**Title**: Solving an elliptical problem on a cubic sphere grid

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**Abstract**: Continuous progress in computational science allow us to run numerical weather prediction model at ever increasing resolution. However, the architecture of the current high-performance computers requires that the numerical methods be easily parallelizable. In this study we examine the possibility increasing the parallelizability by generalizing the Yin-Yang approach used operationally at the Canadian Meteorological Center (Environment and Climate Change Canada) to the ‘cubic sphere’. Following Qaddouri et al. (2008), we develop here a 'cubic sphere' grid free of singularity and quasi-uniform grid spacing. As a first step, we examine the Helmholtz problem on the sphere associated with a semi-implicit or implicit time-discretization. The grid is obtained by superimposing six identical rectangular latitude/longitude panels for which a local solution is obtained. The global solution is obtained by stitching these local solutions with a domain decomposition method. The convergence is accelerated by allowing each domain to overlap with their neighboring domains. We need enough overlap to ensure fast convergence without increasing drastically the computational cost of each local solve. The first condition to be met is the convergence of the whole process for one timestep. The next condition is the requirement of stability. We have proven the first condition. We have defined a pure gravity-wave problem on the sphere to test the stability.

**Key words**: Cubic sphere, domain decomposition method, parallelism, Helmholtz problem, latitude/longitude panels, overlap, stability