

# Computational aspects and performance evaluation of the IFS-XIOS integration

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This work analyzes and improves the I/O process of IFS, one of the most important atmospheric models used around Europe. IFS can use two different output schemes: the MF I/O server and an inefficient sequential I/O scheme. The latter is the only scheme that can be used outside ECMWF. This is the case of EC-Earth, a global coupled climate model that uses IFS as its atmospheric component. In recent experiments of EC-Earth, the I/O part of IFS represented about the 30% of the total execution time. Furthermore, EC-Earth experiments have to run post-processing tasks that perform costly operations.

Therefore, it is presented an easy-to-use development that integrates an asynchronous parallel I/O server called XIOS into IFS. XIOS offers a series of features that are especially targeted to climate models: netCDF format data, online diagnostics and CMORized data. Thus, it will be possible to shorten the critical path of EC-Earth experiments by concurrently running the post-processing task along the EC-Earth execution.

Moreover, a profiling analysis is done to evaluate the new computational performance of the IFS-XIOS integration, proving that the integration itself is not optimal. Thus, it is necessary to optimize it in order to increase both computational performance and efficiency. As a consequence, different HPC optimization techniques, such as computation and communication overlap, are applied in the integration to minimize the I/O overhead in the resulting IFS execution. This proves that it is necessary to analyze from a computational point of view any type of implementation.

The results show that the use of XIOS in IFS to output data is certainly good. This new parallel scheme has reduced significantly the execution time of the original sequential scheme. In one of the tests, XIOS is able to output 3.2 TB of data in only two and a half minutes of overhead. Furthermore, when the cost of converting GRIB to netCDF files is taken into account, the use of XIOS causes that the overall execution is three times faster.

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