



## IFS-SP/FVM Performance Assessment Summary

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The assessment originated from the customer interest in comparing two versions of the code, one being used in production (IFS-SP) and an alternative version in development (FVM). They were analyzed under strong scaling behavior with runs up to 1680 cores on Summit (ORNL) in hybrid MPI/OpenMP mode with 4 threads per process. Both codes have been developed by ECMWF, who uses IFS for its operational predictions.

The two main areas of identified potential for improvement of **IFS** are the granularity and order of computations and communications in the data exchange regions and the scalar performance in some of the computation regions. The analysis showed how typical pack/unpack computations of very fine granularity that do not parallelize well with OpenMP are serialized in the critical path and thus delay the injection and draining of messages. Coarser grain parallelization (using tasks) has the potential to improve the communication performance in these regions. The **FVM** code exposes less sensitivity to the data transfer issues but shows an increase in the total number of instructions with scale thus losing the potential better scaling foreseen when starting its development. Regions with very poor IPC were also identified in this application.

The analysis also found other aspects about the structure of the applications with minor impact on the performance at the analyzed core counts but whose avoidance would result in a cleaner, easier to maintain or more malleable code versions. The usage of nested OpenMP in sections where it was not really needed and just added overhead or the use of very coarse grain parallels without worksharing constructs are examples of such patterns that we would recommend to avoid.

The assessment can be found at

[https://pop-coe.eu/sites/default/files/pop\\_files/pop2-ar-ifs.pdf](https://pop-coe.eu/sites/default/files/pop_files/pop2-ar-ifs.pdf)

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