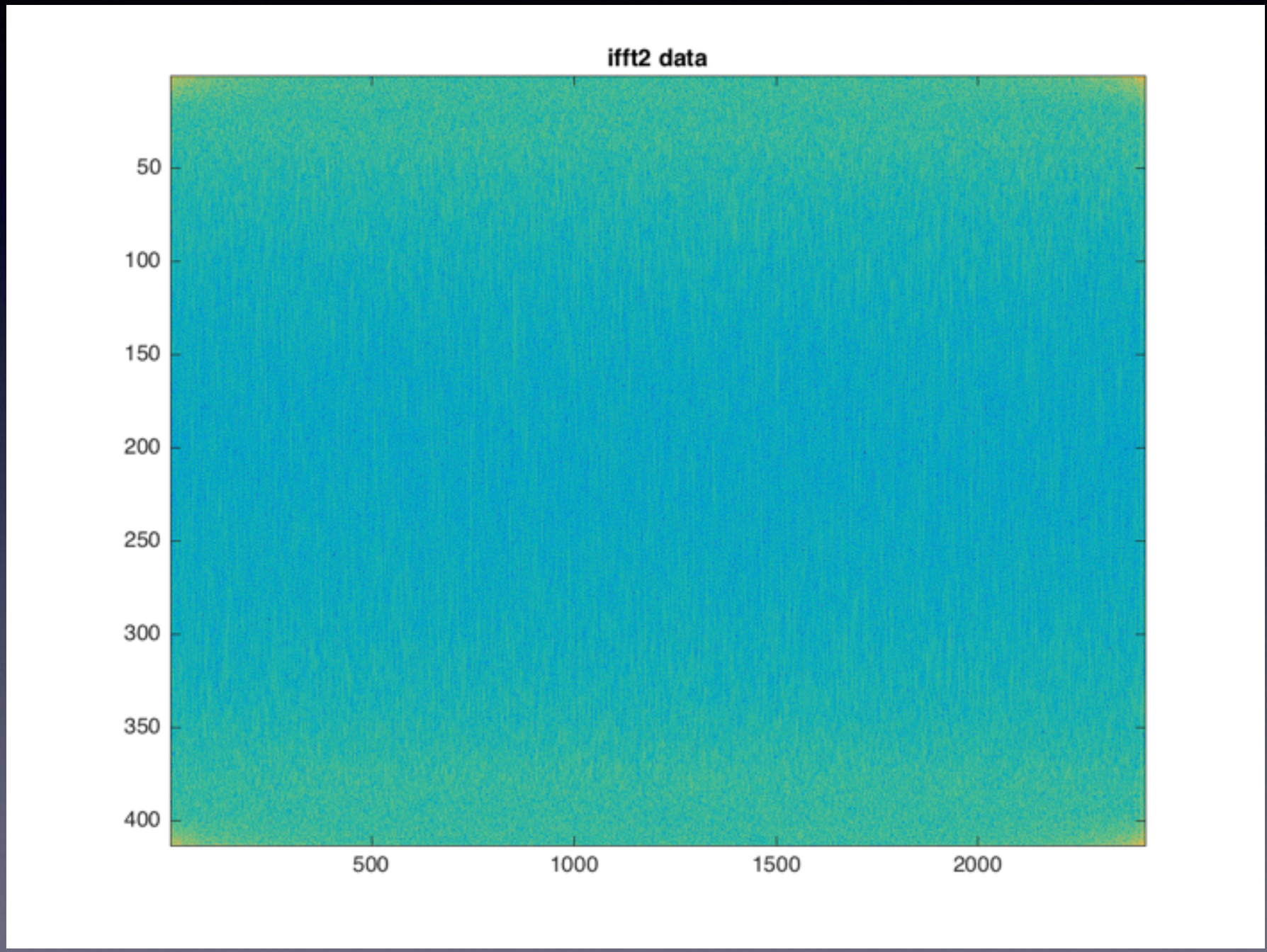
Another filter option:
ifft2 and frequency cut off

Filter the gridded fields

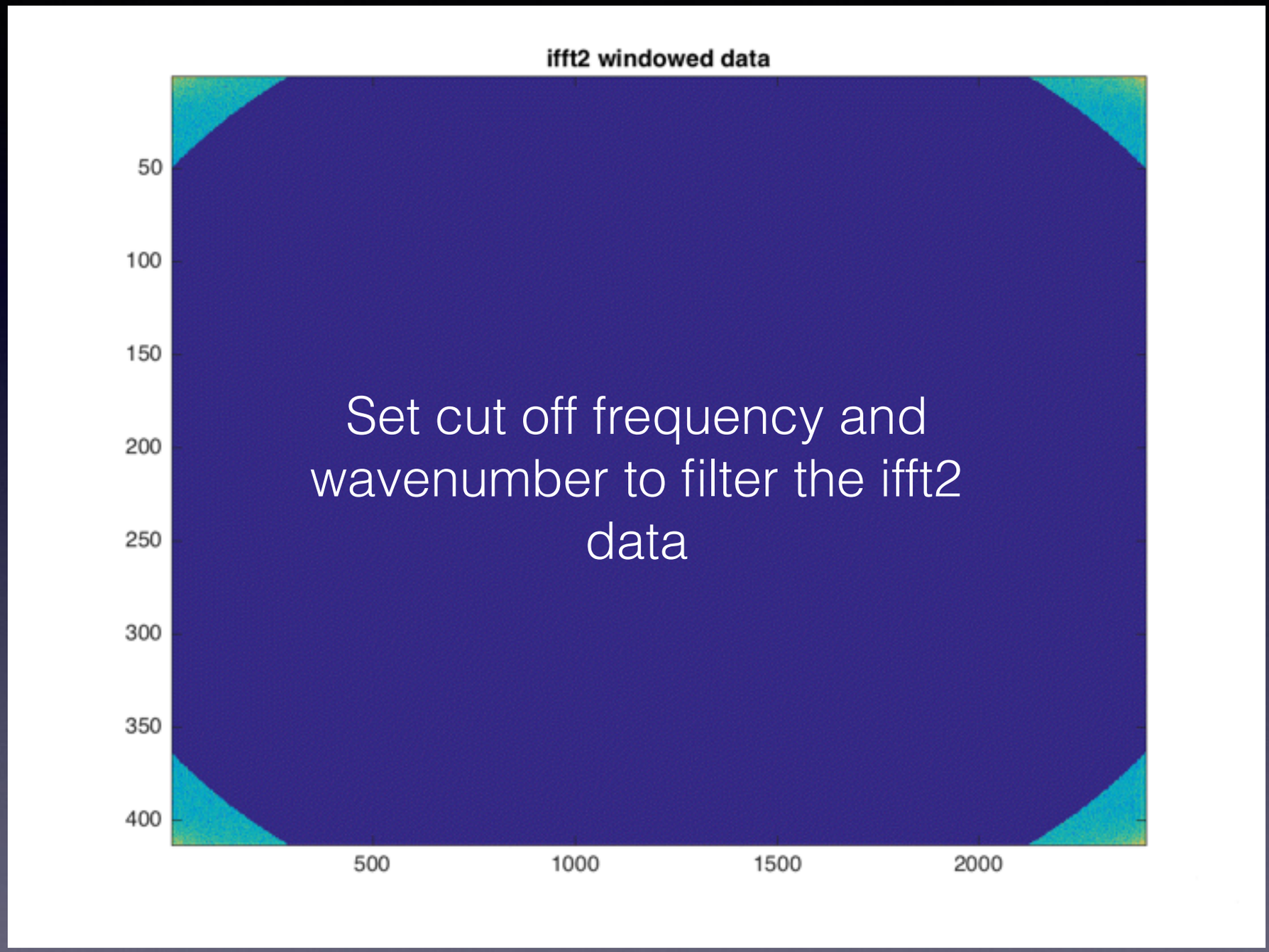


Filter the Upcasts

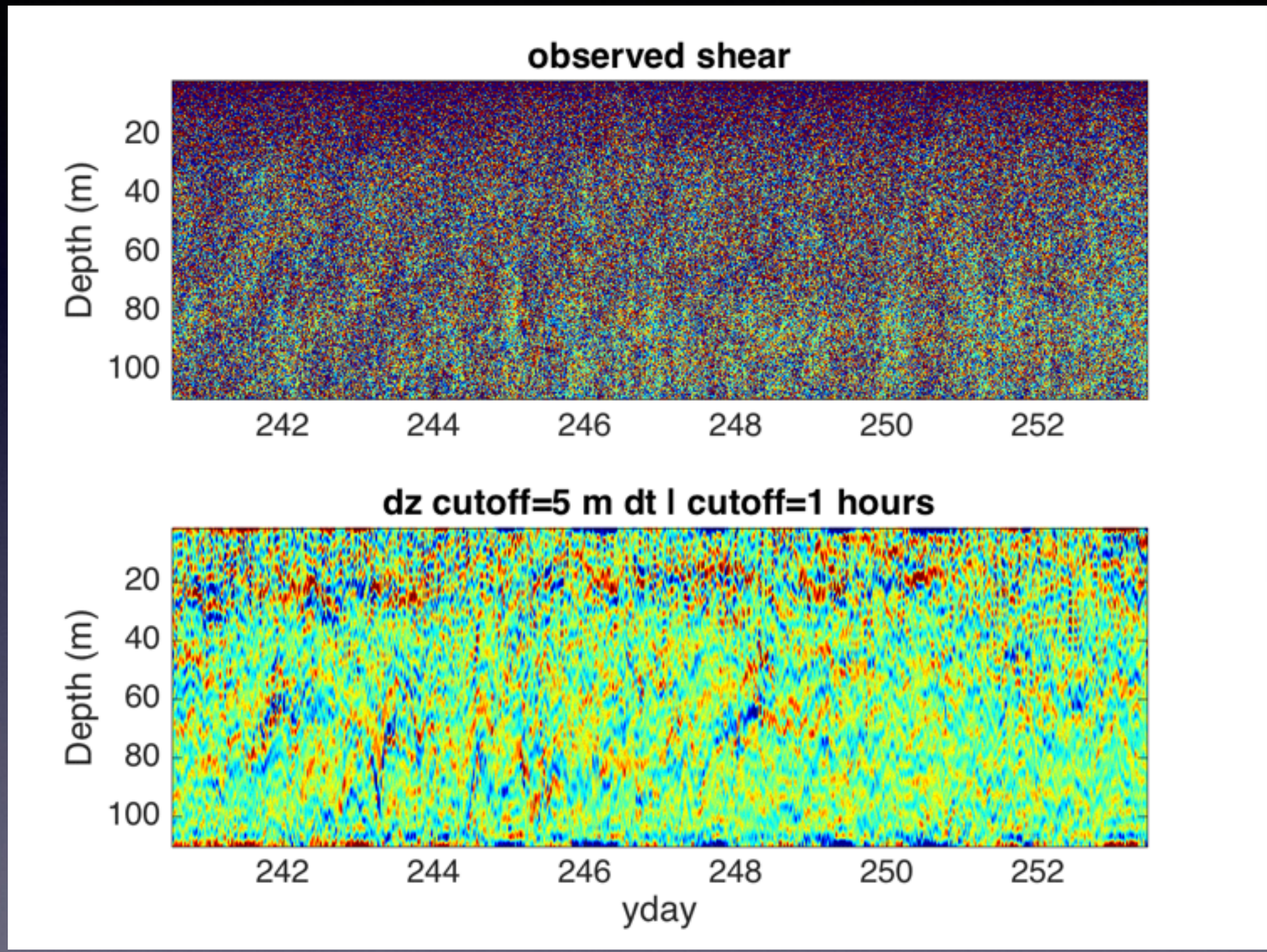
compute fft 2 dimension (fft2)



Filter the Upcasts



Filter the Upcasts



Filter the Upcasts