Development of a parallel spherical harmonic transform library: design and performance (preliminary)

*齋藤 冬樹[1]
*Fuyuki SAITO[1]

1. 独立行政法人海洋研究開発機構
1. Japan Agency for Marine-Earth Science and Technology

The spherical harmonic transform (SHT) is a typical method to describe the dynamical core in climate models (e.g. MIROC). SHT is a combination of two transformation: a Fourier transformation in longitude and an associate Legendre transformation in latitude. Therefore, a simple way to introduce SHT in parallel computing is to apply domain decomposition in latitudes only, involving a relocation in latitudes before/after the Legendre transformation. However, the number of maximum processors is limited by the size of latitude dimension, which is an obstacle to more efficient computing. Recently the `physics' routines in a climate model have become more and more complex and expensive, thus the heavy computation significantly suffers from the limitation. A new (yet-another) library, ***Flageolet***, has been developed to help parallel processing of SHT in particular for climate models like MIROC, to support more flexible domain decomposition, following the approach adopted in several 3D FFT libraries. This study presents a design of ***Flageolet*** and show preliminary results of the performance tests for various sizes of domain around T213 or more, examined on the Earth simulator.

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