2D Imaging of O2 dynamics
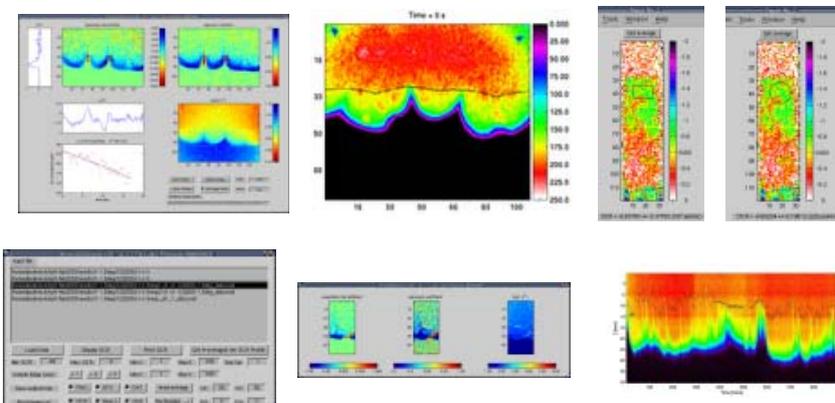
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New: O2dynamics-2D version 2.1.8 now available.

Introduction

Using the MOLLI system, one is able to monitor the 2D distribution of oxygen concentration in different types of samples, such as sandy sediments, microbial mats and others, with high temporal (subsecond) and spatial (down to 50-100 microns) resolution. Understandably, the information of the system is not always contained only in the oxygen *profile* but also how this profile *evolves in time*. For example, if the system contains respiring organisms, a high spatial resolution image of the respiration rate, which can be mapped to the metabolic activity of the organisms, could be of interest. Furthermore, by observing time series of oxygen distribution in a photosynthetic microbial mat, one can determine the 2D profile of the photosynthetic activity of the mat.

O2dynamics-2d is a package of Matlab scripts and functions that enables one to extract this kind of information from the images produced by the MOLLI system, and much more. In this document, I describe briefly different functions provided by the package.

Description of features

Calculation of O2 images

Calculation of a large number of O2 images can be done using the script **O2calcul.m**. One only needs to specify (i) the calibration parameters of the O2 foils, (ii) the prefix and suffix of the input files (supplied by the Look@MOLLI program) and the output files (iii) and the numbers corresponding to the time steps. The O2 images calculated by the script will be stored in the binary int32 format using the **w1w2toO2.m** function. (Note: to save the disk space, only every N pixels are stored, where N can be specified in the w1w2toO2.m file.) The extension of the files is **b16** by default.

Many times, it is required to view the O2 images as a proper images. For this purpose, I wrote a script **b16topng.m** using which one can plot the O2 images as PNG files. One needs to specify the range of the colour scale in which all the images will be displayed. Once the PNG images are obtained, one can convert them into a video showing the dynamics of the oxygen distribution. A number of such videos can be viewed by clicking on the following images.
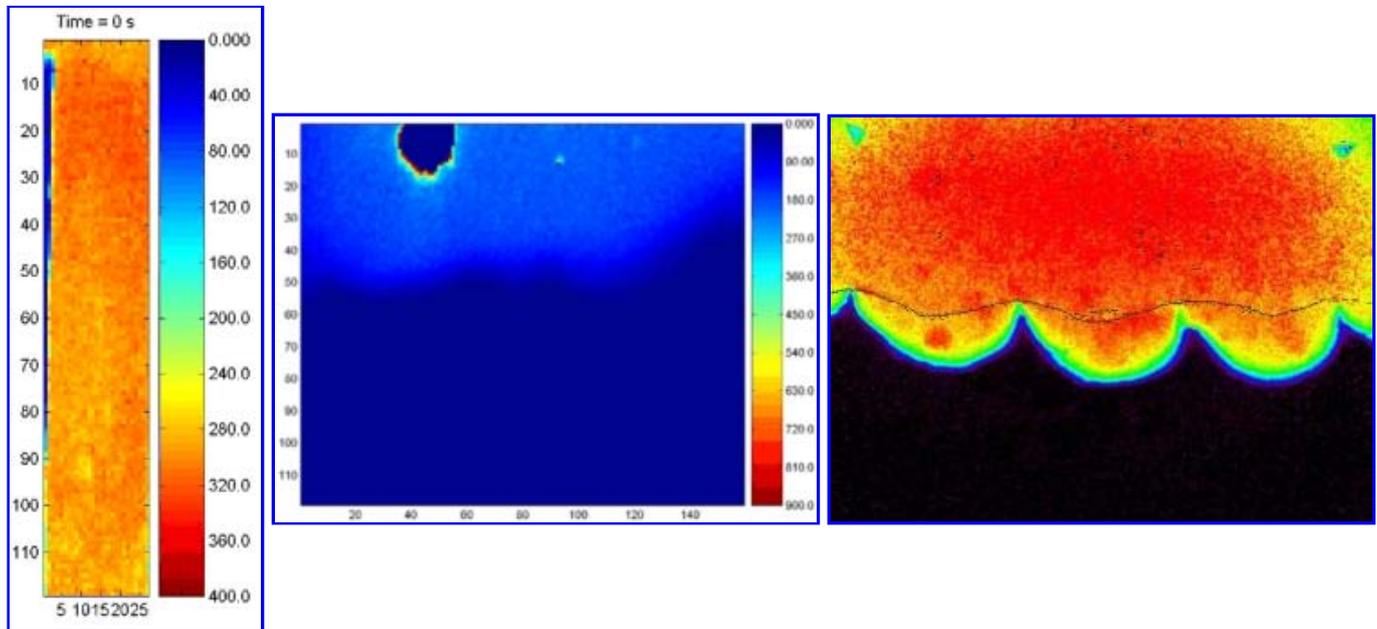
Respiration of a permeable sandy sediment.

Evolution of O2 distribution across a microbial mat upon switching on the light.

Oxygen dynamics in a sandy sadiment with moving ripples due to waves above.

Sometimes, one needs to have a quick overview of all O2 images in the given series. For this purpose, I wrote a script **lookatO2.m**. One needs to specify the colour scale of the O2 images and the indices of the images to be displayed. The images will then be plotted one after the other, as shown below.
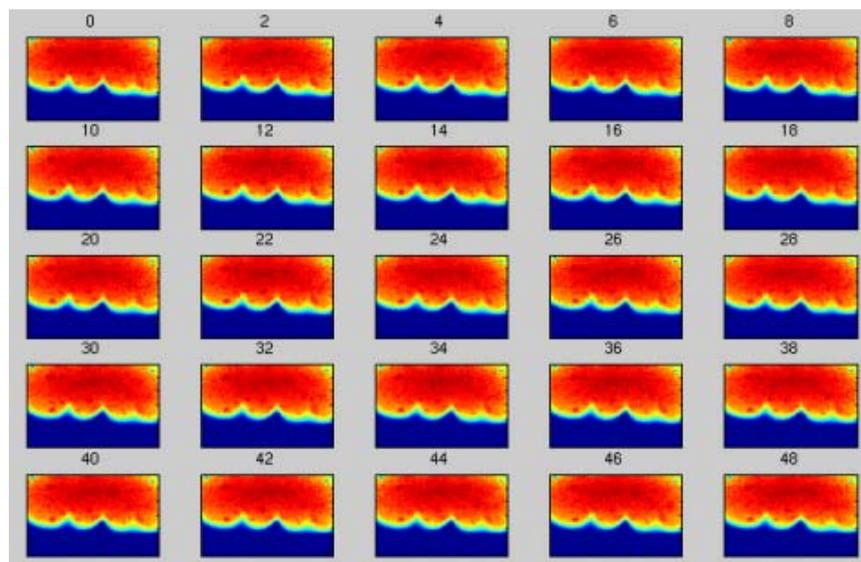
Time series of O2 images.

2D image of O2 dynamics

Once the oxygen images have been calculated, further processing can be done. Using the script **O2dyn.m**, one is able to obtain a 2D image of the oxygen *production* (positive rr) and *consumption* (negative rr) *rate*. It is assumed that in every pixel of the image the oxygen dynamics is *linear* and so each pixel of the O2 production/consumption image corresponds to a linear fit of the oxygen concentration in that particular pixel. If this is not the case, the obtained O2 production/consumption image should not be taken seriously. After the images have been loaded and the O2 production/consumption image has been calculated, a graphical interface like the one shown below is presented to the user. The functions available in this GUI should be self-explanatory.
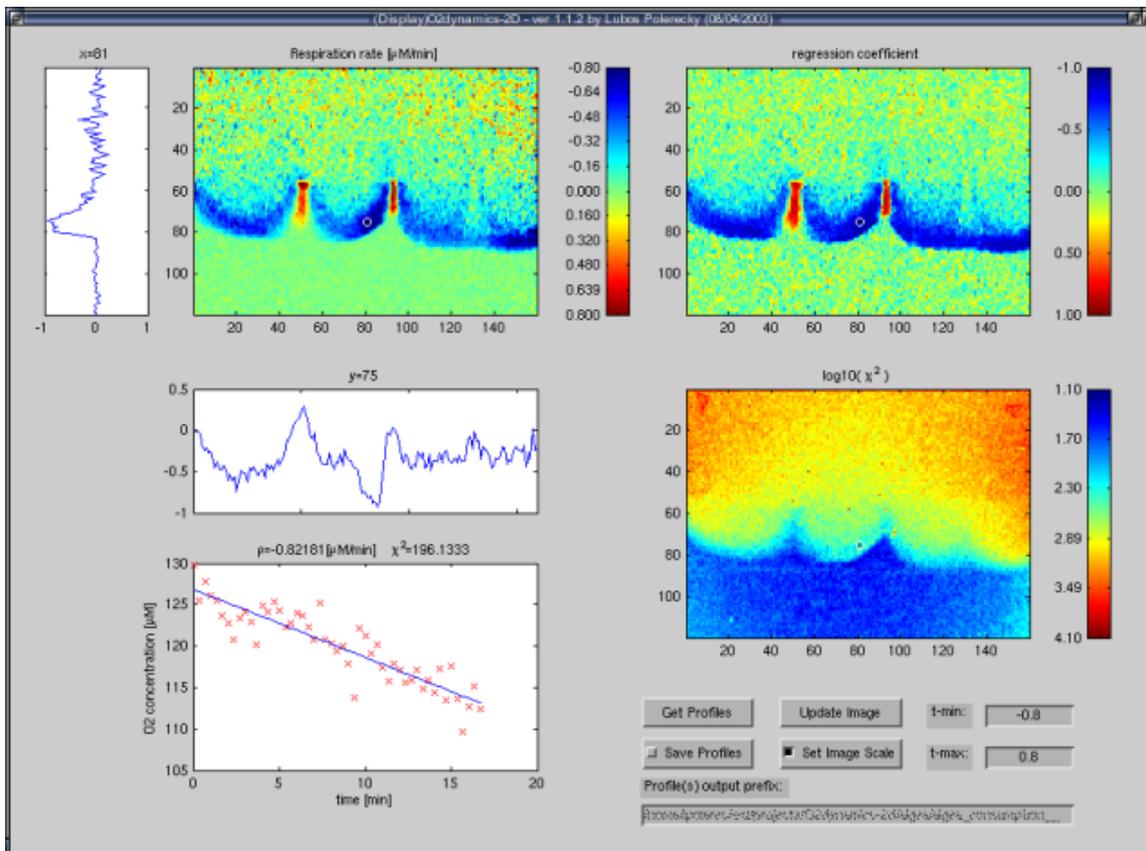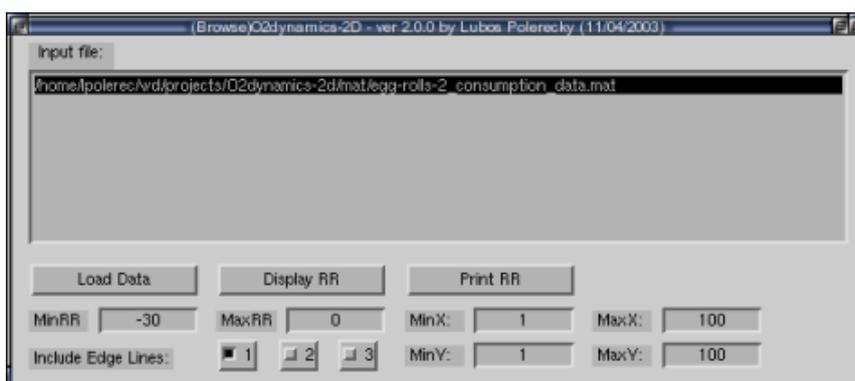
GUI of the O2dyn script.

Which images should be loaded by O2dyn is specified in the **rr_getpar.m** script. The dimensions of the *.b16 images which are loaded by the O2dyn script must be specified in the **rr_readim.m** function.

Fast browsing of files produced by O2dyn

During the run-time of the O2dyn script, a ***.mat** file is created in the same directory as the original *.b16 images. This file contains the matrices of the O2 production/consumption rate, correlation coefficient, Chi² and other parameters relevant to the analysis. All these parameters can be updated by loading the corresponding *.mat file. This way the viewing and/or printing of the previously analysed data can be much faster. Typically, one should copy all the *.mat files into a single directory and use the script **browseO2.m**. This script provides a GUI, as shown below.

GUI of the browseO2 script.

One can select a particular *.mat file and load the data by clicking on the "Load data" button. Then, one can view the dynamics in the way described in the **2D image of O2 dynamics** section by clicking on the "Display RR" button. To produce a ready-to-print display of the O2 dynamics in a selected area, one should click on the "Print RR" button. A window like the one shown below will appear and one can print it into a PNG or EPS file (or any other format supported by Matlab) using Matlab's print command.
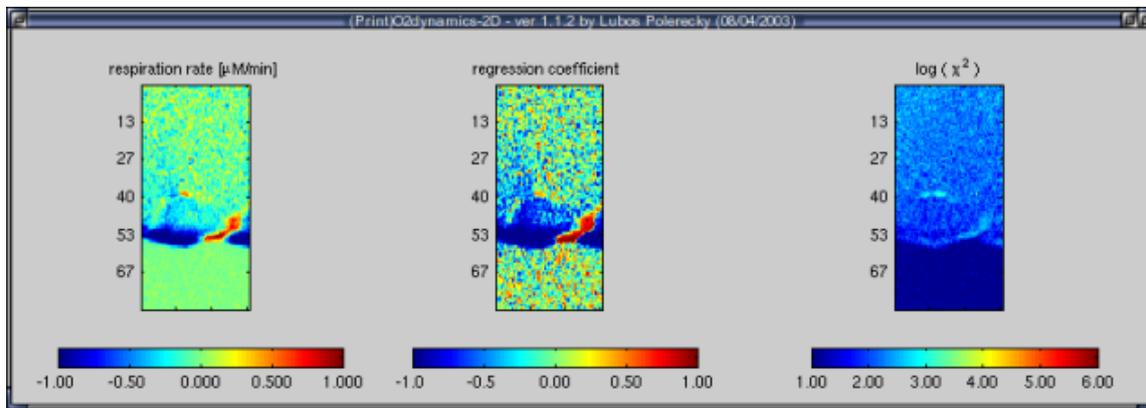
Screenshot of a ready-to-be-printed display of O2 dynamics.

Get O2dynamics-2D

Learn about the **most recent developments** of the O2dynamics-2D project first.

Click here to download the tar-ball. Of course, you need to have Matlab installed on your computer to be able to run the scripts.

Note: The files are accessible ONLY via the LAN of the MPI institute. You must be logged in to the Tux server, otherwise this link will not work! Use Network Neighbourhood -> Tux to log in. If you are outside the institute and would like to use O2dynamics-2d, please let me know by e-mail.

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