

GigaLES 2 Update

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Cyber Infrastructure Breakout -CMMAP Mtg Aug. 7

SAM Development

- Started with version 6.10.4
- ported SiB3; lagrangian parcel tracking (LPT)
- Added radiatively-active snow
- More microphysics statistics
- optimized routines for 3D output (write_fields3D); elliptic solver (pressure_big) - both optimizations increased its speed by about a factor of 3 on 1024 processes.
- A design document has been in circulation - available on request. Do we need a GigaLES-2 page on the CMMAP website for stuff like this?

Optimization Details - Elliptic Solver

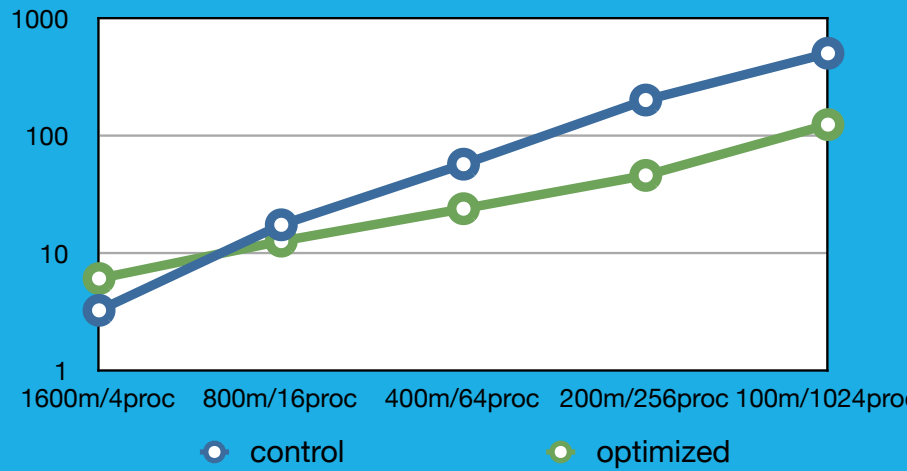
- Elliptic solver - replaced fft package with fftw. This required no extra ghost cells resulting in fewer fft calls, and fftw is about as fast a public domain fft there is.
- The direct transpose from x-z slabs to y-z slabs was replaced with the inverse transpose to the original rectangular decomposition, and then a transpose to the y-z slabs. For N processes, the former requires each process to send and receive N messages, the latter requires only $2*\text{SQRT}(N)$.

Optimization Details - Writing 3D Fields

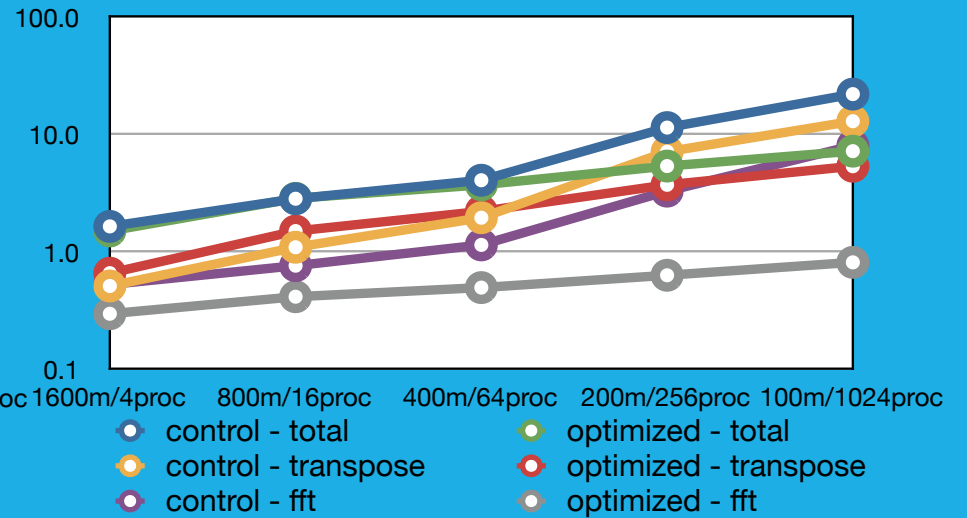
- Originally - every process sends its portion of the array to one process. This process must hold the entire array and write it in its entirety using only one I/O channel.
- NetCDF 4 parallel I/O calls were installed. Every process writes its own section of the array. The array is re-decomposed into x-z slabs to permit the maximum amount of data per write. The array dimensions are now (z,x,y).
- NetCDF output also saves a post-processing step of converting the data.

Scaling

WRITE_FIELDS3D - Time per call



PRESSURE_BIG - time



Run Status

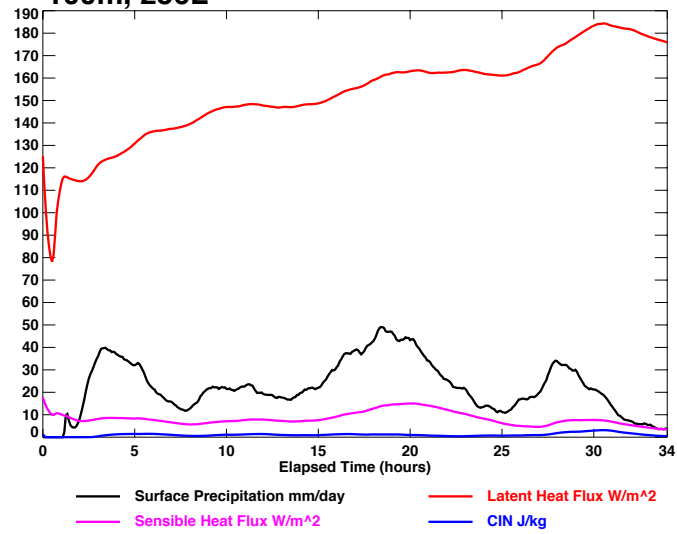
Experiment	simulation length	output volume	machine
TWPICE - 1600m, 64L Control	17 days: 0z 18 Jan - 0z 4 Feb	138GB	desktop
TWPICE - 1600m, 64L Radsnow	17 days: 0z 18 Jan - 0z 4 Feb	138GB	desktop
TWPICE - 800m, 256L Control	17 days: 0z 18 Jan - 0z 4 Feb	2.15TB	gordon
TWPICE - 800m, 256L Radsnow	17 days: 0z 18 Jan - 0z 4 Feb	2.15TB	stampede
TWPICE - 100m, 256L Radsnow	33 hours: 0z 18 Jan - 9z 19 Jan	13.2 TB (no LPT)	stampede
MC3E - 1600m, 64L Radsnow	testing		gordon
MC3E - 800m, 256L Radsnow			gordon
MC3E - 100m, 256L Radsnow			kraken
???			

Allocation Usage

machine	allocated	remaining (Aug 4)
gordon	1,700,000	1,643,596 (96%)
stampede	500,000	42,826 (8%)
kraken	1,600,000	1,126,245 (70%)

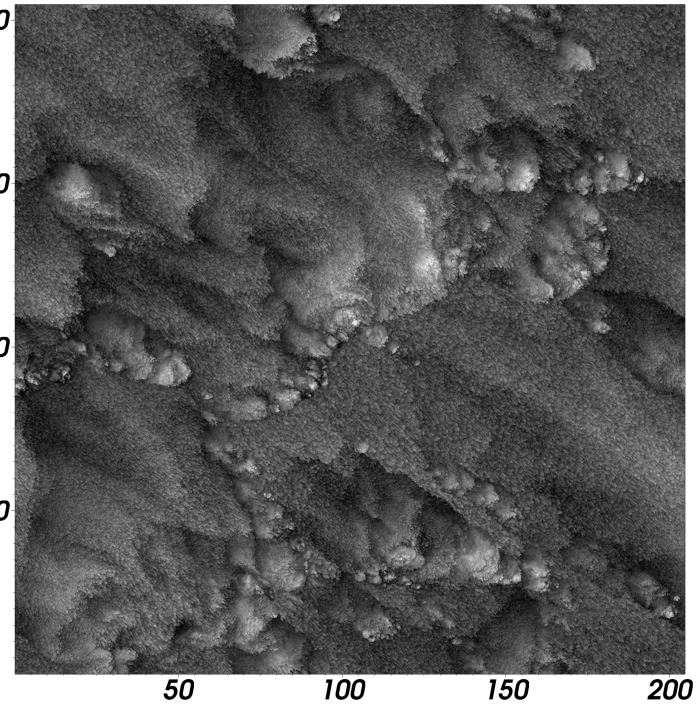
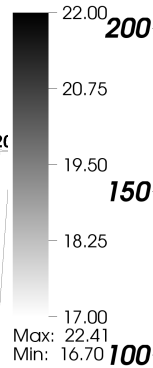
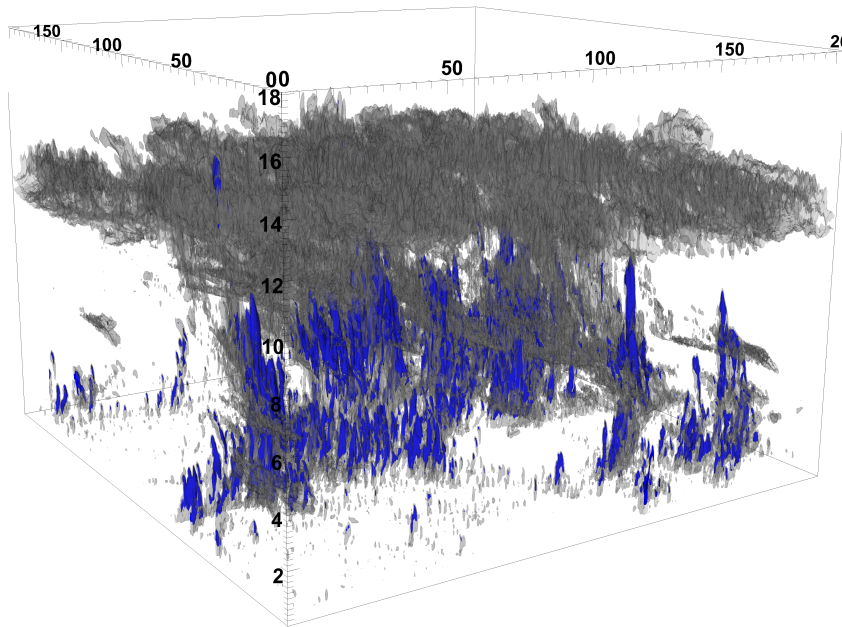
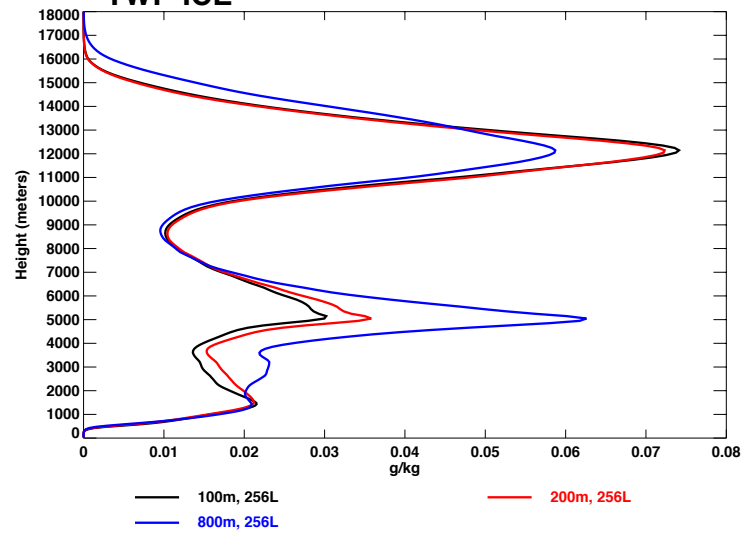
TWP-ICE domain-avg

100m, 256L



Time Mean of Cloud water and cloud ice Hour 12 through 24

TWP-ICE



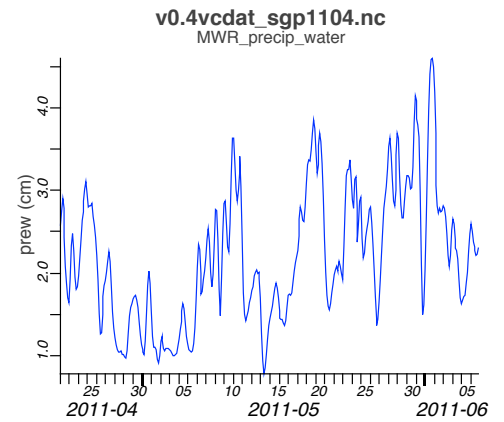
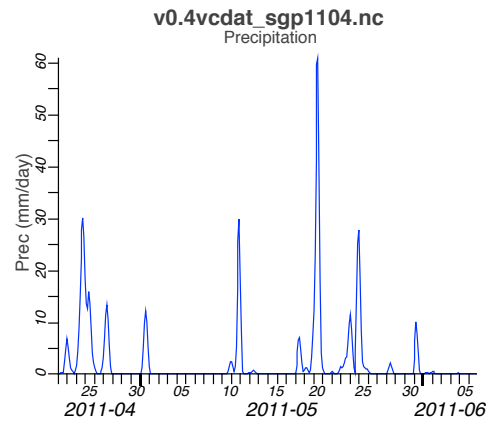
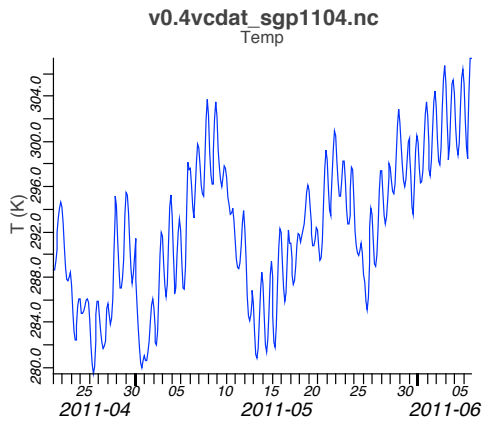
Archival

- Model output is stored as netcdf (except restarts and OUT_MOVIES) as produced by Marat's UTIL programs. Netcdf files are gzipped. Most diagnostics have 5 minute frequency.
- Exception is 100m OUT_3D written as netcdf directly from code. Format is netcdf-4, coordinate order is (z,x,y). Not all applications are up to speed with netcdf-4, but NCO (post 4.0.7) is and can slice and dice, or convert to netcdf-3.
- Archival to the Digital Library is John's hands. He has all the TWP-ICE 800m runs.

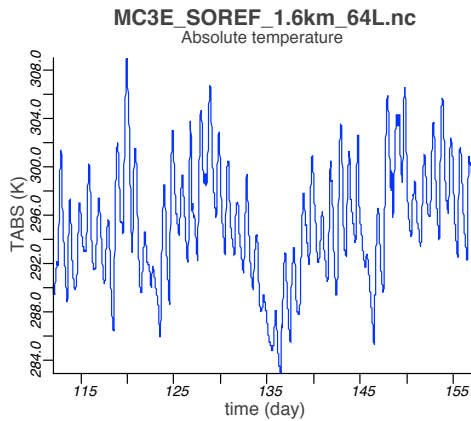
MC3E - Forcing Issues?

- 1.6km MC3E run for entire IOP with large-scale forcing (data is 3-hour average, model is 1/2 hourly).

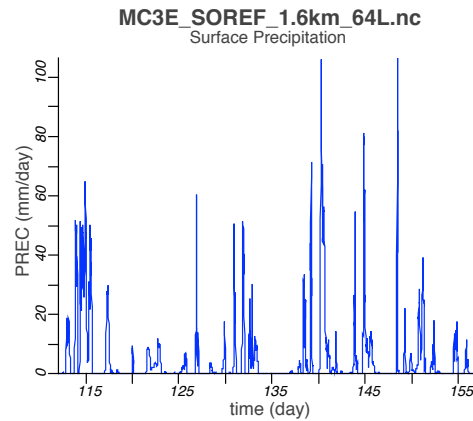
obs



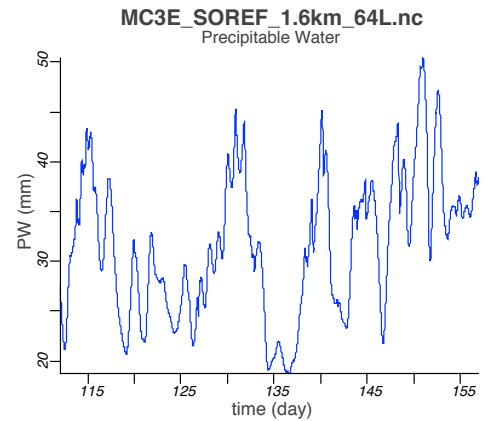
SAM



— TABS [z=25.0, time=]



— PREC [time=]

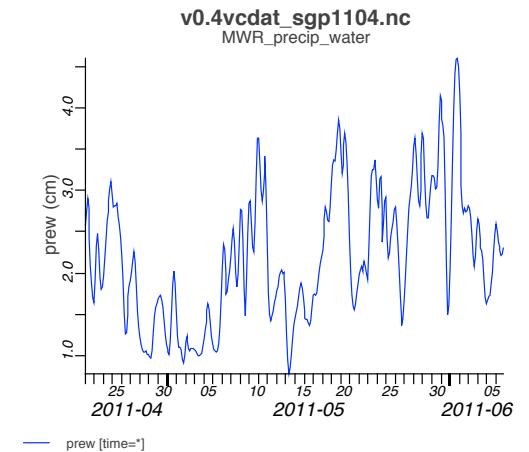
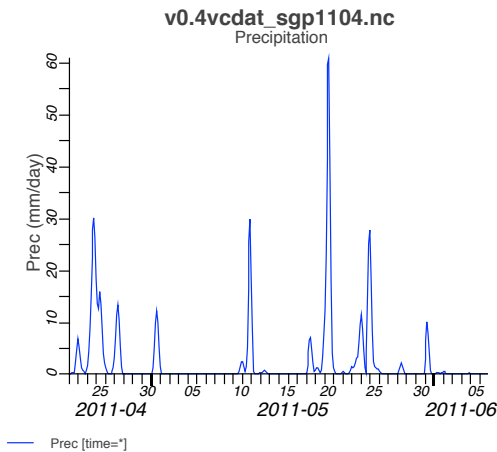
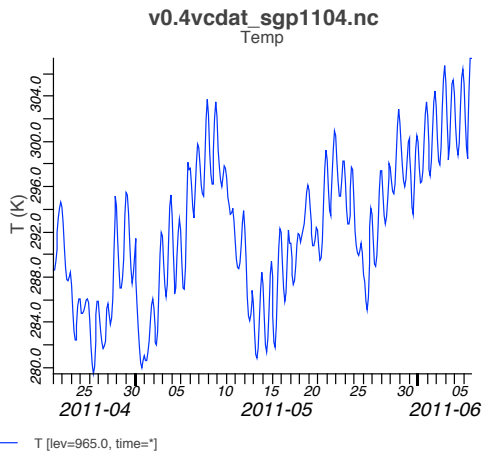


— PW [time=]

MC3E - nudging alternative?

- 1.6km MC3E run for entire IOP with nudging

obs



SAM

