INSTYTUT METEOROLOGII
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TITLE :	**IMPLEMENTATION OF TILE APPROACH IN COSMO AT IMWM**
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Data chosen for tests and why ?

2009.II.01 *
- low temperature
- the ground was frozen solid

2009.IV.22 *
- sunny/fair day

2009.X.16 (analysis done)
ground snow-covered

2009.XI.04 *
windy day with precipitation

2009.XI.21 *
foggy day

* By the end of March analysis will be done for all cases

Methodology

Comparison
(for **all combinations** of **convection** and **numerical** schemes)

- orig vs ctrl
- orig vs subs
- orig vs twins
- twins vs subs

Statistics
(for **all combinations** of **convection** and **numerical** schemes)

- correlation
- standard deviation
- covariance
- variance

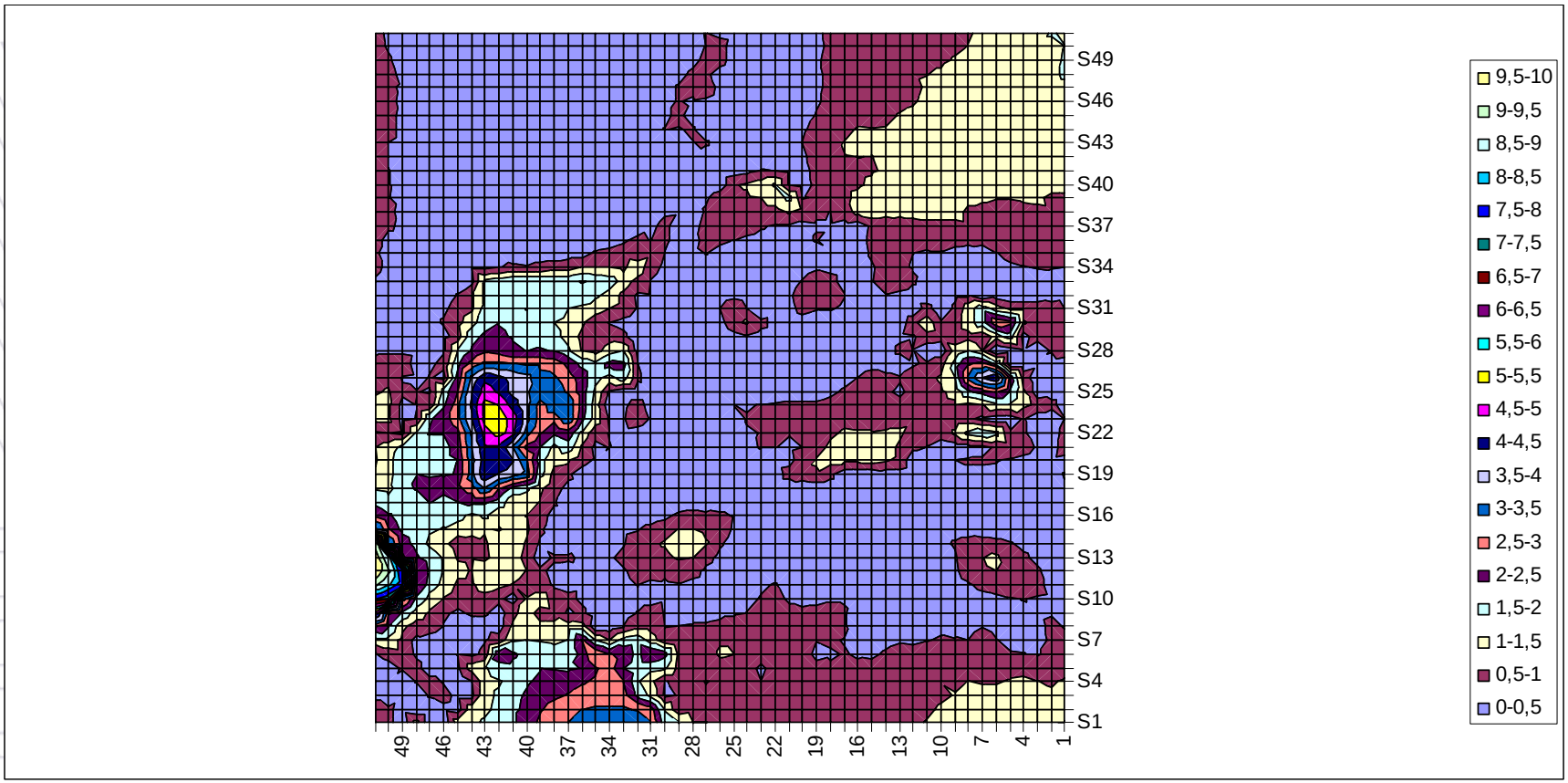
The ”worst” configurations and results

Te worst configuration (concerning correlation coefficient) was obtained for lapsemi – orig, ctrl and subs vs. twins – results for soil temperature

correlation coefficient – TSO						
	leapdef	leapdef1	leapsemi	leapsemi1	RungeKutta1	RungeKutta2
orig-twins	1	1	0,85	1	1	1
orig-subs	0,998	0,998	0,997	0,996	0,998	0,998
orig-ctrl	1	1	1	1	1	1
ctrl-twins	1	1	0,85	1	1	1
ctrl-subs	0,998	0,998	0,997	0,996	0,998	0,998
subs-twins	0,998	0,998	0,85	0,996	0,998	0,998

The ”worst” configurations and results

Soil temperature at 0 cm down (surface temp.)

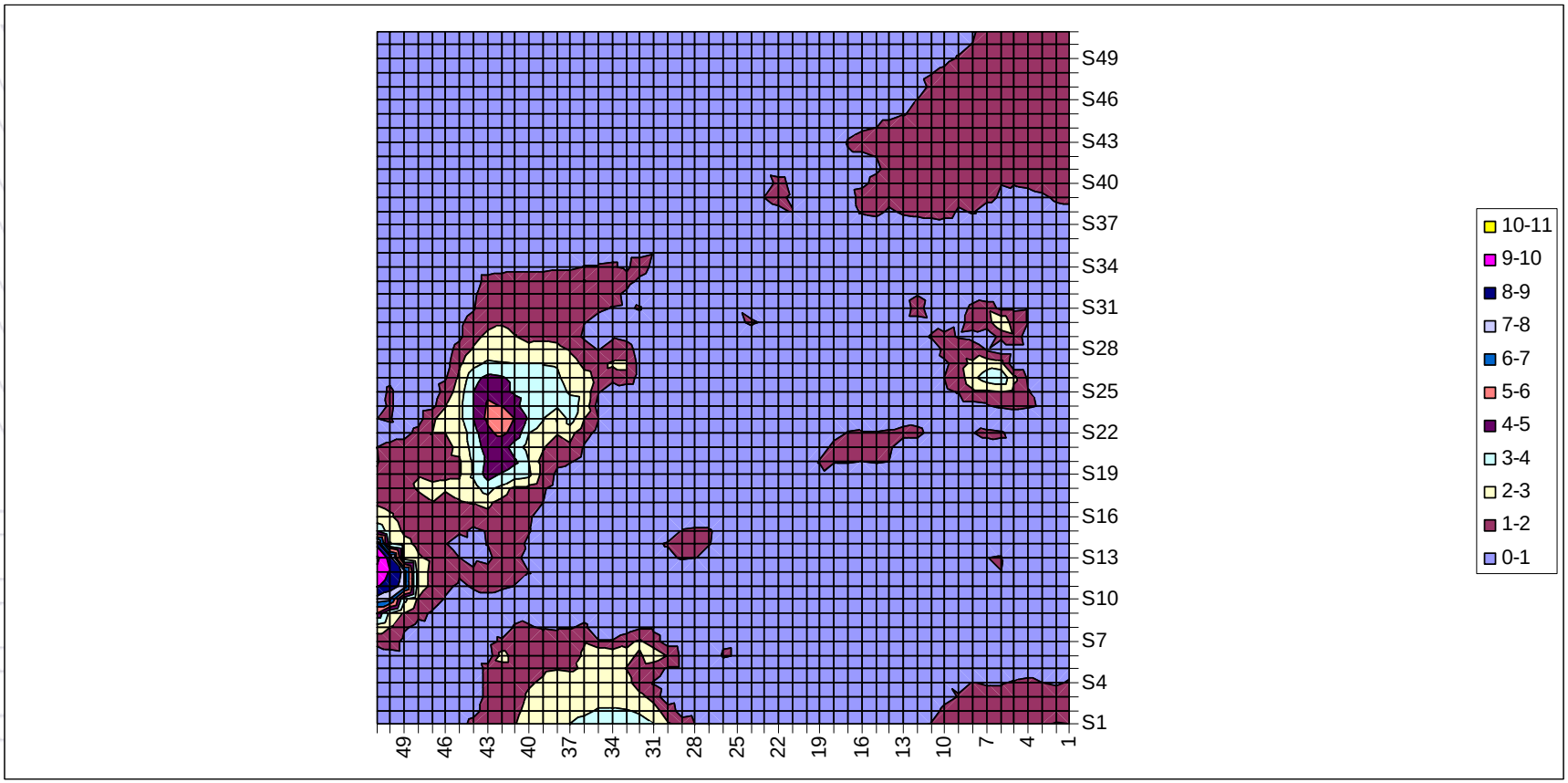


DIFFERENCE BETWEEN ORIG AND TWINS (K)

CORRELATION: 0,85

The ”worst” configurations and results

Soil temperature at 0 cm down (surface temp.)

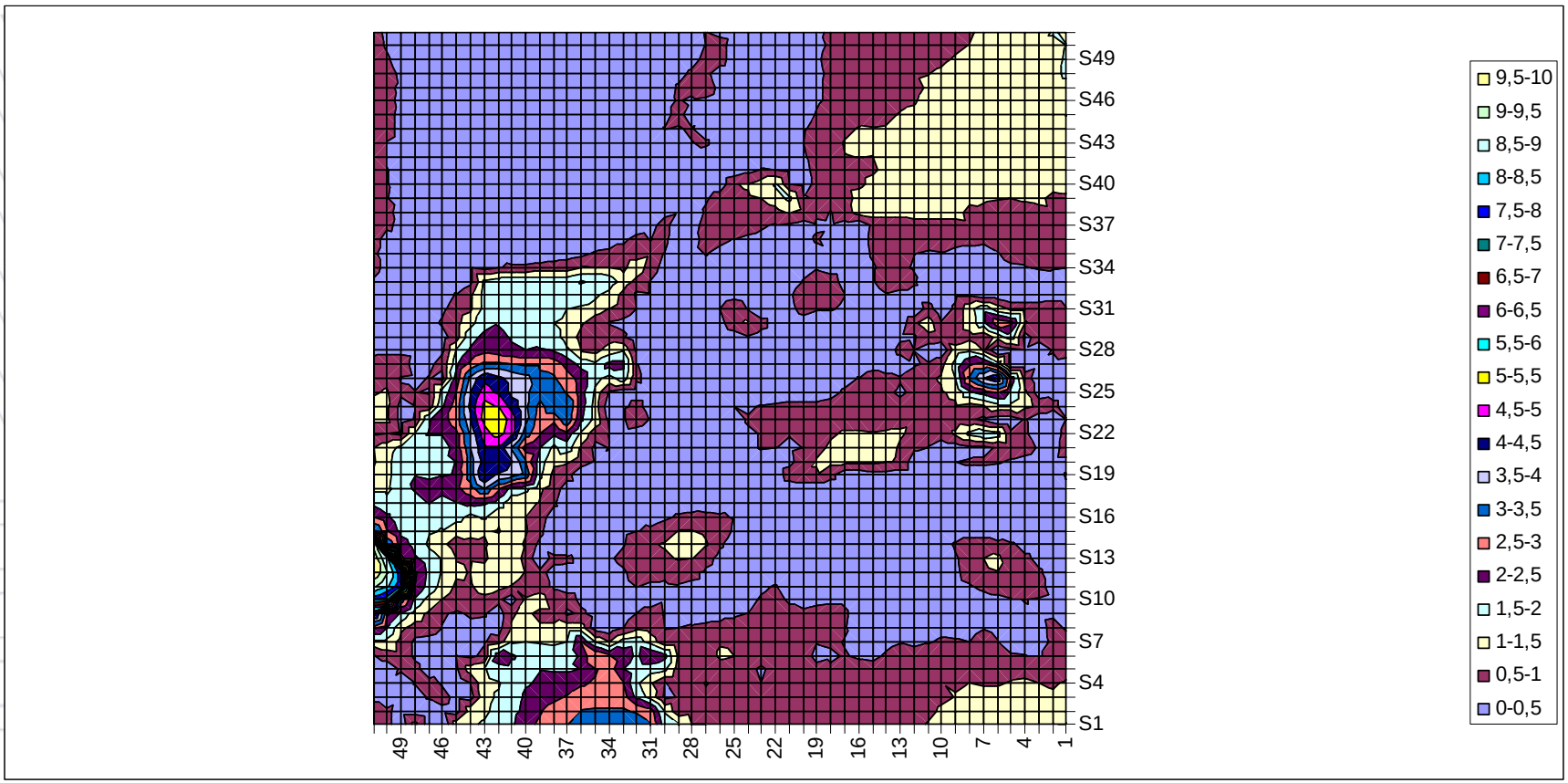


DIFFERENCE BETWEEN SUBS AND TWINS (K)

CORRELATION: 0,85

The ”worst” configurations and results

Soil temperature at 0 cm down (surface temp.)



DIFFERENCE BETWEEN CTRL AND TWINS (K)

CORRELATION: 0,85

IMPLEMENTATION OF TILE APPROACH IN COSMO AT IMWM

Costs of modified code with nsubs=4 compared to original code

Mean values of the timings for all tasks; timings for 5 x 5 cores:

	COLOBOC4.8 (nsubs=4, itype_subs=1)	LMPARBIN (COSMO4.8)
Time for…		
setup:	0.05	0.05
cleanup:	0.00	0.00
total run:	52.04	51.93
Time for…		
setup:	0.03	0.03
cleanup:	0.00	0.00
total run:	52.64	52.31
Time for:		
setup:	0.03	0.03
cleanup:	0.00	0.00
total run:	52.79	51.91

WRONG (see mail 03.03.2010)

Costs are respectively: 0.2%, 0.6% and 1.7%. (On average approx. 0.8%)

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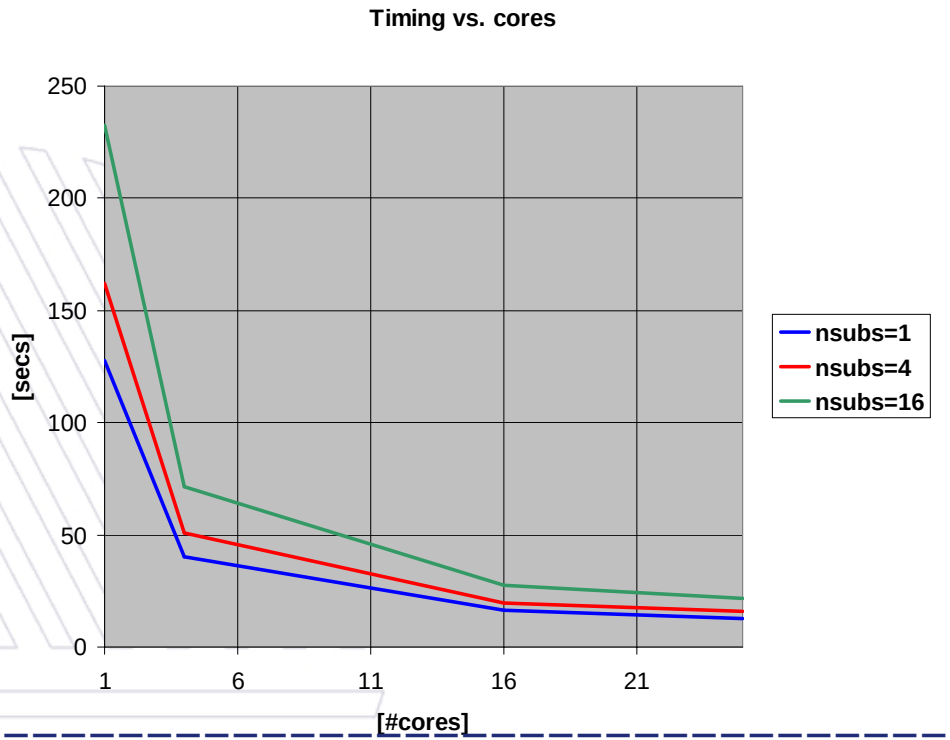
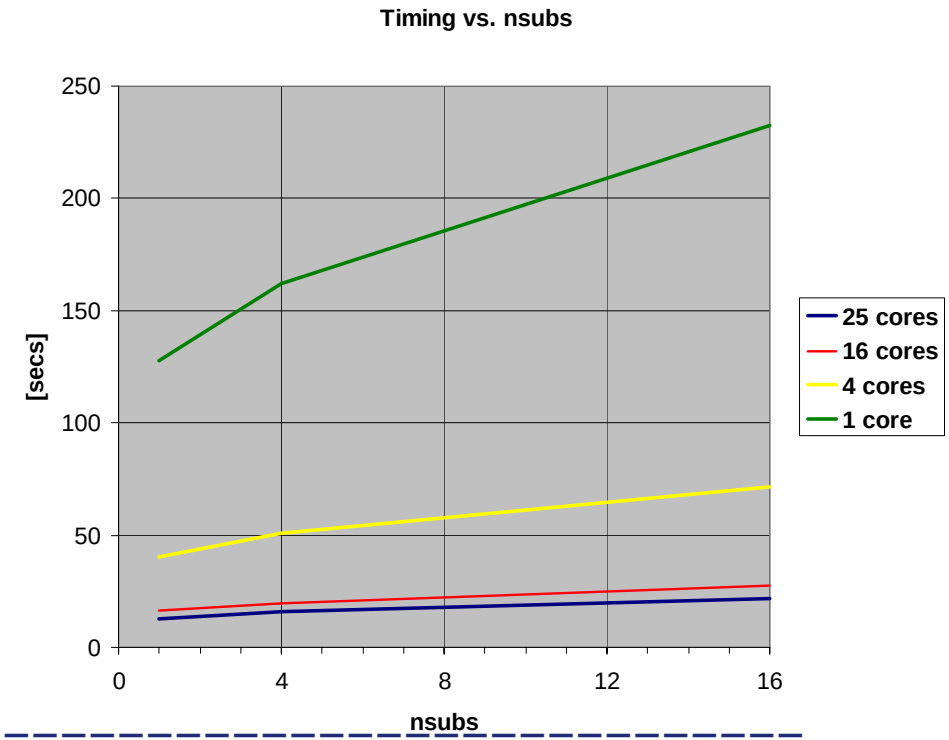
nsubs and number of processors (cores)





Timing (s)

#subs^	25	16	4	1	<-- #processors
1	12.93	16.25	40.50	127.75	
4	15.70	19.58	50.83	162.00	
16	21.54	27.52	71.72	232.27	

Numerical aspects – pertains to Xeon processors in Linux clusters

Problems with running COLOBOC – new machine – Intel-Xeon-based cluster.
Following error messages from some/all cores used for computation:

```
---------------------------------------------------------------------------
[cli_17]: aborting job:
Fatal error in MPI_Address: Invalid argument, error stack:
MPI_Address(137): An address does not fit into a Fortran INTEGER.
Use MPI_Get_address instead
---------------------------------------------------------------------------
```

Solution: following changes in subroutine "setup_data_type" in module "environment.f90" should be introduced:

1. change all the calls to MPI_ADDRESS to MPI_GET_ADDRESS
2. change the KIND=iintegers to KIND=MPI_ADDRESS_KIND in local variables used with these calls
3. change all the MPI_TYPE_STRUCTs to MPI_TYPE_CREATE_STRUCTs in the subroutine.

According to Uli Schaettler, another way (mainly for 64-bit machines) is to set in namelists ldatatypes=.FALSE.
However, the 1-3 above change obsolete functions of MPI into newer ones
And… the above solution probably will be implemented in COSMO v. 4.11

Numerical aspects – setup of input initial/boundary data

Problems with preparing initial/boundary data (laff- and lbff files) – Script named gen_ana_subs generates some extra (and absolutely unnecessary) bytes between resulting grib records (at least on SGI machine and on Intel-Xeon based cluster) – need to remove it.

Explanation:

Normal situation(s):

GRIB……7777GRIB……7777GRIB……7777 etc.

or

GRIB……7777[8bytes]GRIB……7777[8bytes]GRIB……7777[8 bytes] etc.

8 bytes is an info on record size – in case of record of constant length

Abnormal situation

GRIB……7777xxGRIB……7777xyzGRIB……7777xx etc.

Temporary solution – cut off any extra byte(s) from between records.

Appropriate solution – review *grid2slice* code to eliminate cause.

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”Done” list, ”To-do” list, conclusions

1. 1.08.2006 – 12 UTC - the first numerical experiment: results weren’t satisfactory
2. We have chosen 6 different meteorological situations
3. We have finished analysis for one case (16.10.2010 – 00 UTC) –
   results are much better than in previous case (because of bug detection and elimination)
4. Shallow convection scheme – also included in tests, results will be available very soon
5. By the end of March we will finished analysis for remaining cases
6. Documentation of changes will be available by the end of March, 2010
7. The most time-consuming processes - with increasing *nsubs* – are horizontal advection,
   soil model and turbulence computations.

THANK YOU FOR YOUR ATTENTION

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