Topic Selection: Challenges for Weather, Water and Climate Modeling at Exascale
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Code design and performance considerations for Exascale computing

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Future exascale HPC awaits advanced meteorological software to exploit technology breakthroughs. To benefit from such computational resources, software for weather predictions needs to meet not only scientific merit, but computational criteria, such as, abundant parallelism for HPC, high computational intensity, low MPI communication cost (e.g. surface to volume ratio), and high FLOPS requirements. We intend to design a clean, small software ("dwarfs") with notable advantages: (i) flexibility to adopt advanced computing standards and methods, (ii) compatibility to idealized tests via modules, (iii) metrics calculations for computational efficiency. We will potentially investigate effects on performance and numerical error of such fundamental considerations as grid choice. This effort will reveal suitability of existing methods for emerging or proposed exascale architectures, and rank algorithms that map to these architectures. We will report the current status of this ongoing work.