# Notes on Osmosis model / obs comparisons

February 26, 2021

## 1 Kinetic Energy

Below are some comparisons for the spectral density of kinetic energy between observations from Osmosis (the central mooring) and various model datasets, including GIGATL1 (Atlantic CROCO at 1-km res.), GIGATL3 (same at 3-km), a ROMS nest at 500 m resolution, LLC4320 (global MITgcm at 1/48), and eNATL60 (NEMO North-Atlantic at 1/60).

GIGATL1 and ROMS500 simulations compare pretty well with obs. Tidal and NI peaks are usually well reproduced at different depths and seasons. One issue seems to be a lack of subinertial energy at 500 m, especially between late-winter, spring and early summer (when the mixed-layer is pretty deep in obs.).

LLC4320 performs remarkably well in all seasons. It lacks a bit of NI energy, and some tidal peaks are a bit too strong, but subinertial energy is very close to obs (except maybe winter where it is a bit low in all simulations).
eNATL60 a bit less energetic than other models. It is especially too low in subinertial energy in fall and summer at 500 m, but is doing good during spring. The superinertial continuum is steeper than in LLC4320 despite the higher vertical and horizontal resolution.

It is important to remember that, here, we are comparing observations and models corresponding to different years. So interannual variability could play an important part in the differences. Furthermore, the models spinups are pretty short (typically not much more than a year, GIGATL1 is branched from GIGATL3 in summer 2007) and this could also influence the results. For example an eventual submesoscale inverse cascade would take a year or more to be effective in energising the mesoscale.

An example of interannual variability using the 3-km run is shown in Fig. 6. The year 2008 (used above for GIGATL1 and GIGATL3) is significantly less energetic in spring at 500 m compared to other years, 2010 being the most energetic.

A preliminary comparison for GIGATL1 in spring 2008 and 2009 (we compare only March-April because May-June 2009 are not available yet) seems to also show an increase of submesoscale energy in 2009 compared to 2008 (Fig. 7). The evolution of the stratification in the simulation also highlights that the mixed-layer penetrate deeper in 2009 compared to 2008 (Fig. 8).

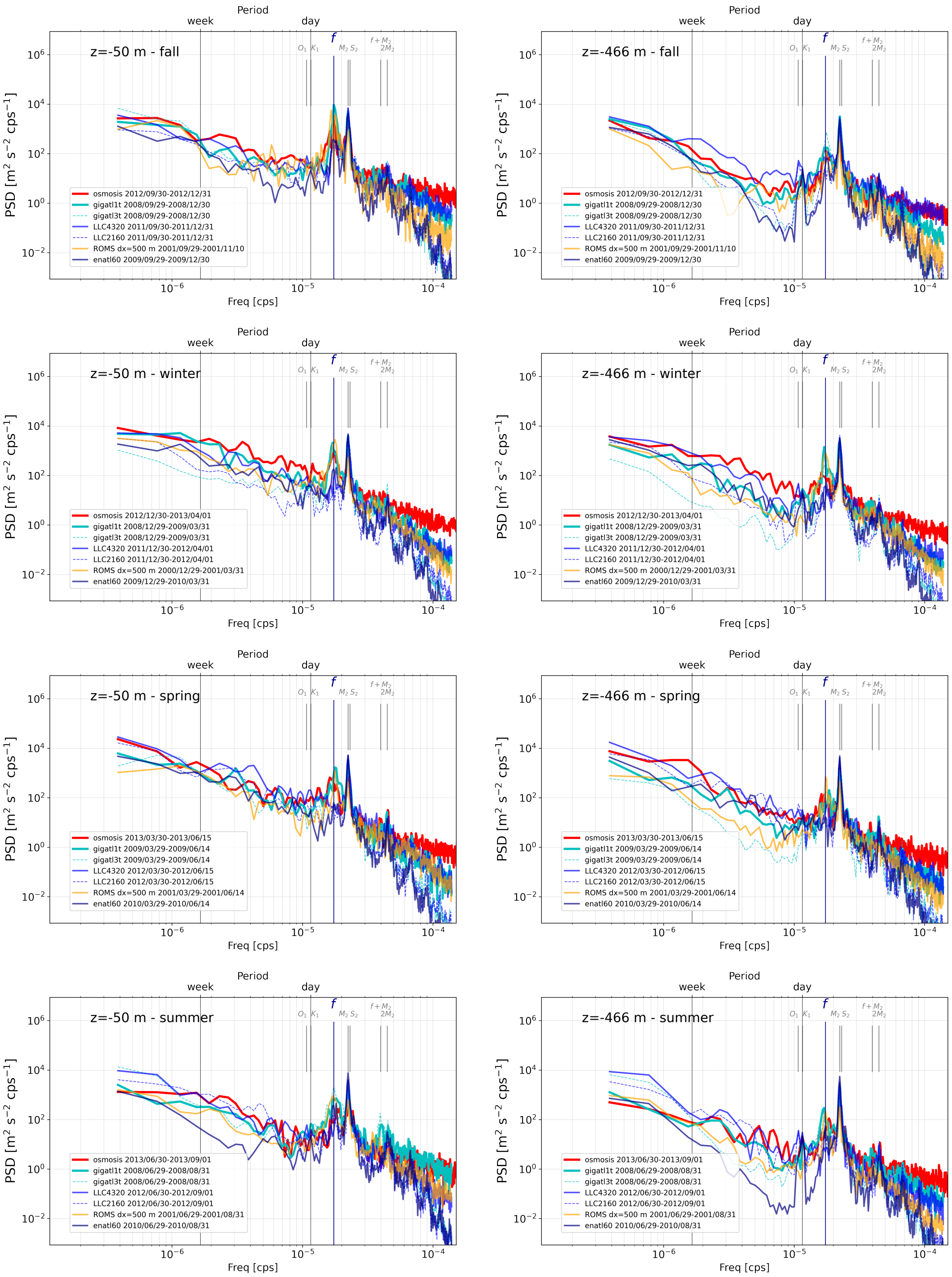
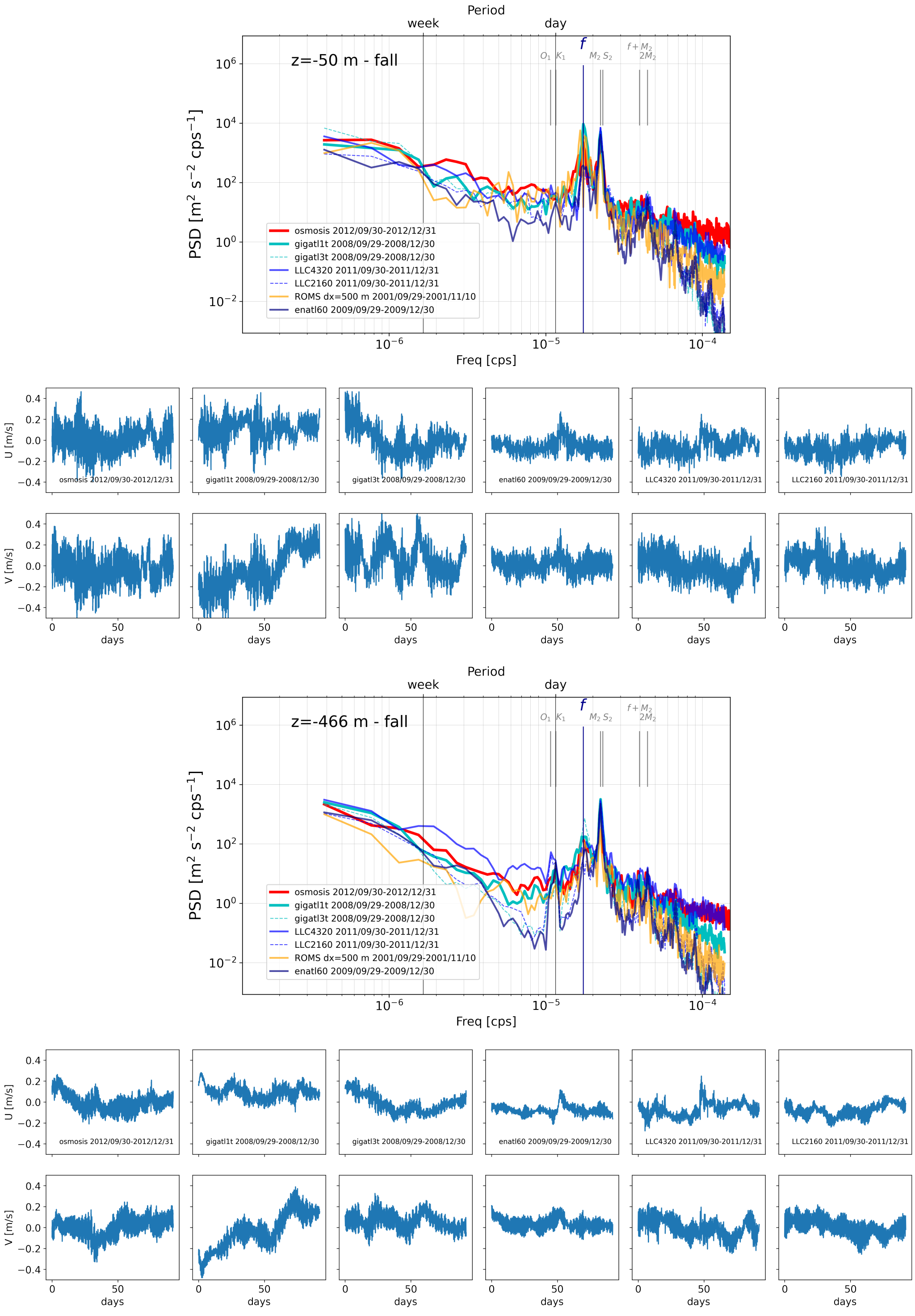



Figure 1: Frequency spectra (using a welch method over 30 days periods) for various datasets. Seasons are here defined as JFM (winter = January-February-March).



Period
week
day
PSD [m$^2$ s$^{-2}$ cps$^{-1}$]
Freq [cps]
osmosis 2012/09/30-2012/12/31
gigatl1t 2008/09/29-2008/12/30
gigatl3t 2008/09/29-2008/12/30
LLC4320 2011/09/30-2011/12/31
LLC2160 2011/09/30-2011/12/31
ROMS dx=500 m 2001/09/29-2001/11/10
enatl60 2009/09/29-2009/12/30

Figure 2: Fall spectra (SON) and the corresponding time-series for u and v.

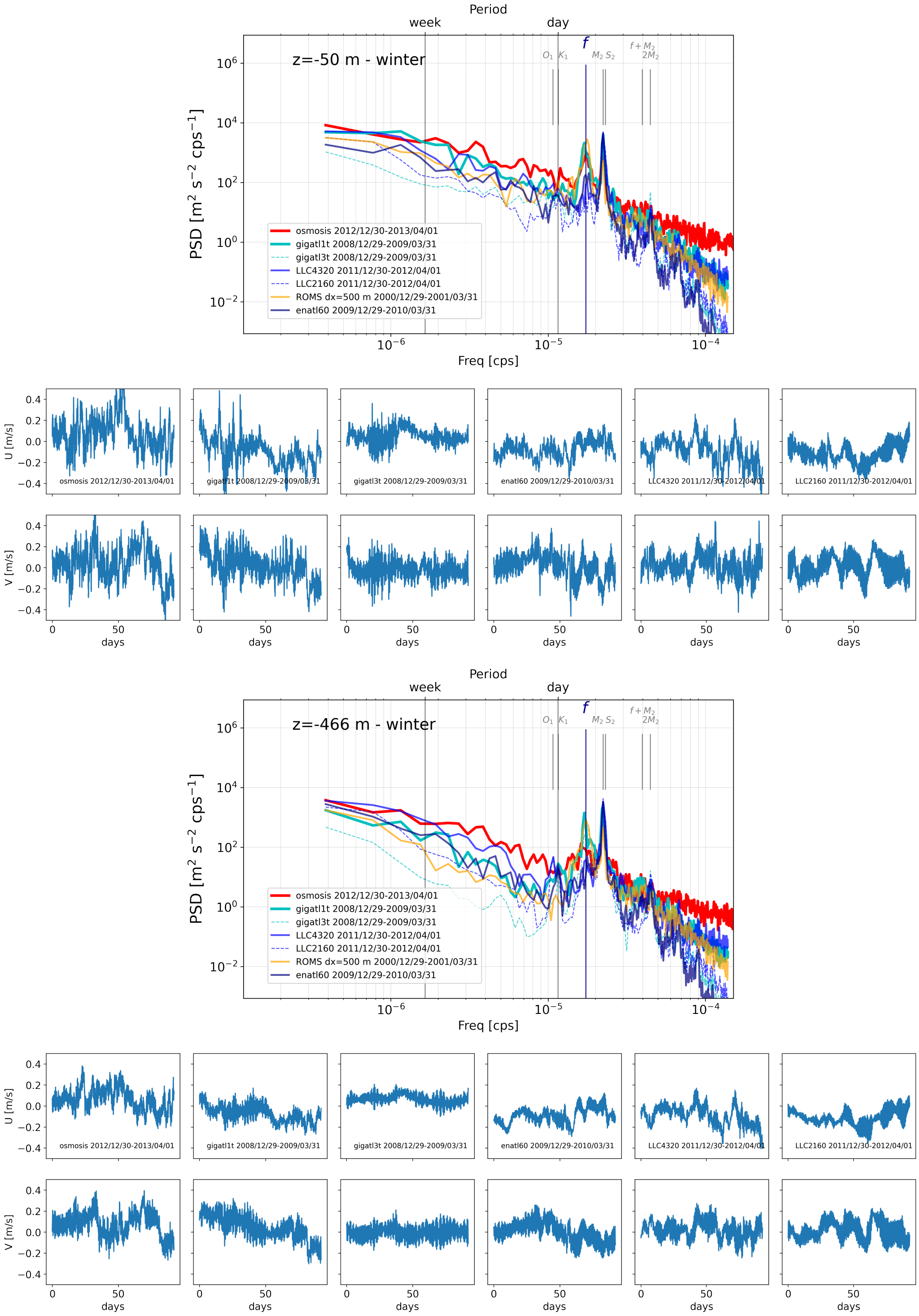



Figure 3: Winter spectra (DJF) and the corresponding time-series for u and v.

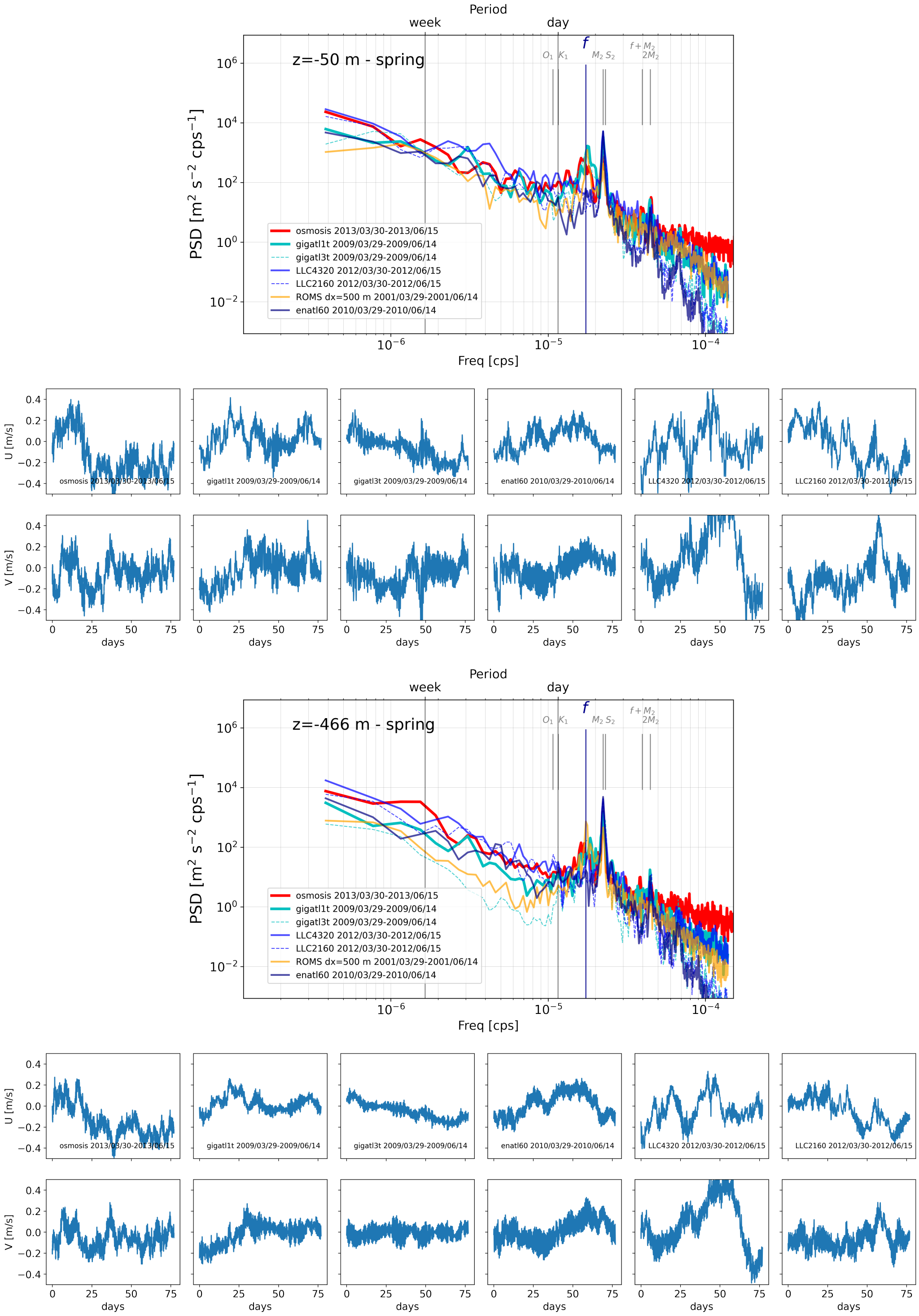



Figure 4: Spring spectra (MAM) and the corresponding time-series for u and v.

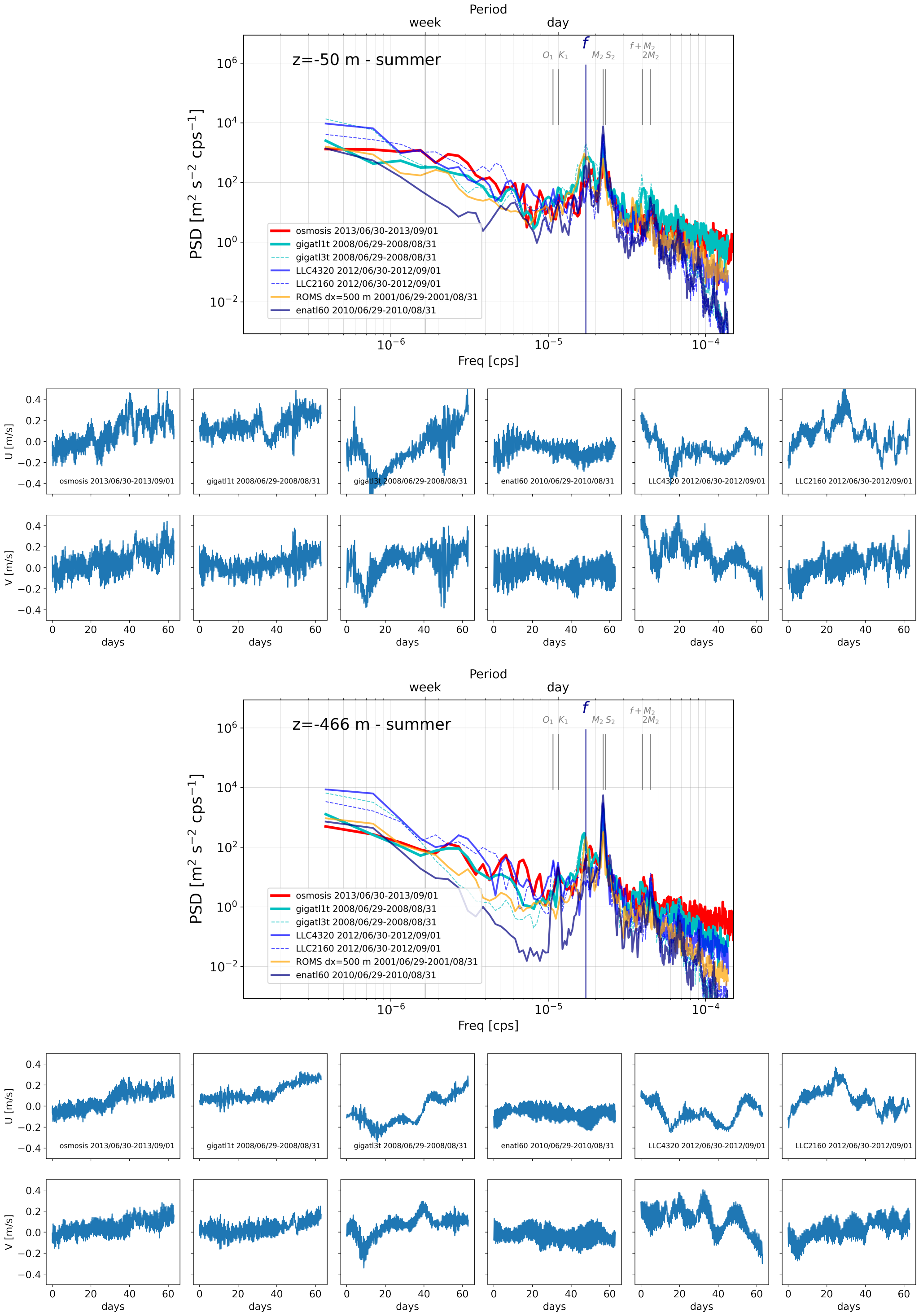



Figure 5: Summer spectra (JJA) and the corresponding time-series for u and v.

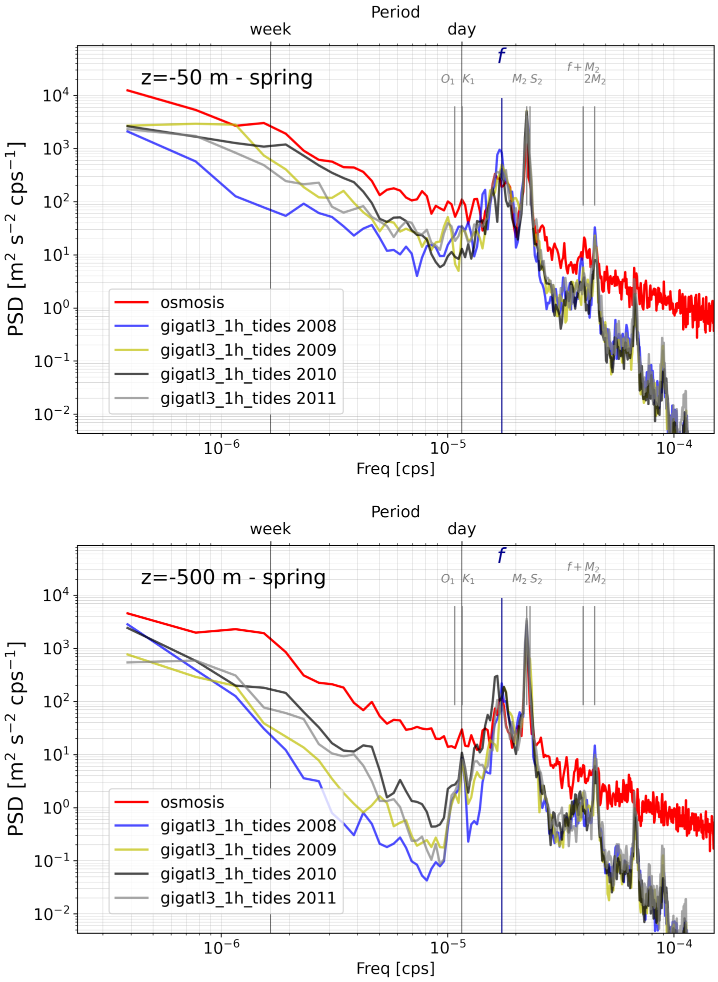



Figure 6: Interannual variability in the 3-km simulation.

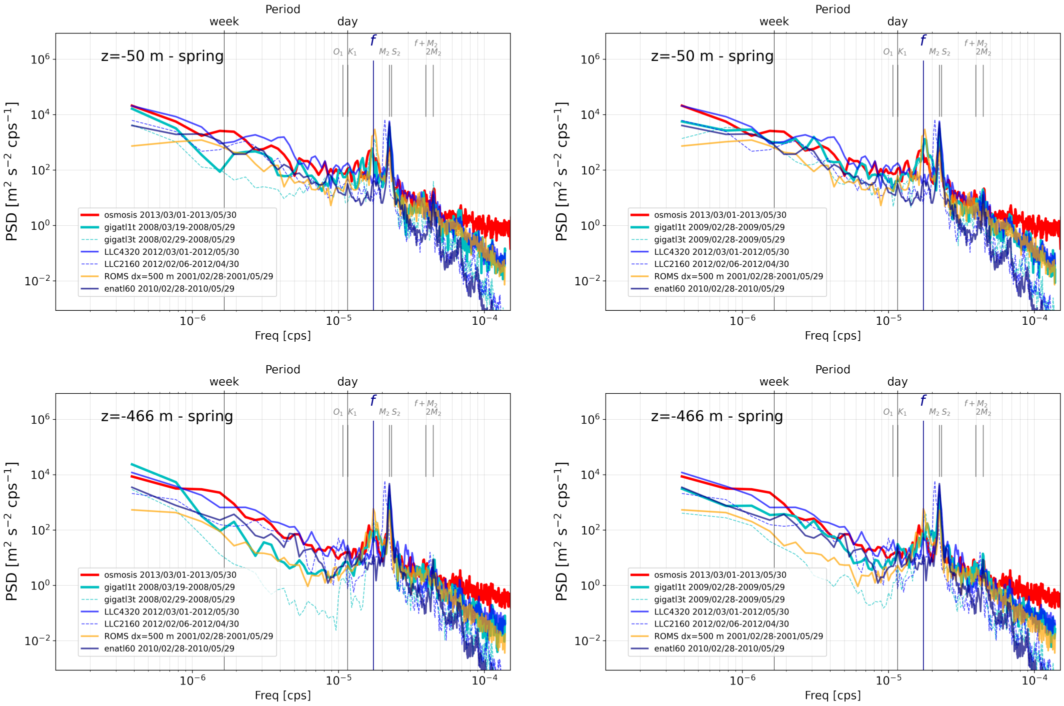



Figure 7: Interannual variability in the 1-km simulation.

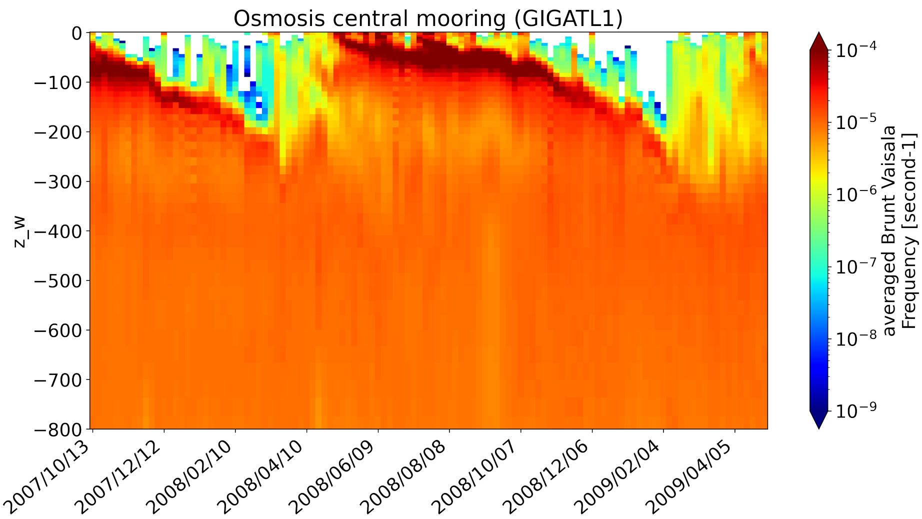



Figure 8: stratification at the central mooring in gigatl1