DDT,
a Global Debugger Solution at KIT

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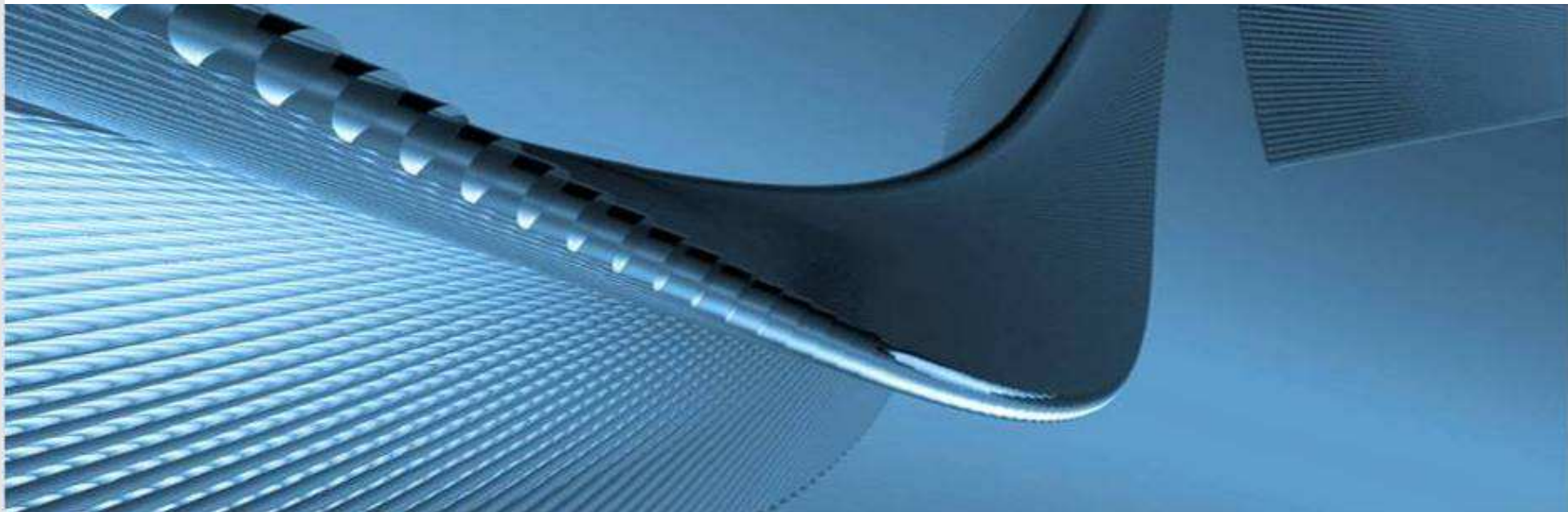
Karlsruhe Institute of Technology (KIT)

University

11	fakulties
120	institutes
4,000	employees
18,500	students
250 mio €	budget

Forschungszentrum

science
education
structures for the
administration

institutes

services

infrastructure

10	programs (research areas)
21	large institutes
4,000	employees
310 mio €	budget

n **Karlsruhe Institute of Technology -
two strong partners united**

  ¤ Universität Karlsruhe (TH)

    n One of the most research oriented universities in Germany
    n Nominated to one of three top universities in October 2006
    n Capitalized with over 100 million € over 5 years

  ¤ Forschungzentrum Karlsruhe

    n Member of the Helmholtz Association
    n Internationally acknowledged non-university institution

n **Under the roof of KIT –
Steinbuch Centre for Computing**

  ¤ Computing Center of the Universität Karlsruhe (TH)

  ¤ Institute of Scientific Computing at the Forschungszentrum Karlsruhe

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in der Helmholtz-Gemeinschaft

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Virtual Computing Centre Karlsruhe since 1996

RZ Uni KA

IWR / FZK

Cooperation in
High Performance Computing

Virtual Computing Centre since 1996

- n IT-Services for UKA
- n High Performance Computing
- n Numerical Methods on HPC
- n Integrated Information Mgmt.

- n IT-Services for FZK
- n Scientific Computing
- n GridKa, CampusGrid, D-Grid
- n Nat. & Intl. Grid Projects

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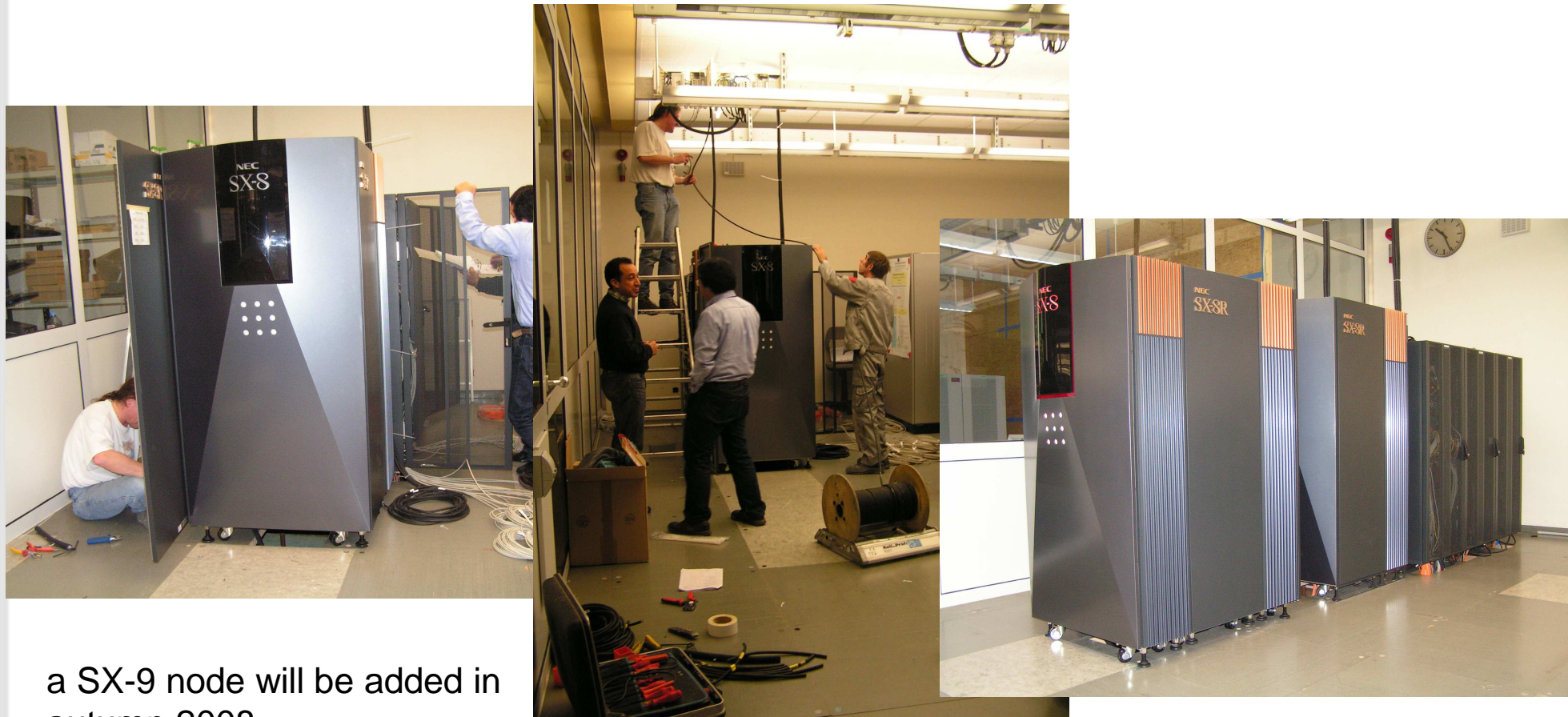# HP XC4000 – Baden-Württemberg-State-Supercomputer, a part of SCC

Phase 2 (Q3 2006)

» 750 4-way nodes (two sockets)
- dual core AMD Opteron 2.6 Ghz
- 16 GB main memory

» 10 server nodes

» 10 file server nodes
- Approx. 56 TB storage system

» Infiniband DDR interconnect

» 20 water cooled racks (HP MCS)

» **Total of 3000 processor cores**

» **Total of 15.6 TFlop/s peak** performance

» **Total of 12 TB** of main memory

» **Total 110 TB** of local disk space (scratch)

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Parts of SCC

a SX-9 node will be added in autumn 2008

DDT versions at KIT

- n 1.9.1c in the Linux based OPUS^{IB} environment
- n SX8beta6.RELEASE on SX8R and front-ends (Version 2.3)
- n 1.10 in the AIX environment
- n 2.2 on the HP XC4000 system

Concept: Like the solution with TotalView 5-10 years ago, SCC will give the users the possibility to use only one interface for solving problems in a parallel and heterogeneous environment. à in the future only one version should be in production

But: user's don't want to use a debugger. Help from the computer centre is needed!

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DDT at HP XC4000

n Interactive mode is limited to 8 tasks

n No limitation for batch, but wait time is required if the machine is fully loaded

DDT at OPUS^{IB}

n Interactive mode with only limitations in memory and CPU-time

n No limitation for batch, but wait time is required if the machine is fully loaded

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DDT under AIX

- n Interactive mode is limited to 8 tasks
- n No limitation for batch, but wait time is required if the machine is fully loaded

DDT at SX-8R

- n Interactive mode with no limitations in memory and CPU-time (interactive mode preferred), limitation is one node
- n No limitation for batch, but wait time is required because the machine is normally fully loaded

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DDT at SX-8R, some features

- Breakpoints
- attaching running processes
- OpenMP
- visualize data
- Watchpoints

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DDT problems at SX-8R

n timeout because debugging is not a high priority process, you have to set DDT_NO_TIMEOUT=1, it's not the solution but it helps!

n selection of message queues doesn't work

n the scalar unit of the SX-8R is very slow compared with x86 hardware

n add a close icon to close windows (some have it!)

n evaluating for visualization in 3D takes a lot of time

n adding static fields to a list of watchpoints is not possible

n 3-D view isn't very helpful, but the table helps a lot

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3-D view of data, helpfull?
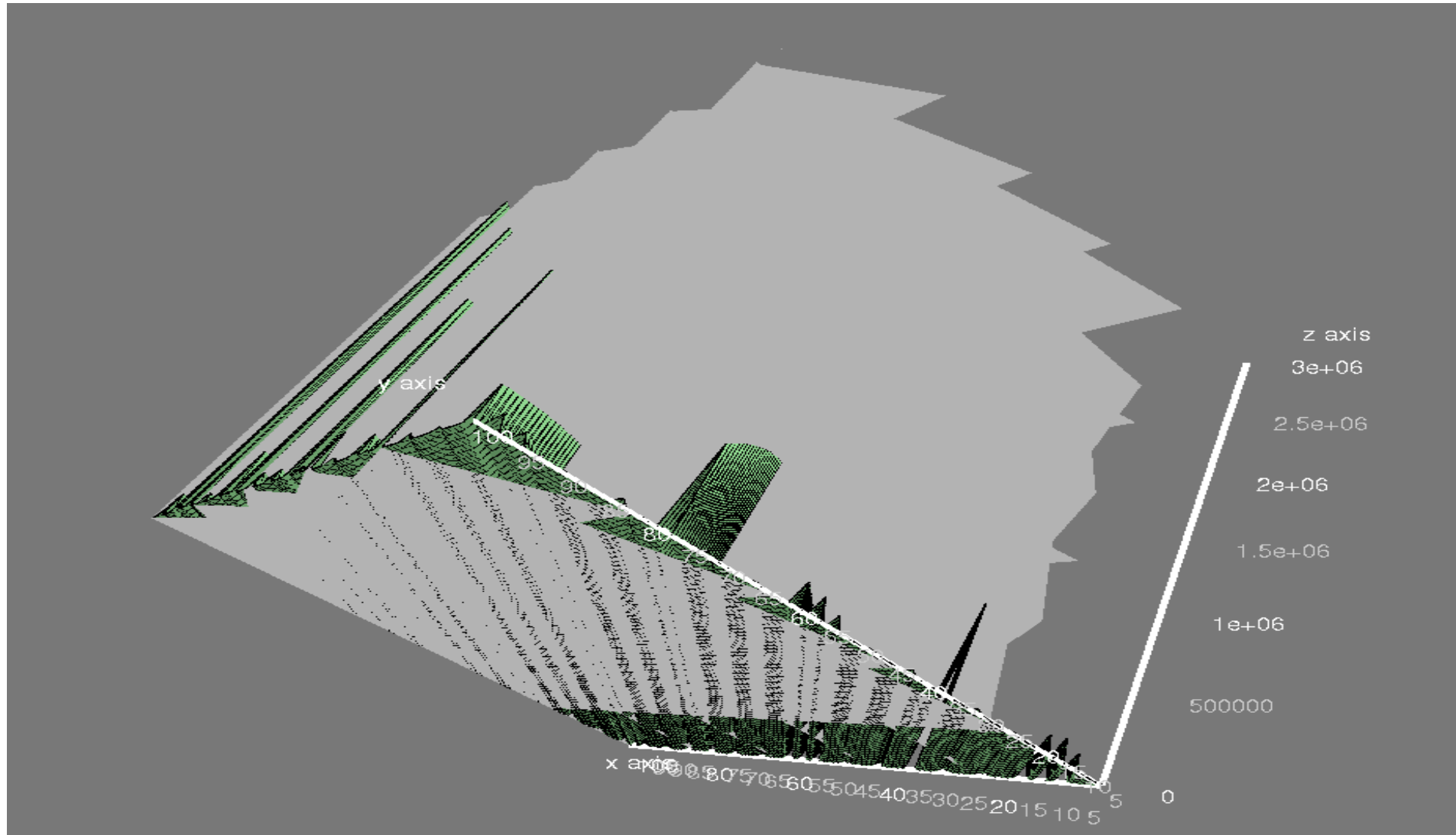
Data table

Array Expression: c[$i,$j]

Range of $i
From: 1
To: 100
Display: Rows

Range of $j
From: 1
To: 100
Display: Columns

☐ Auto-update

Evaluate

Cancel

Aggregate Function: Sum

☐ Filter: =

Data Table | Statistics
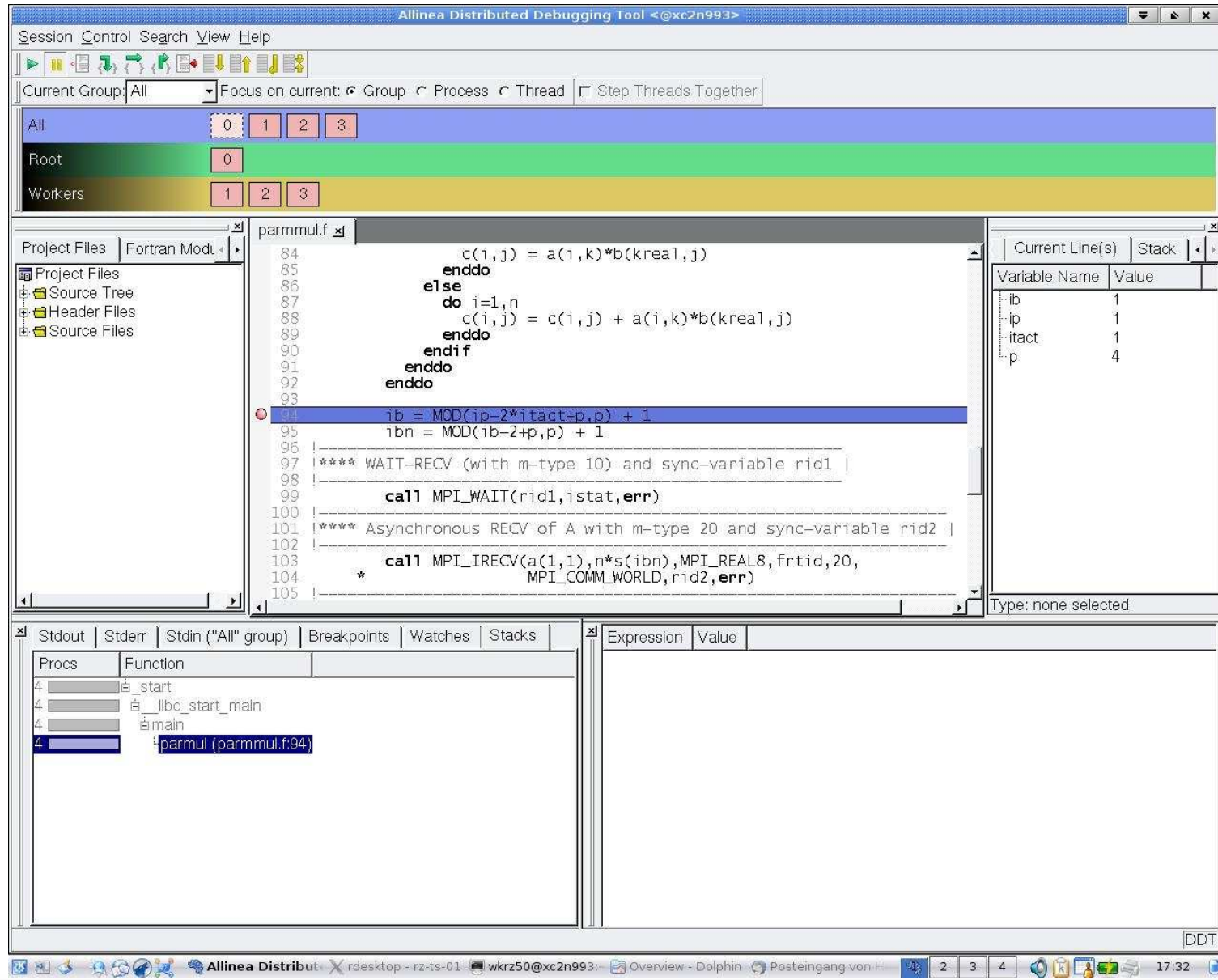
	1	2	3	4	5
1	10925.54870298208	1166.444316954099	571.1687855806970	512.7761596216023	785.6856
2	1166.444316954099	571.7380015093366	513.7971280909828	788.0304735593255	2938.907
3	571.1687855806970	513.7971280909828	788.8120804799773	2944.738150080539	87049.37
4	512.7761596216023	788.0304735593255	2944.738150080539	87142.89830155349	1733.850
5	785.6856527973699	2938.907474176382	87049.37528013957	1733.850981586058	664.0792
6	2927.246122368068	86768.80621589771	1730.448935629626	663.4315815664968	124890.6
7	86301.19110882796	1723.644843716763	661.4886028997657	124890.6107246275	673.8041
8	1713.438705847467	658.2503051218807	124890.6009732201	671.8517675277851	1792.370
9	653.7166882328418	124890.5863461092	668.5977728192163	1785.471708258071	100729.3
10	124890.5668432945	664.0421802272199	1775.123900701252	100201.8088397234	2997.151
11	658.1849897517960	1761.326823958828	99463.19693384752	2979.994768807044	819.3344

Expression "c[$i,$j]" evaluated for process 0 at 09:32.

Visualize in 3D | Export to Spreadsheet... | Close

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DDT at HP XC4000

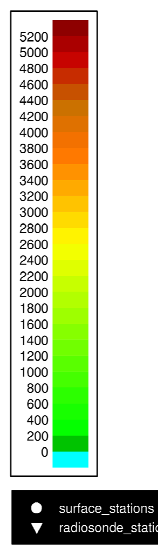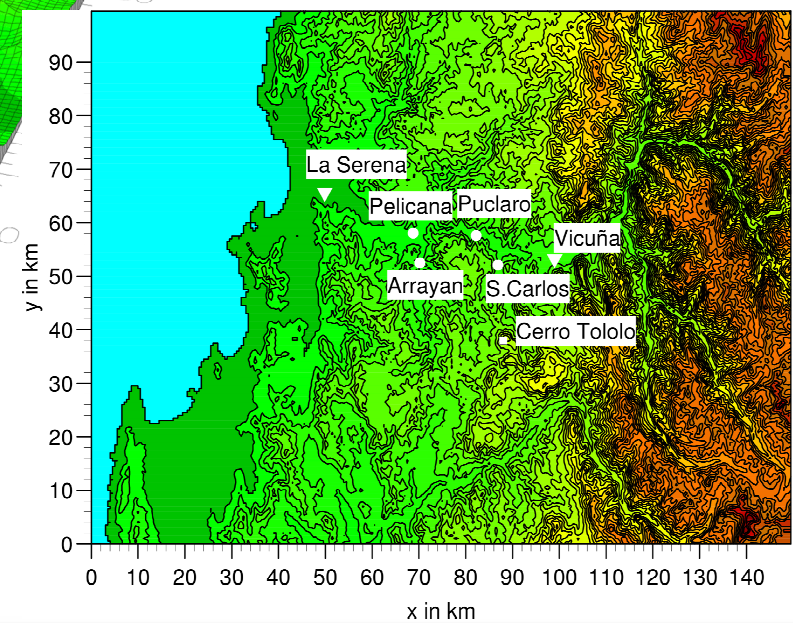Factor 20-25 between Cluster and vector computer

The influence of a Storage Lake in the Arid Elqui Valley in Chile on the Local Climate
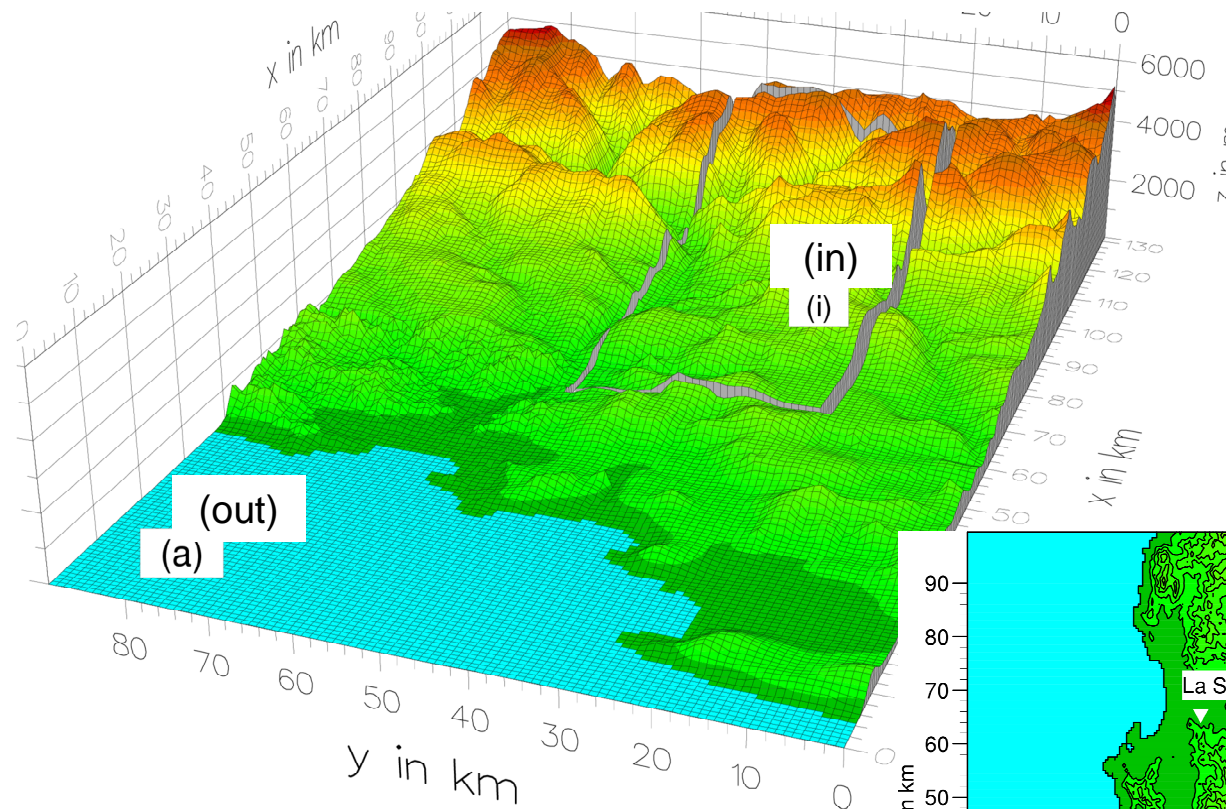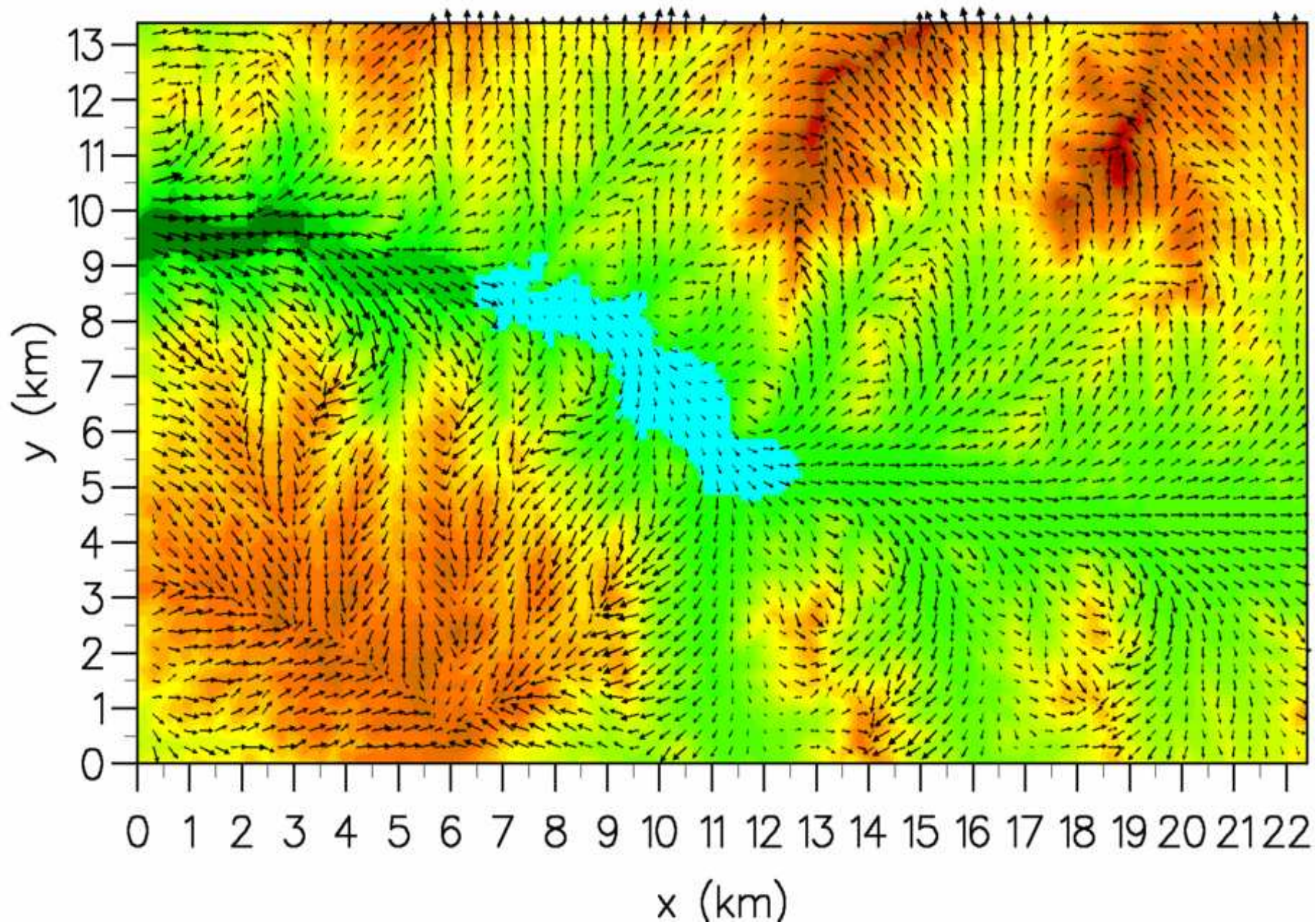

225 x 135 horizontal gridpoints
100   vertical levels

out: $\Delta x = 800$ m, $\Delta y = 800$m

in(1): $\Delta x = 400$ m, $\Delta y = 400$ m

in(2): $\Delta x = 200$ m, $\Delta y = 200$ m

in(3): $\Delta x = 100$ m, $\Delta y = 100$ m

Thank you!

Questions?