

The use of parallelized ispack
and spml in the dcpam

Motivation

- A part of ispack (snpack and fftw2 version of p2pack) has been parallelized by using OpenMP.
- The spml has also been updated to use the parallelized ispack.
- The dcpam should be able to use these parallel computation capability with a little modification.
- In this work,
 - I try to use parallelized ispack and spml in dcpam.
 - I examine the scalability of the “parallelized dcpam”.

A test of dcpam for parallel computation

- Computer (eva05.ep.sci.hokudai.ac.jp)
 - Dual CPUs SMP system of Intel Xeon Processors 3.2 GHz
 - 2 GB memory
- Model
 - dynamical core of dcpam without horizontal diffusion and any forcing
 - T42L20 resolution, 1 day integration
 - Parallelization by using OpenMP
 - The ispack version 0.71 and the spml version 0.4.0-2 are compiled by using the Fujitsu Fortran compiler with `-Kfast,OMP` option.
 - A little modification has been done for dcpam. The details are described later.

Results

- Model seems to work well.
 - The result obtained from a computation with 2 CPUs is almost the same as that with 1 CPU, but is not exactly same.
- Computational speed of dynamical core of the “parallelized dcpam”
 - $T_1/T_2 \sim 455 \text{ s}/325 \text{ s} \quad \sim 1.4$
 - TX indicates computational time when X CPUs are used.

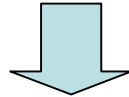
Results with auto parallelization

- Computational speed of dynamical core of the “parallelized dcpam” when auto parallelization is used
 - $T1/T2 \sim 491 \text{ s}/500 \text{ s} \sim 1.0$
 - The ispack, the spmodel, and the dcpam are compiled with `-Kfast,parallel` option. The `PARALLEL` environmental variable is set to 2 when 2 CPUs are used.
 - It was checked that 2 CPUs were active.
 - Were something wrong?

Modification of dcpam to use parallelized spml and ispack

The spml_init subroutine of src/shared/spml.f90 should be rewritten like below:

```
call wa_Initial(nm,im,jm,km)
```



```
!$ use omp_lib  
...  
integer(intkind) :: nthreads  
...  
nthreads=1  
!$ nthreads=omp_get_max_threads()  
call wa_Initial(nm,im,jm,km,nthreads)
```

Specify the number of processors to OMP_NUM_THREADS environmental variable when multi-processors are used.

Summary

- Owing to the parallel computational capability of the ispack and the spml, the dcpam can be parallelized with only a little modification.
- For T42L20 resolution, when two CPUs are used, the computational speed of dynamical core of the dcpam is about 1.4 times as fast as that with one CPU. The parallelization using OpenMP seems to be much better than that using auto parallelization, at least, on our computer.
- It should be remembered that the results are not the same when the number of CPUs changes.