Title of the project:
Optimising the eddy covariance method to estimate oxygen fluxes across the sediment-water interface

Assignment no.: 33.17	**Internal/external:** External, NIOZ-Yerseke
Head graduation committee: Dr. Kathelijne Wijnberg	**Daily advisor:** Dr. Karline Soetaert (NIOZ) Dr. Bart Vermeulen
Name(s) of participating companies or institutes:	**Start of the project:** Flexible

Required courses:
Data Analysis
Marine Dynamics

Short description and objective of the project:
The survival of organisms living in marine sediments depends on the availability of oxygen, which is supplied to the sediment from the water column. Consequently, the oxygen sediment-water exchange rates are a good measure of sediment biological activity. Several methods exist to estimate oxygen consumption rates of sediments in aquatic environments. The eddy covariance method is based on the concurrent measurement of vertical velocity and oxygen concentrations, and uses the correlation in the fluctuations of these quantities as an estimate of the oxygen fluxes. It is a non-invasive method that estimates fluxes integrated over a rather large area (so-called footprint, in the order of 10-100 m2), which renders it superior over flux measurements performed by the intrusive core incubations (integrating over ~10 cm2) or micro-profiling (~mm2). However, it relies on several assumptions that are not always fulfilled making this a difficult method to interpret. The NIOZ has deployed the eddy covariance lander at several occasions in different areas, and with apparently variable success. For instance, during a recent Northsea cruise in June 2017, the NIOZ eddy covariance lander was deployed three times; one deployment gave consistent measurements over the entire time span, another deployment produced reasonable fluxes only over one phase of the tidal cycle, while the third seemed to produce no good data at all. Other data sets from the Northsea, the Wester and OosterSchelde are also present at NIOZ. In the master thesis, the student will optimise the procedure to convert the raw eddy covariance data into oxygen fluxes. Several data handling procedures, e.g. to separate the turbulent fluctuations from the advective signal may lead to different results, and their impact needs to be tested. Another unknown is in how far the method can serve to estimate non-stationary oxygen fluxes, e.g. when shallow sediments switch from oxygen consumption in the dark to production during the day. The master student is also expected to help in deploying the lander in the field, both from shore during research cruises. Several opportunities for the latter may arise, in the North Sea, or the Dutch Delta (Oosterschelde, Westerschelde, Grevelingen).