



## The PRISM couplers: OASIS3 and OASIS4

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The OASIS3 and OASIS4 couplers, developed in the framework of the EU FP5 PRISM project, are software allowing synchronized exchanges of coupling information between numerical models representing different components of the climate system. The component models themselves may remain separate executables, keeping their own main options as in the uncoupled mode.

OASIS3 is the direct evolution of the OASIS coupler developed since more than 10 years at CERFACS (Toulouse, France). Portability and flexibility are OASIS3 key design concepts. At run-time, OASIS3 acts as a separate mono process executable, which main function is to interpolate the coupling fields exchanged between the component models, and as a library linked to the component models, the OASIS3 PRISM Model Interface Library (OASIS3 PSMILe). OASIS3 supports 2D coupling fields only. To communicate with OASIS3, directly with another model, or to perform I/O actions, a component model needs to include few specific PSMILe calls. OASIS3 PSMILe supports in particular parallel communication between a parallel component model and OASIS3 main process based on Message Passing Interface (MPI) and file I/O using the GFDL mpp\_io library. OASIS3 has been extensively used in the PRISM demonstration runs and is currently used by approximately 10 climate modelling groups in Europe, USA, Canada, Australia, India and Brasil.

As the climate modelling community is progressively targeting higher resolution climate simulations run on massively parallel platforms with coupling exchanges involving a higher number of (possibly 3D) coupling fields at a higher coupling frequency, a new fully parallel coupler OASIS4 has also been developed within PRISM.

The concepts of parallelism and efficiency drove OASIS4 developments, at the same time keeping in its design the concepts of portability and flexibility that made the success of OASIS3. OASIS4 main functional parts are the Driver, the Transformer, and the OASIS4 PRISM System Model Interface Library (OASIS4 PSMILe). During the run, OASIS4 Driver extracts the configuration information defined by the user in XML files and organizes the process management of the coupled simulation. OASIS4 Transformer performs, in a fully parallel mode, the interpolation of the coupling fields. OASIS4 supports 3D and 2D coupling fields. To interact with the rest of the coupled model, the component models have to include specific calls to the OASIS4 PSMILe, which, at runtime performs fully parallel the MPI-based exchanges of coupling data including automatic repartitioning, either directly or via additional Transformer processes, and file I/O using the GFDL mpp\_io library. At the beginning of the run, the OASIS4 PSMILe also performs, for the coupling field interpolation, a parallel neighborhood search based on a multi-grid algorithm. OASIS4 portability and scalability have been demonstrated with different "toy" models and OASIS4 has also been used to realize the coupling between the MOM4 ocean model and a pseudo atmosphere model.

The OASIS4 PSMILe Application Programming Interface (API) was kept as close as possible to OASIS3 PSMILe API. This should ensure a smooth and progressive transition between OASIS3 and OASIS4 use in the climate modelling community.