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A review of the coupling software developed and used in the climate modelling community

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Coupling numerical codes is certainly not a new preoccupation in the climate research community and in other research fields such as electromagnetism or computational fluid dynamics. Ideally, the software interface between the different scientific modules should ensure an efficient realization of the coupled simulation on different types of platforms while allowing testing of different coupling algorithms and an easy replacement of one or more modules for inter comparison exercises. These specifications suggest modularity, portability and efficiency as key concepts onto which to base the design of the software.

In the climate modelling community, different approaches exist to answer these specifications. On one hand, some tools ensure a minimal level of interference in the original codes so that they will run in the coupled system with main characteristics unchanged with respect to the uncoupled mode. This approach, while in some cases less efficient than a more integrated approach, is probably the best trade-off that can be chosen when the different component models come from different research groups that also use these components independently in stand-alone mode for other research purposes and that are not likely to follow strict coding rules imposed by external constraints.

On the other hand, some tools or frameworks require more modification or adaptation of the original codes and are used to build and control a hierarchical merged application integrating the different elemental pieces of the original codes. This approach ensures efficient coupling exchanges within the merged application but requires a deeper level of interference in the codes and imposes strict coding rules in order to take full advantage of the framework functionalities. This second approach is therefore probably the most recommended one in a controlled top-down development environment.

In this talk, we will review the different coupling tools developed and used in the climate modelling community, following more or less the different approaches described above.