# Model of Early Diagenesis in the Upper Sediment with Adaptable complexity – MEDUSA (v. 2): a time-dependent biogeochemical sediment module for Earth System Models, process analysis and teaching

## Contents of the Zenodo archive

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## Code and Data

The archive contains the source codes of MEDUSA (framework system and configuration and code generation utility) and of the applications discussed in the main paper. Also included are data for the MBM and JEASIM applications; data for the COUPSIM_BEC application have to be separately downloaded and pre-processed.

`src-med`
: the MEDUSA framework system;

`src-mcg`
: the MEDUSA COnfiguration and COde GENeration tool MEDUSACOCOGEN;

`src-mbm`
: the ocean carbon cycle model MBM;

`apps`
: the applications COUPSIM (one serial and three MPI versions) and JEASIM.

The source codes of the THDYCT and $\mu$XML libraries must be downloaded separately:

- THDYCT – DOI:10.5281/zenodo.4677790;
- $\mu$XML – DOI:10.5281/zenodo.4677788.

The necessary details about the different steps to prepare the code for using it are provided in `buildandrun.pdf` (see below).

## Memos, Guides and Reports

The `medmbm/docs` directory provides extensive scientific and technical reference documentation:

`diagengen.pdf`
: *Early Diagenesis in Sediments – A one-dimensional model formulation* (Version 3.3.1, 23rd March 2021, 55 pp.)

  This report lays out the theoretical foundations of MEDUSA.

`medusatechref.pdf`
: MEDUSA*: Model of Early Diagenesis in the Upper Sediment with Adaptable complexity – Technical Reference* (Version 1.1, 20th April 2021, 32 pp.)

  This report deals with more technical aspects that had to be addressed in the course of the development of the MEDUSA source code (upwinding procedures, grid layouts, scaling of the equations, ...).

`medusa-frameworksystem.pdf`
: MEDUSA – *The Basic Framework* (15th June 2020, 31 pp.)

  This document presents the common framework system of MEDUSA. It includes a wide range of information about the components that are common to all MEDUSA configurations. The system of units used in the code is detailed. Customization and runtime configuration options are presented, as are the most important compile time options (pre-processor switches).

`coupling-guidelines.pdf`
: MEDUSA – *Guide to Coupling* (21st September 2017, 27 pp.)

  This reference guide provides detailed instructions for coupling MEDUSA to a marine biogeochemical cycle model or a similar application.

`medusa-cocogen.pdf`
: MEDUSA – *Reference Guide to the Configuration and Code Generation Tool* MEDUSACOCOGEN (30th August 2018, 60 pp.)

  This reference guide gives comprehensive explanations about the functionality of the configuration and code generation tool MEDUSACOCOGEN. It also includes a detailed description of the formats of the MODLIB library files (kinetic rate laws and laws of mass-action), about how to use them and how to extend the library.

`buildandrun.pdf`
: *Building and Running the Test Case Applications* (20th April 2021, 6 pp.)

  This document explains how to replicate the experiments presented and discussed in the main paper. It includes instructions about how to retrieve and process extra data that cannot be distributed in this archive, but are nevertheless required to complete the simulation experiments.

`jeasim_defs.pdf`
: *Setting up a simplified version of the early diagenesis model of Jourabchi et al. (2008) with* MEDUSA (7th August 2020, 12 pp.)

  This memo lays out the foundations of the original model configuration of Jourabchi et al. (2008) and details the simplifications and conversions adopted to produce the JEASIM application.

`medmbm.pdf`
: MEDMBM*: Coupling* MBM *and* MEDUSA – *A tentative handbook* (28th July 2020, 21 pp.)

  This is the users' guide to the coupled ocean carbon cycle-sediment model MEDMBM. All the necessary input and configuration files for running the coupled model are detailed.