On the feasibility of overnight industrial high-fidelity simulations of CSP technologies on modern HPC systems

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In the last decades, computational fluid dynamics (CFD) has become a standard design tool in many fields, such as the automotive, aeronautical, and renewable energy industries. The driving force behind this is the development of numerical techniques in conjunction with the progress of high-performance computing (HPC) systems. The main recognised limitations of high-fidelity simulations in the industry are their computational cost and wall-clock simulation time. Thanks to the advent of new computational architectures, the former is becoming less and less critical, whereas the latter is still the most limiting factor precluding large-eddy simulations (LES) from being routinely used in the industry. For that to be possible, the consensus is that widespread adoption in the industry begins when a run can be carried out overnight. In this context, this work assesses the feasibility of overnight LES simulations on GPU-accelerated supercomputers with TFA, our novel in-house code, which relies on a symmetry-preserving discretisation for unstructured collocated grids that, apart from being virtually free of artificial dissipation, is shown to be unconditionally stable. The cases of study will be taken from central receivers used in concentrated solar power (CSP) plants, and a comparison with open-source CFD codes will be made.