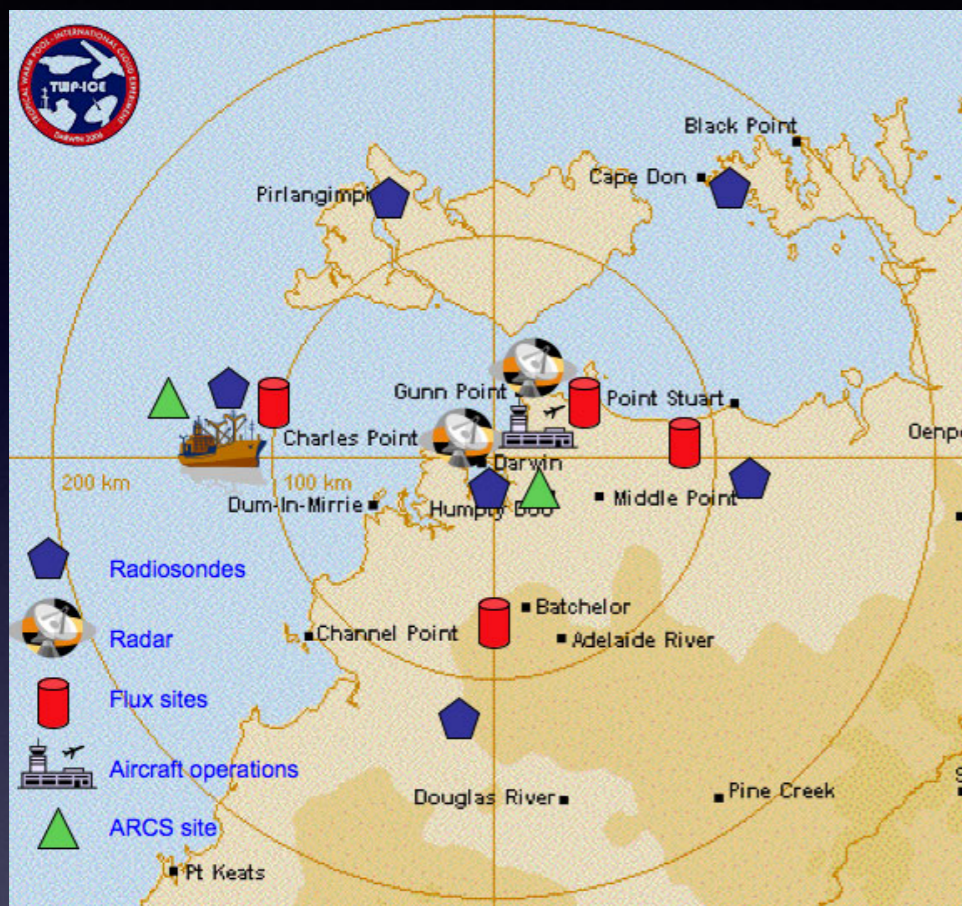


An update on the TWPICE GigaLES

Don Dazlich
Steve Krueger
Chin-Hoh Moeng
Marat Khairoutdinov
Robert Pincus
Peter Blossey
Hugh Morrison
Dave Randall
John Helly

CMMAP Mtg August 6, 2014, Fort Collins
Physical Processes Breakout

Tropical Warm Pool - International Cloud

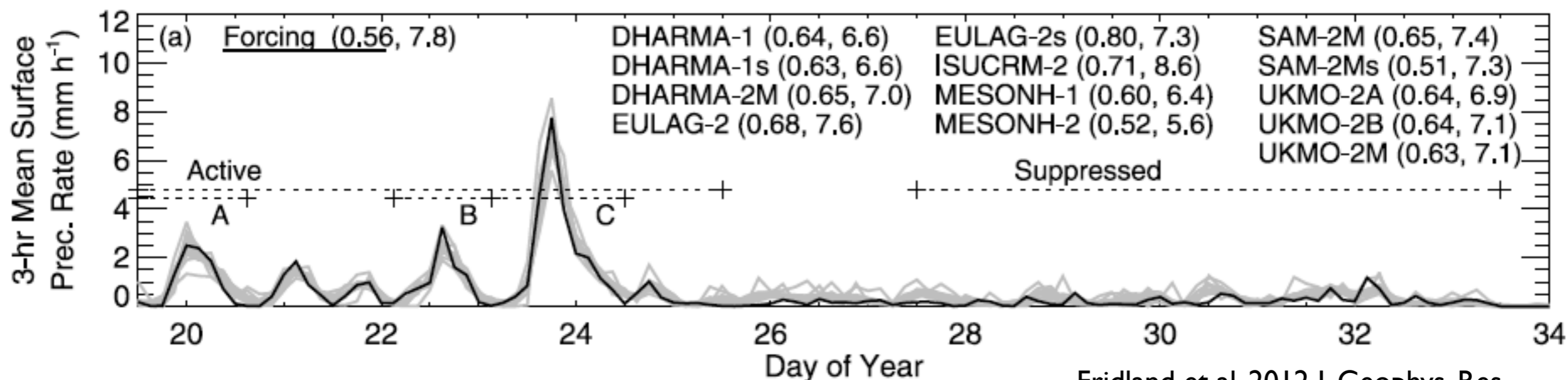


Location – 130.9E,12.4S

Intense measurement period – 18 Jan 2006 – 4 Feb 2006.

Features active (19 Jan.–25 Jan.) and suppressed (27 Jan.–4 Feb.) monsoon periods.

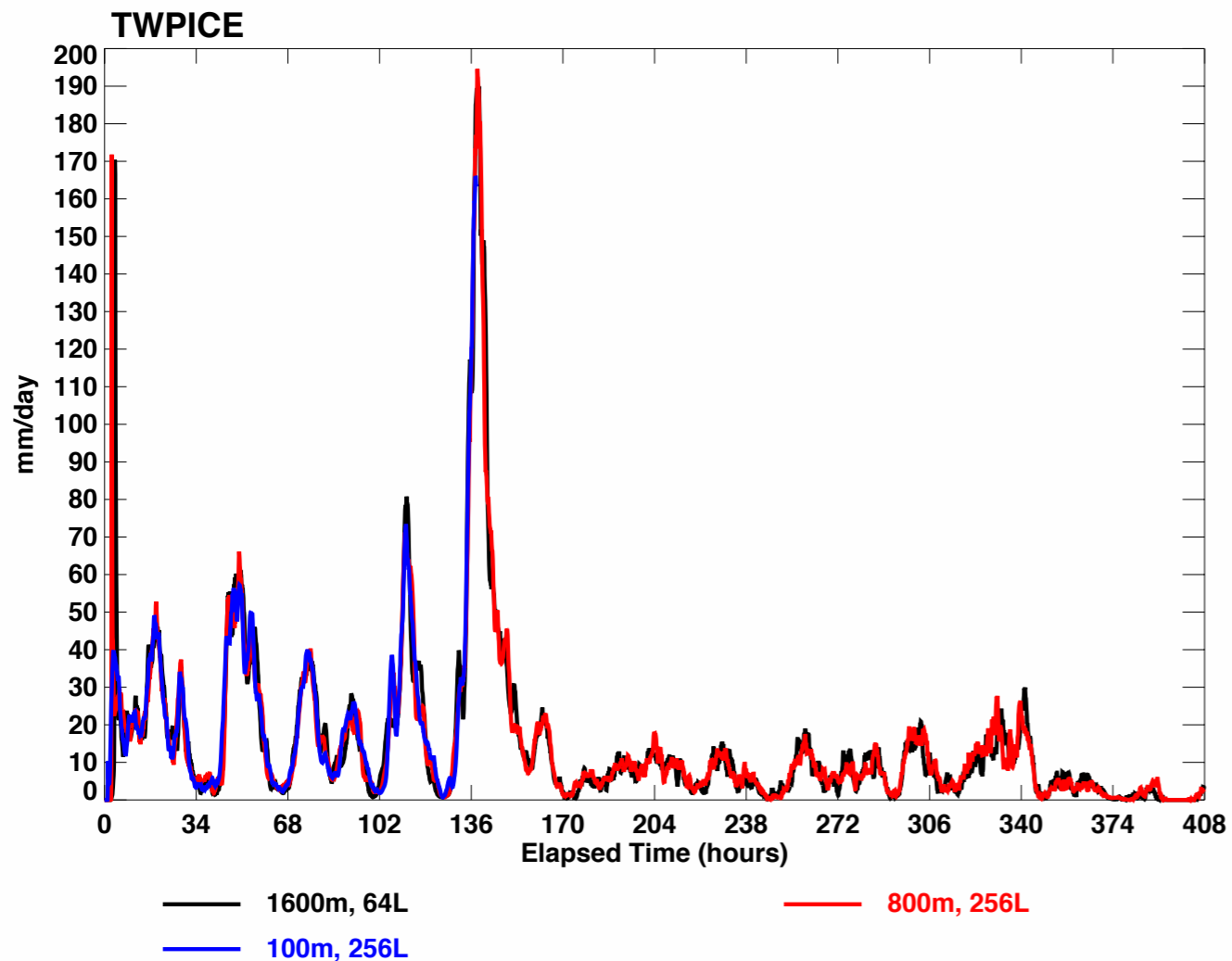
The model is run according to the CRM intercomparison specifications in Fridland et al, 2012. The domain is treated as a uniform ocean surface with fixed SST.



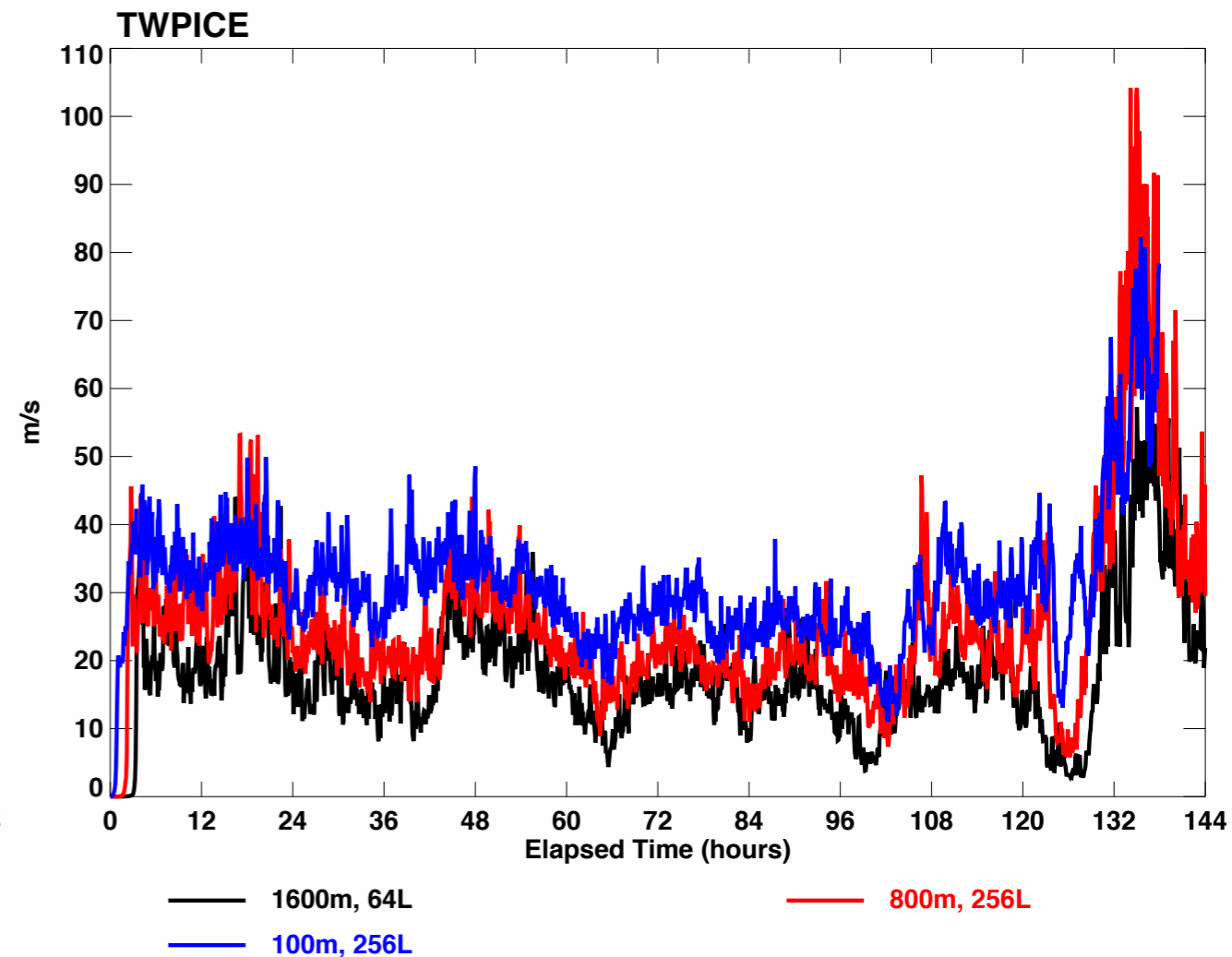
Run Status

- Control - no snow-radiation interaction, 1600m, 64L - 17 days
- Control - no snow-radiation interaction, 800m, 256L - 17 days
- CAM5 snow radiative properties, 1600m, 64L - 17 days
- CAM5 snow radiative properties, 800m, 256L - 17 days
- CAM5 snow radiative properties, 100m, 256L - 138 hours (of 144 planned)

Surface Precipitation



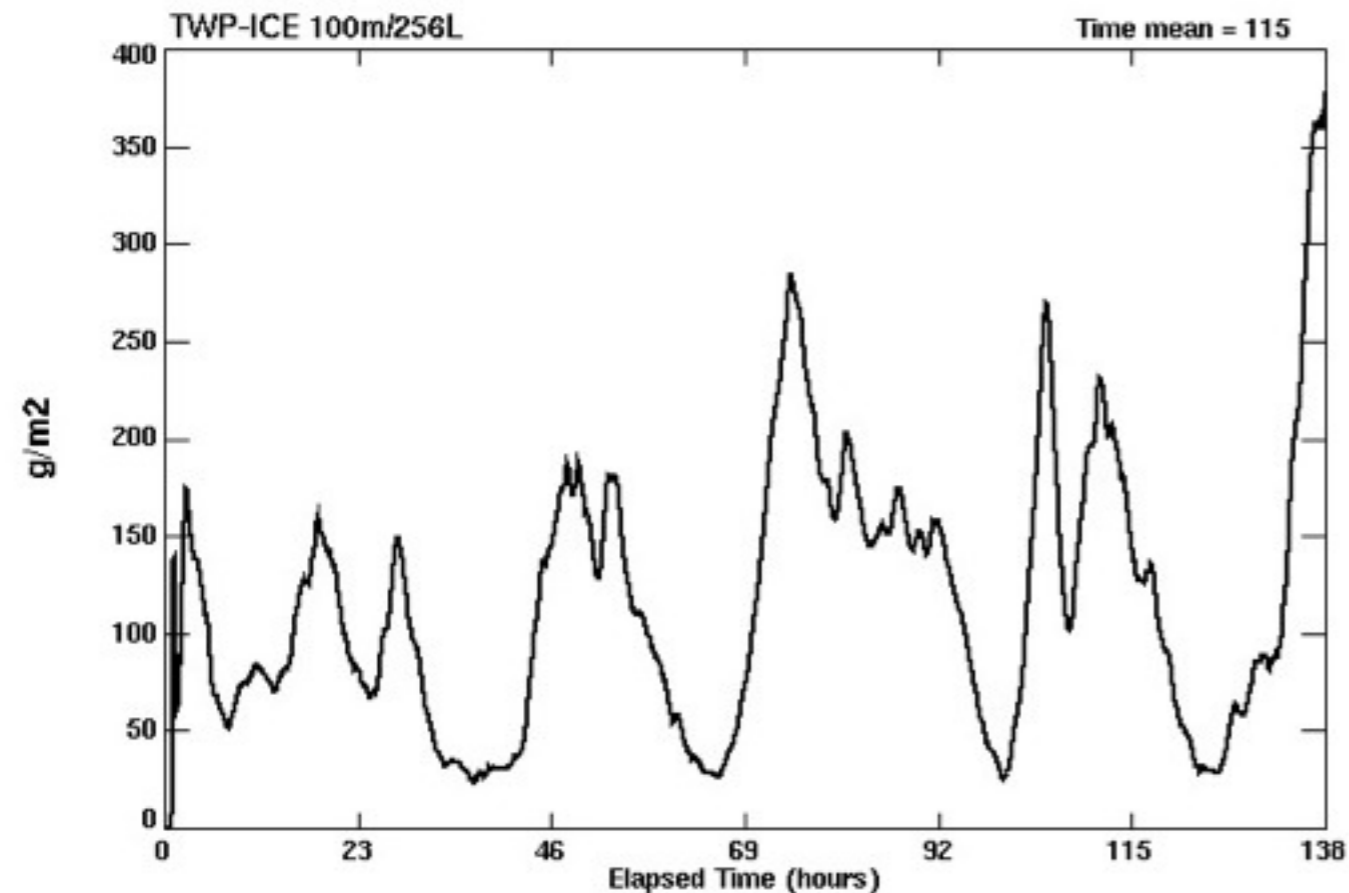
Maximum Updraft Velocity



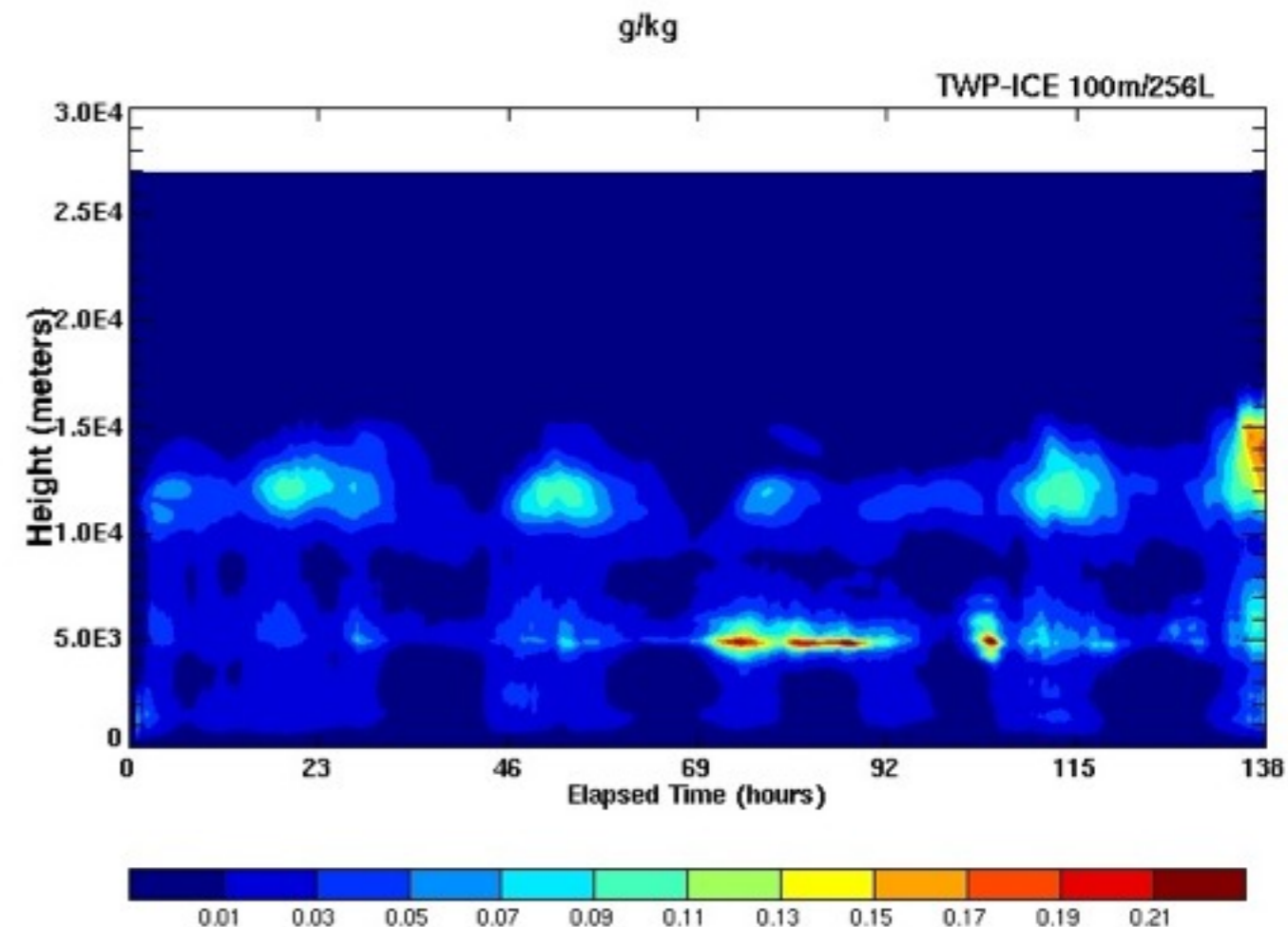
Output types - OUT_STAT

- Domain-averaged variables
- 5 minute frequency
- more than 400 variables
- NetCDF format - 1 file per run
- O(1GB) per run

Cloud Water Path



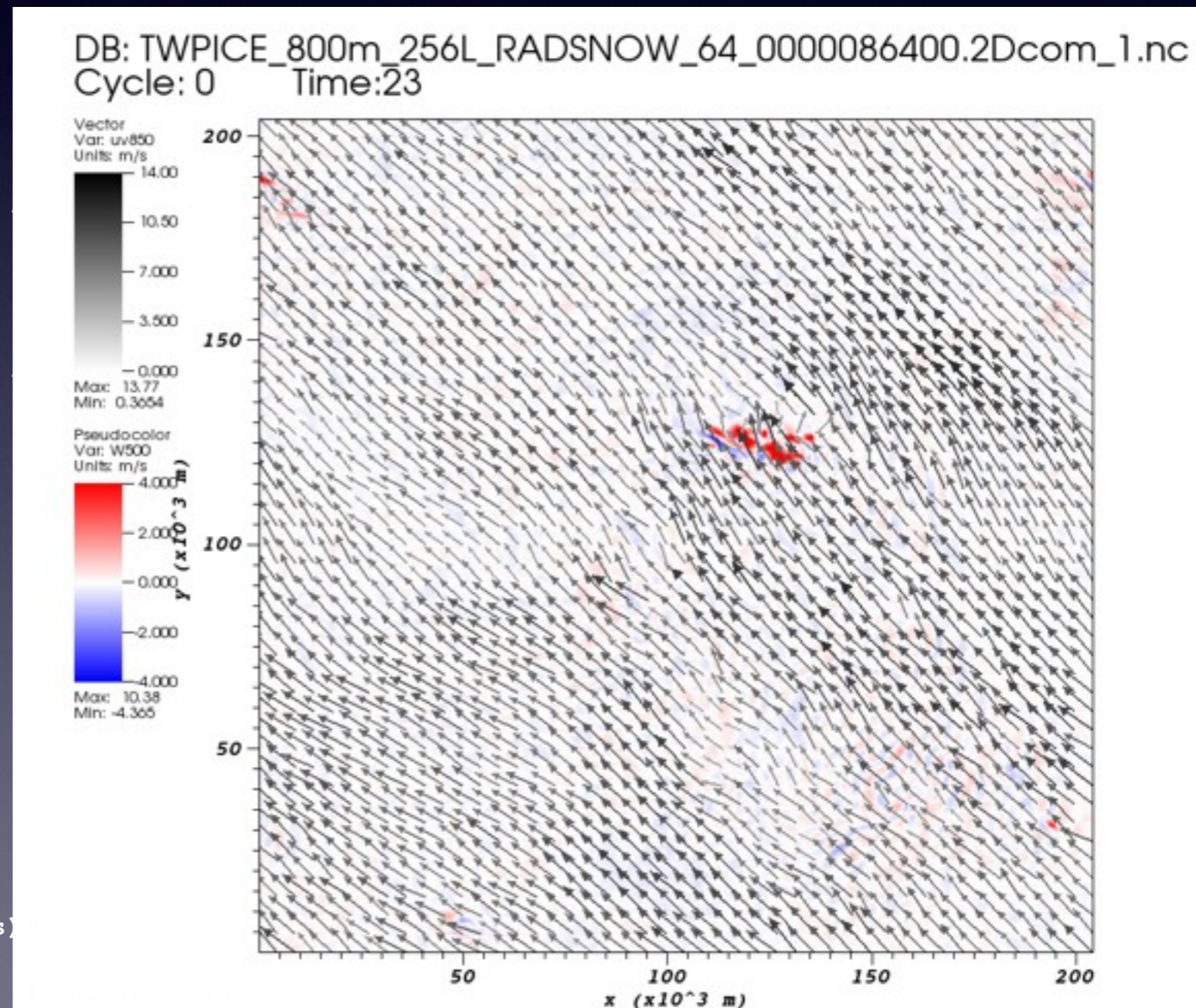
Cloud water and cloud ice



Output types - OUT_2D

- Variables with two horizontal dimensions
- 5 minute frequency
- 30 variables
- NetCDF format - 1 timestep per file
- O(70GB) per day at 100m (gzipped)

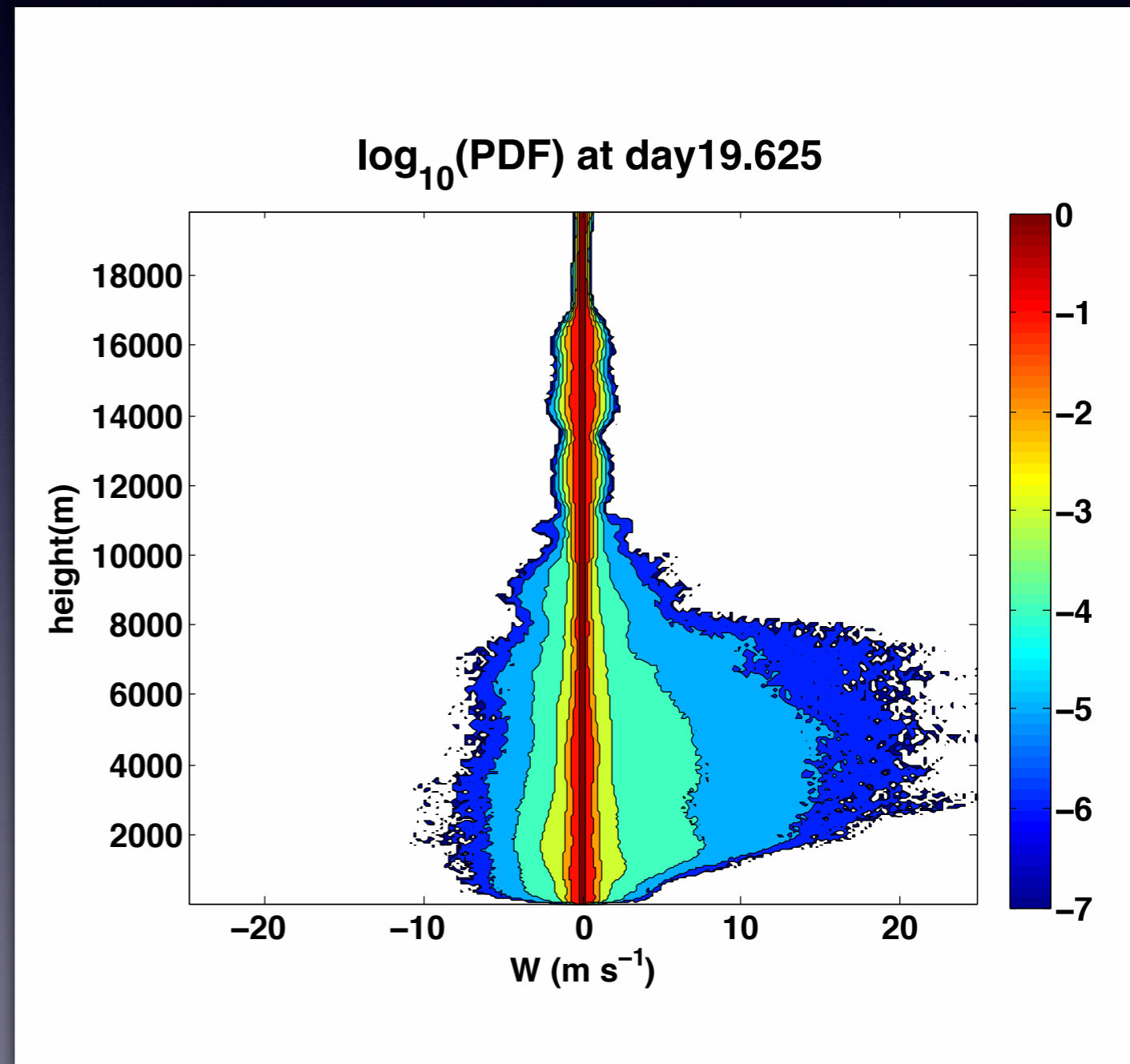
```
Prec:long_name = "Surface Precip. Rate" ;
SHF:long_name = "Sensible Heat Flux" ;
LHF:long_name = "Latent Heat Flux" ;
LWNS:long_name = "Net LW at the surface" ;
LWNSC:long_name = "Net clear-sky LW at the surface" ;
LWNT:long_name = "Net LW at TOA" ;
LWNTC:long_name = "Clear-Sky Net LW at TOA" ;
SOLIN:long_name = "Solar TOA insolation" ;
SWNS:long_name = "Net SW at the surface" ;
SWNSC:long_name = "Net Clear-sky SW at the surface" ;
SWNT:long_name = "Net SW at TOA" ;
SWNTC:long_name = "Net Clear-Sky SW at TOA" ;
CWP:long_name = "Cloud Water Path" ;
IWP:long_name = "Ice Path" ;
CLD:long_name = "Cloud Frequency" ;
PW:long_name = "Precipitable Water" ;
USFC:long_name = "U at the surface" ;
U200:long_name = "U at 200 mb" ;
VSFC:long_name = "V at the surface" ;
V200:long_name = "V at 200 mb" ;
W500:long_name = "W at 500 mb" ;
PSFC:long_name = "P at the surface" ;
SWVP:long_name = "Saturated Water Vapor Path" ;
U850:long_name = "850 mbar zonal velocity" ;
V850:long_name = "850 mbar meridional velocity" ;
ZC:long_name = "Cloud top height (Instantaneous)" ;
TB:long_name = "Cloud top temperature (Instantaneous)" ;
ZE:long_name = "Echo top height (Instantaneous)" ;
THETAB:long_name = "Cloud top potential temperature
```



Output types - OUT_3D

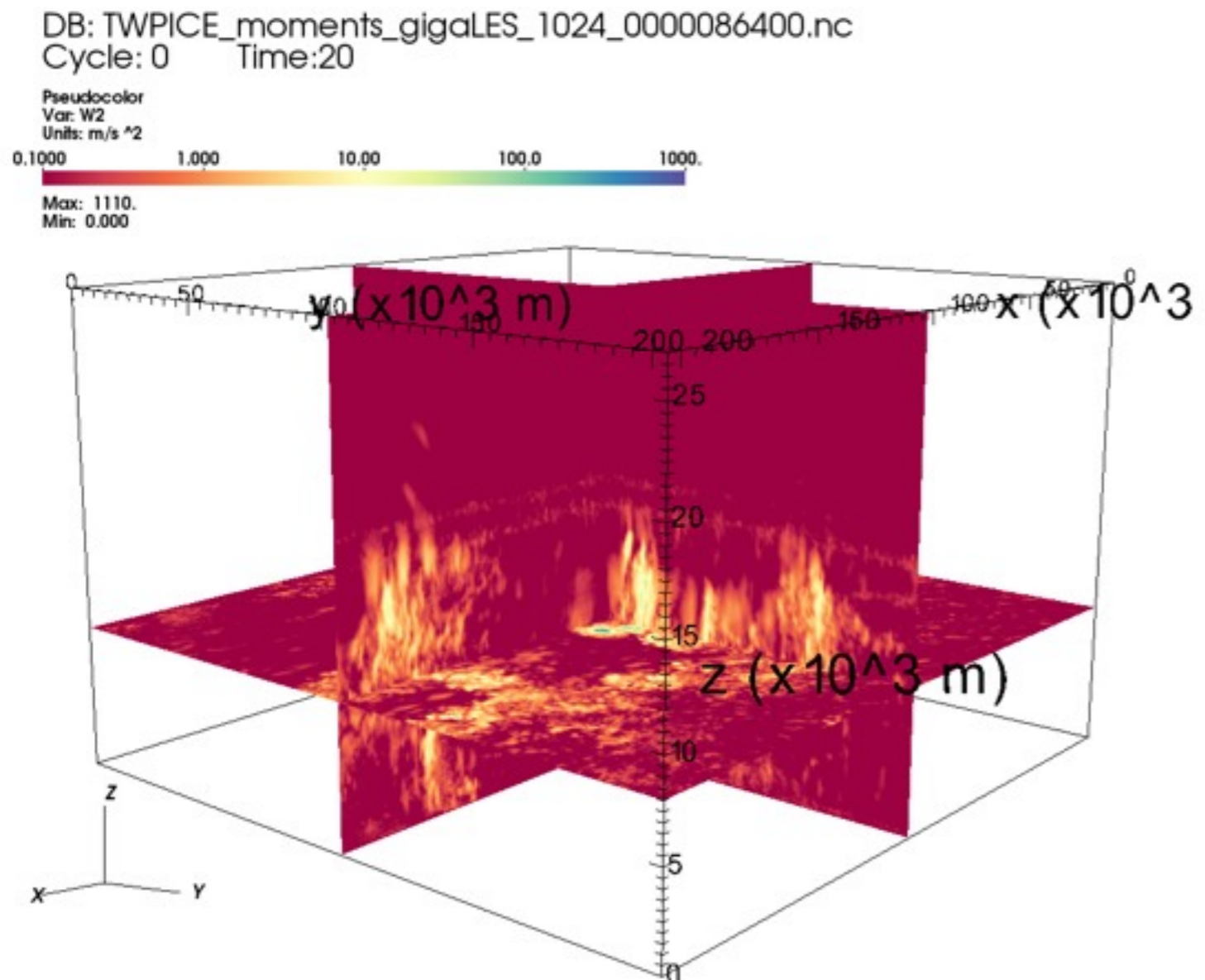
- Three-dimensional variables at all grid points
- 5 minute frequency
- 20 variables
- NetCDF-4 with compression, 1 time-step and variable per file
- O(40GB) per time-step at 100m (11.5TB/day)

```
KEDISS ;  
NC ;  
NG ;  
NI ;  
NR ;  
NS ;  
PP ;  
QG ;  
QI ;  
QN ;  
QR ;  
QRAD ;  
QS ;  
QV ;  
TABS ;  
TR01 ;  
TR02 ;  
U ;  
V ;  
W ;
```



Output types - OUT_MOMENTS

- Moments of 3-D variables averaged to 800m horizontally
- 5 minute frequency
- 33 variables
- NetCDF format - 1 file per timestep
- O(0.9GB) per file (260GB/day)
- Missing moments files can be recreated offline from 3D files



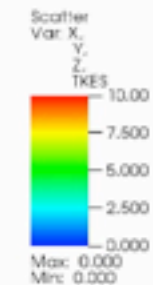
```
THL1:long_name = "First Mom Liquid Wat Pot Tmp  
THL2:long_name = "Second Mom Liquid Wat Pot Tmp  
THLW:long_name = "Flux THL and W  
THLW:units = "K m/s      " ;  
THL3:long_name = "Third Mom Liquid Wat Pot Tmp  
QW1:long_name = "First Mom Total Water  
QW2:long_name = "Second Mom Total Water  
THLQW:long_name = "Flux THL and QW  
QW3:long_name = "Third Mom QW  
W1:long_name = "First Mom Vert Vel  
W2:long_name = "Second Mom Vert Vel  
WQW:long_name = "Flux W and QW  
W3:long_name = "Third Mom Vert Vel  
U1:long_name = "First Mom U-Wind  
U2:long_name = "Second Mom U-Wind  
UW:long_name = "Flux U and W  
V1:long_name = "First Mom V-Wind  
V2:long_name = "Second Mom V-Wind  
VW:long_name = "Flux V and W  
QL:long_name = "QL AVG  
CDFRC:long_name = "Cloud Fraction  
WQL:long_name = "Flux W and QL  
W2QL:long_name = "Flux W^2 and QL  
THLQL:long_name = "Flux THL and QL  
QTQL:long_name = "Flux QT and QL  
W4:long_name = "Fourth Moment W  
W2THL:long_name = "Flux W2 and THL  
W2QT:long_name = "Flux W2 and QT  
WTHL2:long_name = "Flux W and THL2  
WQT2:long_name = "Flux W and QT2  
WQTTHL:long_name = "Flux W and QT and THL  
WU2:long_name = "Flux W and U2  
WV2:long_name = "Flux W and V2
```

Output types - OUT_LPT

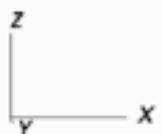
- Lagrangian Parcel Trackers
- 146800640 (every grid point at 35 levels from 250m to 17,250m every 500m initialization at hour 48.
- 30 s frequency
- 37 variables
- NetCDF-4 with compression, 1 file per timestep (13 GB/file)

NVI	[number]	Number of vertical initialization
X	[m]	X position
Y	[m]	Y position
Z	[m]	Z position
U	[m/s]	U wind
V	[m/s]	V wind
W	[m/s]	W wind
PRES	[Pa]	Pressure
RHO	[kg/m3]	Density
PPRIME	[Pa]	Pressure perturbation
LWSE	[K]	Liquid water static energy
MSE	[K]	Moist static energy
DSE	[K]	Dry static energy
VDSE	[K]	Virtual dry static energy
SMSE	[K]	Saturation moist static energy
TABS	[K]	Absolute temperature
THETA	[K]	Potential temperature
THETAL	[K]	Liquid water potential temperature
THETA_V	[K]	Virtual potential temperature
THETA_E	[K]	Equivalent potential temperature
QV	[g/kg]	Water vapor
QCL	[g/kg]	Cloud water
QSAT	[g/kg]	Saturation mixing ratio
RELH	[unit]	Relative humidity
TKE	[m2/s2]	Parameterized ensemble-mean resolved scale TKE
TKES	[m2/s2]	SGS TKE
Rig	[unit]	Gradient Richardson number
NC	[#/cm3]	CLOUD WATER NUMBER CONCENTRATION
QR	[g/kg]	RAIN
NR	[#/cm3]	RAIN NUMBER CONCENTRATION
QI	[g/kg]	CLOUD ICE
NI	[#/cm3]	CLOUD ICE NUMBER CONCENTRATION
QS	[g/kg]	SNOW
NS	[#/cm3]	SNOW NUMBER CONCENTRATION
QG	[g/kg]	GRAUPEL
NG	[#/cm3]	GRAUPEL NUMBER CONCENTRATION
TR01	ppbv	Ozone-initialized passive tracer
TR02	kg/kg	PBL-source=1, 12 hour decaying tracer

DB: TWICE_gigaLES_LTP048_LPT00001.nc
Cycle: 0



0 50 100 (x 10^3) 150 200 250 (x 10^3)



Distribution

- Currently, must contact me to arrange transfer.
- I will extract the fields you want to minimize the size of the transfer.
- Files < 2GB in size can be placed on the Randall group doc exchange -
<http://kiwi.atmos.colostate.edu/rr/docexch.php>
- OUT_STAT files have been placed there already and available for download and inspection

TWPICE_1.6km_64L_CONT.nc.gz	Aug 04, 2014	264M
TWPICE_1.6km_64L_RADSNOW.nc.gz	Aug 04, 2014	264M
TWPICE_800m_256L_CONT.nc.gz	Aug 04, 2014	1G
TWPICE_800m_256L_RADSNOW.nc.gz	Aug 04, 2014	1G
TWPICE_gigaLES.nc	Jul 24, 2014	653M

Distribution

- GigaLES data has already been distributed (to some extent):
 - Steve Krueger - Utah
 - Chin-Hoh Moeng - NCAR
 - Grant Firl - CSU
 - Sasha Glanville - CSU
 - Justin Williams - CMMAP intern

What about MC3E?

- We also have plans to run a GigaLES for MC3E (ARM Southern Great Plains, 22 April 2011 through 06 June 2011). GigaLES is the 3-day period of the convective event of 23 May.
- Low resolution runs have a warm, moist bias we are trying to understand and deal with.
- More in Multiscale Land Breakout.

Table 1: GigaLES-002-001 manifest.

Data Volume	Number of Files	Percentage	Parameter Directory or File
3.7TiB	1.036	[36.6%]	OUT_3D.PP
3.3TiB	982	[32.6%]	OUT_3D.U
3.1TiB	926	[30.8%]	OUT_3D.TR02
10.0TiB	2.947	Total (Incomplete)	

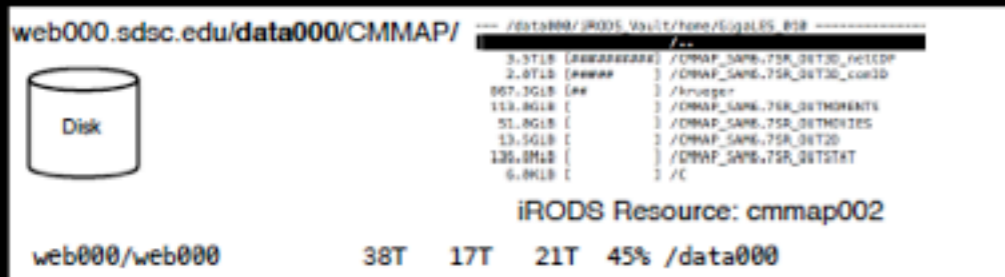
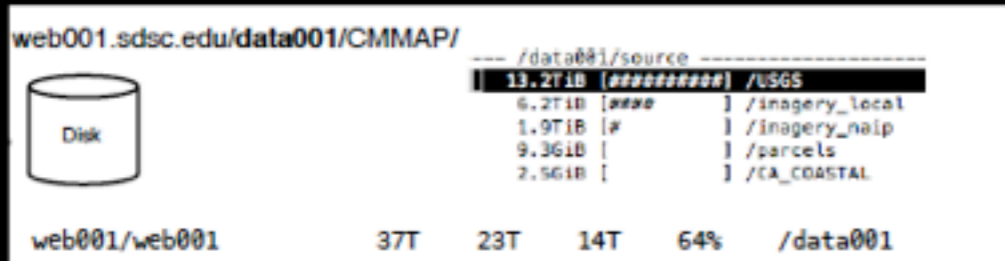
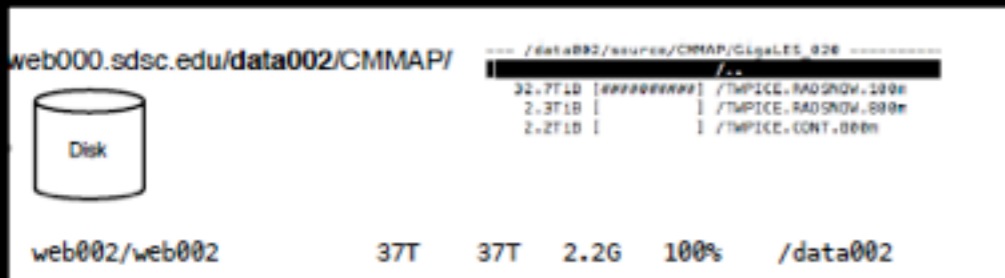
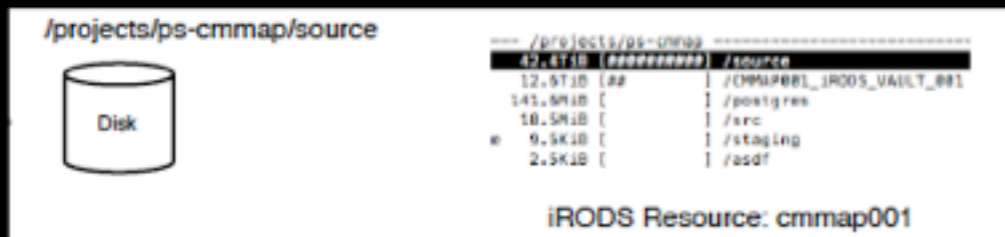
Table 2: GigaLES-002-002 manifest.

Data Volume	Number of Files	Percentage	Parameter Directory or File
2.8TiB	1.036	[12.6%]	OUT_3D.TABS
2.6TiB	752	[11.7%]	OUT_3D.QRAD
2.6TiB	753	[11.5%]	OUT_3D.V
2.5TiB	752	[10.9%]	OUT_3D.QV
2.3TiB	1.036	[10.3%]	OUT_3D.TR01
1.4TiB	1.036	[6.1%]	OUT_3D.NI
1.3TiB	1.036	[5.6%]	OUT_3D.NR
1.1TiB	846	[4.7%]	OUT_3D.NS
1.1TiB	752	[4.7%]	OUT_3D.QN
1.0TiB	751	[4.4%]	OUT_3D.QI
0.9TiB	751	[4.1%]	OUT_3D.QR
0.9TiB	751	[4.1%]	OUT_3D.QS
920.9GiB	359	[4.0%]	OUT_3D.KEDISS
513.8GiB	1.036	[2.2%]	OUT_3D.NG
369.9GiB	751	[1.6%]	OUT_3D.QG
195.2GiB	1.036	[0.8%]	OUT_3D.NC
183.9GiB	798	[0.8%]	OUT_2D
23.5MiB		[0.0%]	src_twpice_radsnow_100m.tar
23.4MiB		[0.0%]	input.tar.gz
2.0KiB		[0.0%]	OUT_STDOUT
2.0KiB		[0.0%]	OUT_STAT
2.0KiB		[0.0%]	OUT_RESTART
2.0KiB		[0.0%]	OUT_MOVIES
2.0KiB		[0.0%]	OUT_MOMENTS
2.0KiB		[0.0%]	OUT_LPT
2.0KiB		[0.0%]	OUT_3D.W
27.1TiB	33.770	Total (Incomplete)	

Data Characteristics and Packaging

- Two directories for distributed storage: GigaLES-002-001 and GigaLES-002-002.
- Needed for organizing data across storage devices each with less than total required capacity.
- Decide on gzipped, tar-file sizes for transportation.
- **Recommend 100-500 GiB file sizes with naming convention** (e.g., *DOI-GigaLES-002- \langle Parameter \rangle -File01-of-05 .tar.gz*).
- Assign unique CMMAP DOI to each parameter or to the entire collection? **Recommend each parameter.**
- For example, TiB is Tibibytes (1024^4 bytes), the units used by the *ncdu* utility.

Data Cyberinfrastructure



- Four (4) storage devices: 55 TB HPC + 3 Aberdeens (2 x 37 + 38TB) = 167 TB total distributed capacity.
- Virtualized into a single filesystem using iRODS with 2 new user front-ends (cf. below).
- Registered user and 'anonymous' user capability for private and public access.

New Digital Library User Front-ends

Drop-web - iDrop Cloud Br...
cmmmap001.sdsc.edu 8080/iDrop-web2/browse/index#view=detail&view=V100
name fontsize in baseA

Drop Home Browse Search Tools Account Shopping Cart

/cmmmap001/home/public

Refresh New Folder Info

Get this as the root of the tree Star Collection Add to Cart Upload Bulk Upload
New Folder Rename Delete

/cmmmap001/home/public

Info Metadata Sharing Tickets Audit

Info
Basic information, including update of tags and a description

Created: Thu Jul 31 13:27:29 PDT 2014
Updated: Thu Jul 31 13:27:29 PDT 2014
Owner: public
Owner Zone: cmmmap001
Type: NORMAL
Object Path:
Description:
Info1:
Info2:
Tags:
Comment:

Web

Tree Download Upload Refresh New Copy/Move/Delete Info Tools Settings Queue Grids Sync

File System size last modified

/

- .DocumentRevisions-V100
- .DS_Store
- .file
- .fsevents
- .PKInstallSandboxManager
- .Spotlight-V100
- .Trashes
- .vol
- _CCC_Archives
- Applications
- bin
- cores
- dev
- Developer
- doc
- etc
- home
- Incompatible Software

cmmmap001

- home (Jan 7, 2013)
 - CMMAP_SPCAM_MACM_EXP01 (Aug 12, 2013)
 - GigaLES_010 (Jun 16, 2014)
 - cmmmap (Aug 7, 2013)
 - dazlich (May 28, 2013)
 - hellyj (Jan 7, 2013)
 - jjhstest (Jul 31, 2014)
 - jritchie (Aug 2, 2013)
 - katec (Aug 7, 2013)
 - morrison (May 21, 2013)
 - open-access (Jul 31, 2014)
 - pritch (Sep 18, 2013)
 - public (Jul 31, 2014)
 - trash (Jan 7, 2013)

Current File:

name:hellyj Resource: cmmmap001 ✓

Desktop Client

iDrop: Grid Accounts

Host	Zone	User Name
cmmmap001.sdsc.edu	cmmmap001	anonymous
cmmmap001.sdsc.edu	cmmmap001	hellyj

Registered and 'anonymous' for public access

+ - ✎

✕ 🔒

Summary

- GigaLES-2 simulation of TWP-ICE has completed 5.75 days of an intended 6.0 days and reasonably simulates the observations. Over 60 TB output generated to date.
- A LPT run at hour 48 has been setup and will complete shortly after a recent false start.
- GigaLES output is already beginning to be distributed for specific purposes.
- A new XSEDE proposal has been submitted to support completion of the TWP-ICE and MC3E experiments and post-processing of the simulations.
- The archival of the output is ongoing. John Helly is working on a better method for distribution.