

AGCM parallel algorithm development for cluster computers

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Computing Centre (CC) AGCM uses uniform 72 degrees on longitude and 46 degrees on a latitude horizontal grid for single processor computer. Program was modified for high performance cluster.

Global area was distributed between processors (domain decomposition) on meridians at parallel version of the program.

Advantage of this way is that all this geographic areas are similar, and the same algorithm of calculations can be used on all processors. Lack of this approach is that each of areas borders on all by others (in points of northern and southern poles). It results that the data on the previous temporary layer are necessary for receiving for calculations of points near to poles from all other processors, that assumes enough amount of information interchanges between processors.

The information interchanges between processors on each time layer (sublayer) are necessary only at performance advective steps. All areas are identical with the computing point of view, and the amount of the information, transmitted between processors, is not great, namely, those parts of numerical arrays are transferred only which correspond to boundary points of subareas. It provides high efficiency of algorithm.

The library MPI was used as a means of parallel program realization.

The opportunity of splitting on various number of subareas is stipulated in parallel variant of the program, depending on quantity of the involved processors. The data received on the single processor computer are used as initial. The converter program is created for compatibility with the available data.

The basic properties of the given parallel program briefly can be formulated as follows:

1. Amount of duplicated operations is small, because all calculations will be carried out independently, and the group operations are effectively realized by means MPI.

2. Loading on processors is balanced, as the area is divided into subareas identical each other.

3. Time of is small, as the volumes of the information, sent at exchanges, are small, and the time of calculations between exchanges is rather great.

4. The memory of processors is used effectively, as the basic volumes of the information - file of results and all preliminary files - are allocated on processors.

The test calculations on high-efficiency Computer Center cluster. (2 - 8 processors) are carried out. The good agree of results for single processor and parallel programs is received. The comparison of times of calculations has shown (fig. 1), that on 4 processors the acceleration at 3.81 times is received in comparison with the single processor program. It corresponds to efficiency 95 %, that allows to make a conclusion about the good parallel characteristics of the developed program.

It is necessary to study other ways of considered area splitting: splitting along geographical parallels, and splitting combining both ways. Also it is necessary to provide an

opportunity of transition to more detailed grids, that is required for coupling of regional models with global.

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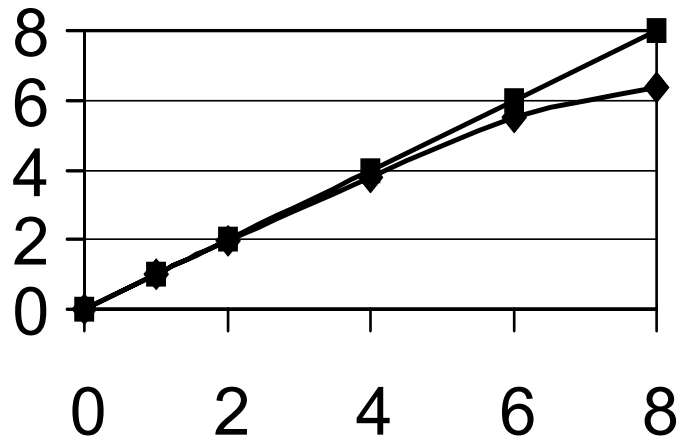


Figure 1. Dependence of run acceleration (lower line) from processors numbers (horizontal axes)