ECMWF Observation Feedback Archive

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Observation Feedback Archive

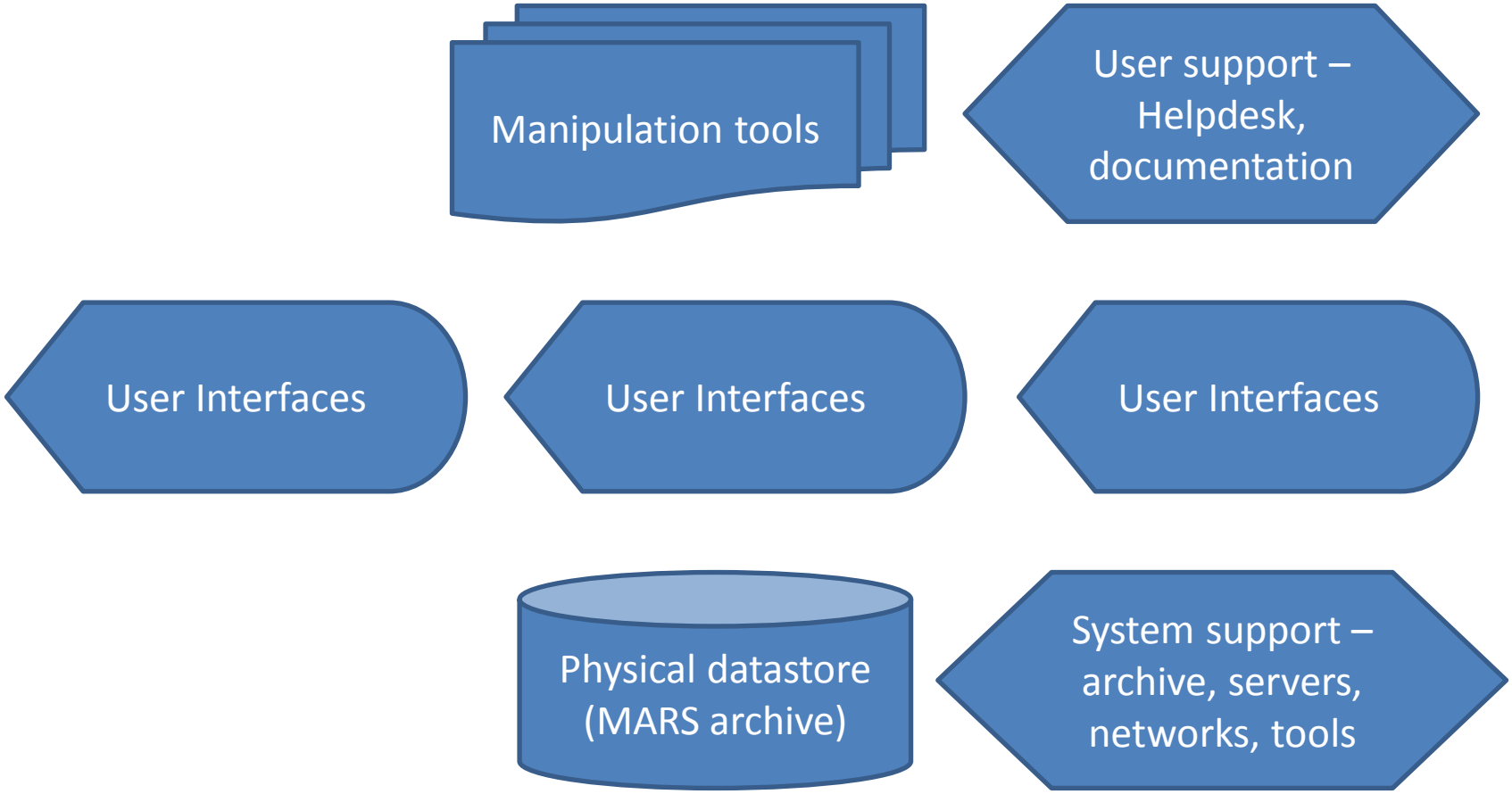
- A product of ERA-CLIM
- Offers an **open-access web interface**
- Major improvement as it enables users to 'see' the observation systems and data locations, without transferring large data amounts across the network

- Still limited by export format (ASCII and ODB2)
- Publicly available ODB2 tools limited, but an ODB2 decoder is in the works
- Needs manual intervention to create the catalogue (not self-made)

- Ongoing developments:
  - Native support for **NetCDF** in MARS (ERA-CLIM2)
  - Searchable metadatabase of events (CHARMe)

Slide from Paul's talk. To continue – what does it look like in practice?

OFA Infrastructure



Why have multiple interfaces?

- The user base & expertise is increasingly diverse
  - Reanalysis producers
  - CDR providers
    - Satellite agencies & In-situ/ground-based communities
    - Wider than NWP – ESA CCI, GCOS GRUAN, CHUAN, ACRE
  - Third parties
    - Science community - SPARC Reanalysis Intercomparison Project etc
    - Climate service applications - resource management etc
- One-size-fits-all doesn't work (but too many is unmanageable)

User Interface 1

- Direct MARS requests
  - Via ECMWF internal userid and/or MARS server
  - Familiarity with MARS & ODB2 keywords and values

```
linux% emacs mirage_request2b.txt
linux% cat mirage_request2b.txt
retrieve,
class=e2,
date=2010-12-31,
expver=1873,
filter="select reportype, varno, timeseries_index, \
        date, time, lat, lon, obsvalue, fg_depar, an_depar \
        where (datum_status.active=1) and (source='ISPD3.26') and (varno=110);",
reportype=16002,
stream=oper,
time=all,
type=ofb,
padding=0,
target=ispd_ps_ManualLandSynop_active_2b.odb

linux% mars mirage_request2b.txt
MARS - INFO - **
MARS - INFO - **
```

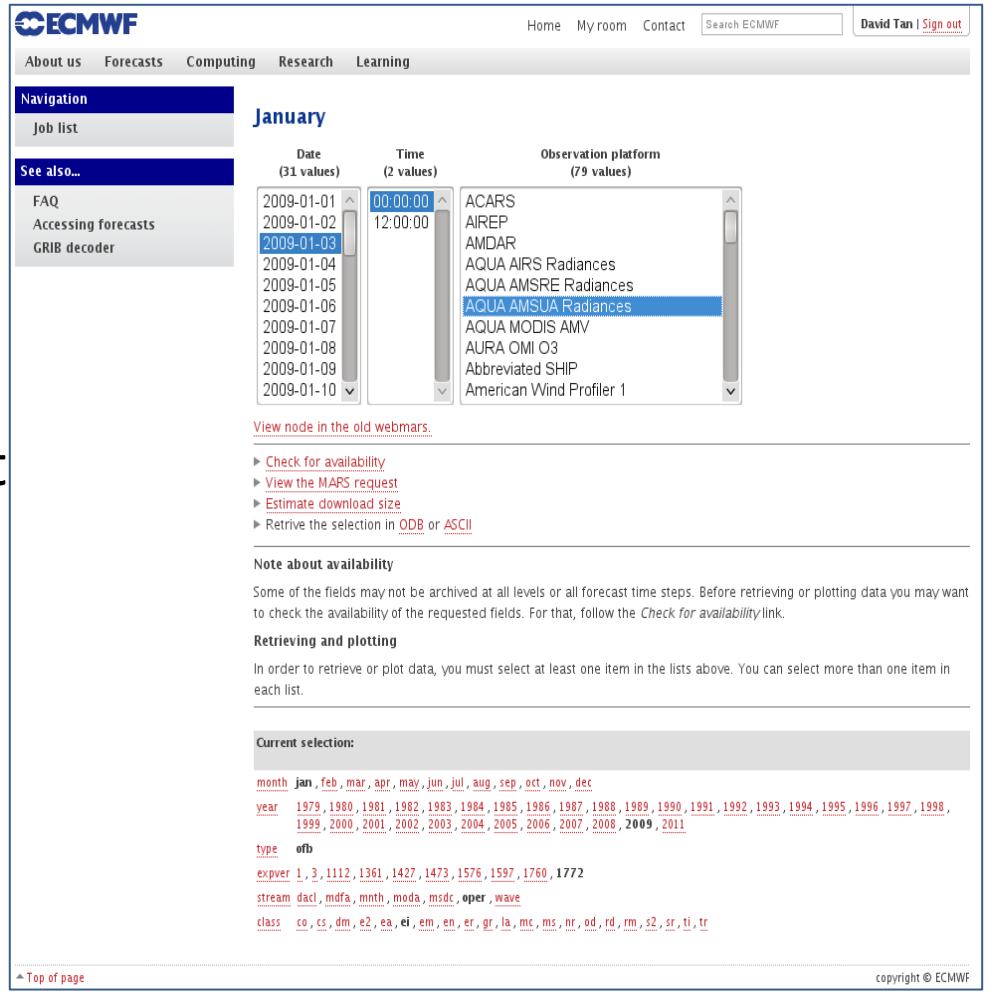
User Interface 1

- Direct MARS requests
  - Maximum control on the request, minimal on data discovery
  - Underlies the GUI & Batch-mode/API/Python interfaces

```
mars - INFO   - 20141104.155420 - Calling mars on 'marser', callback on 54748
mars - INFO   - 20141104.155420 - Mars client is on loki.ecmwf.int (136.156.34.102) 54748
mars - INFO   - 20141104.155420 - Mars server is on dhs1111.ecmwf.int (136.156.164.31) 42869
mars - INFO   - 20141104.155420 - Got connection from dhs1111.ecmwf.int (136.156.164.31) 42869
mars - INFO   - 20141104.155420 - Server task is 219 [marser]
mars - INFO   - 20141104.155420 - Got connection from dhs1111.ecmwf.int (136.156.164.31) 54834
mars - INFO   - 20141104.155420 - Got connection from dhs1111.ecmwf.int (136.156.164.31) 39765
mars - INFO   - 20141104.155420 - Request cost: 1 field, 60.7229 Mbytes online, nodes: mvr01 [marser]
mars - INFO   - 20141104.155420 - Got connection from dhs1111.ecmwf.int (136.156.164.31) 44191
mars - INFO   - 20141104.155420 - Got connection from dhs1121.ecmwf.int (136.156.164.61) 50003
mars - INFO   - 20141104.155420 - Transfering 63672524 bytes
mars - INFO   - 20141104.155420 - odb_filter: sql = '"select reportype, varno, timeseries_index, date, time, lat, lon, obsvalue, fg_depar, an_depar where
) and (varno=110);"', total_to_read = 63672524
000 2014-11-04 15:54:20 (I) BitColumnExpression::BitColumnExpression: name=datum_status, field=active, tableReference=: name_=datum_status
000 2014-11-04 15:54:20 (I) SQLSelectFactory::create: where = and(and(=(datum_status.active,1),=(source,'ISPD3.26')),=(varno,110))
000 2014-11-04 15:54:21 (I) SelectIterator::parse: SELECT reportype,varno,timeseries_index,date,time,lat,lon,obsvalue,fg_depar,an_depar FROM input WHERE
3.26')),=(varno,110)) SQLIteratorOutput
000 2014-11-04 15:54:21 (I) WriterBufferingIterator::pass1
000 2014-11-04 15:54:21 (I) WriterBufferingIterator::pass1init
000 2014-11-04 15:54:22 (I) Matching row(s): 87,765 out of 985,591
000 2014-11-04 15:54:22 (I) Skips : 897,826
000 2014-11-04 15:54:22 (I) WriterBufferingIterator::pass1: processed 87765 row(s).
mars - INFO   - 20141104.155422 -  => odb_filter
mars - INFO   - 20141104.155422 - Got connection from dhs1111.ecmwf.int (136.156.164.31) 44905
mars - INFO   - 20141104.155422 - Request time:  wall: 2 sec  cpu: 1 sec
mars - INFO   - 20141104.155422 -   Visiting marser: wall: 2 sec
mars - INFO   - 20141104.155422 - No errors reported
linux%
```

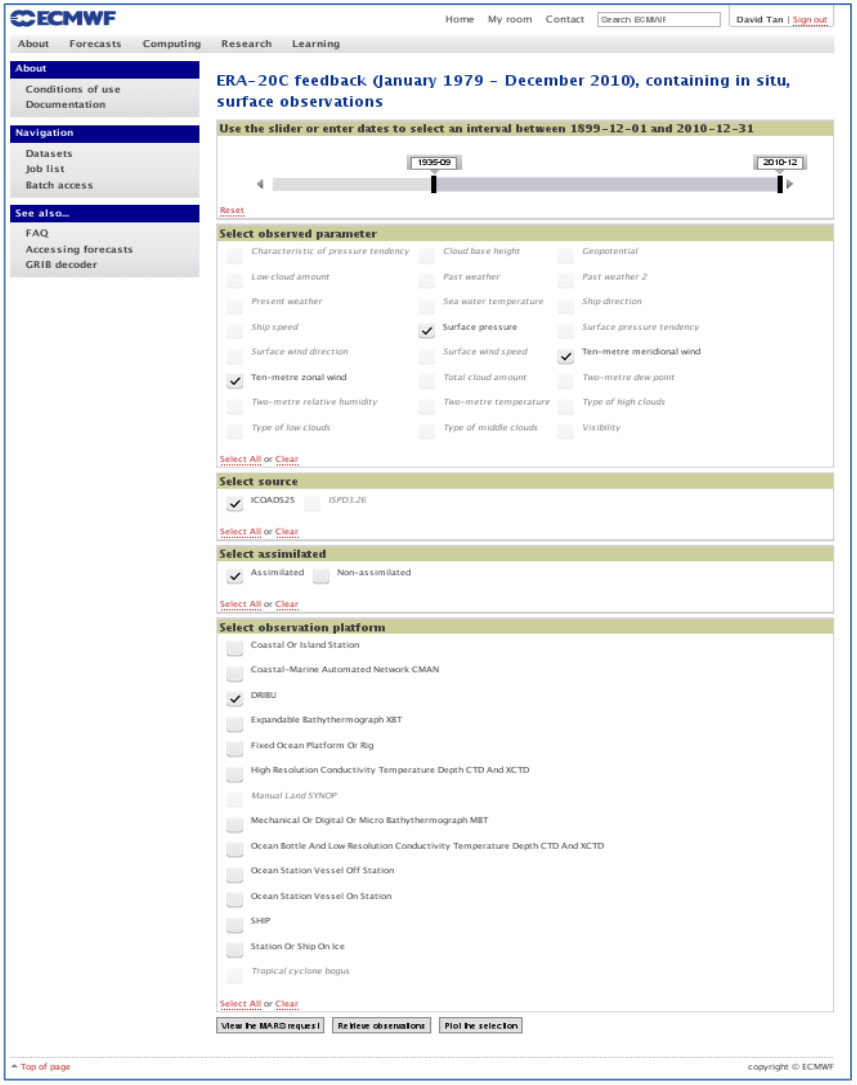
User Interface 2

- ECMWF *Internal* Web browser
  - Catalogs allow data navigation/discovery
  - Hierarchy matches underlying MARS layout
  - Less syntactic, more semantic: Reportype (numerical codes) translated to “Observation platform” (strings)



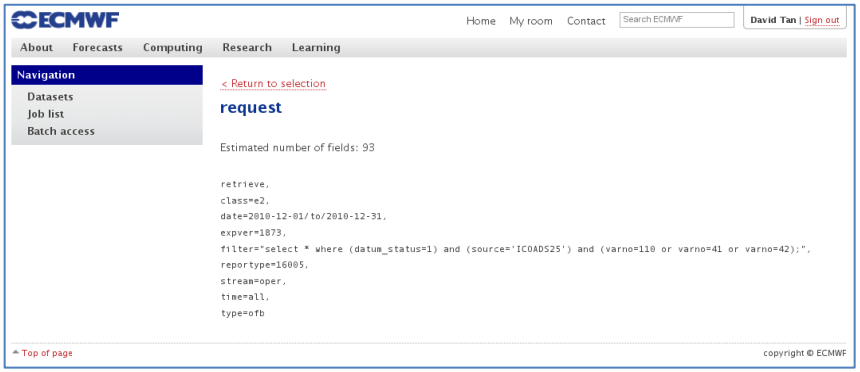
User Interface 3

- ECMWF *Public* Web browser apps.ecmwf.int/datasets
  - Increasingly semantic: slider controls date range
  - And dynamic: selection of Surface Pressure restricts Platform, both restrict date range
  - Further customization available under Retrieve

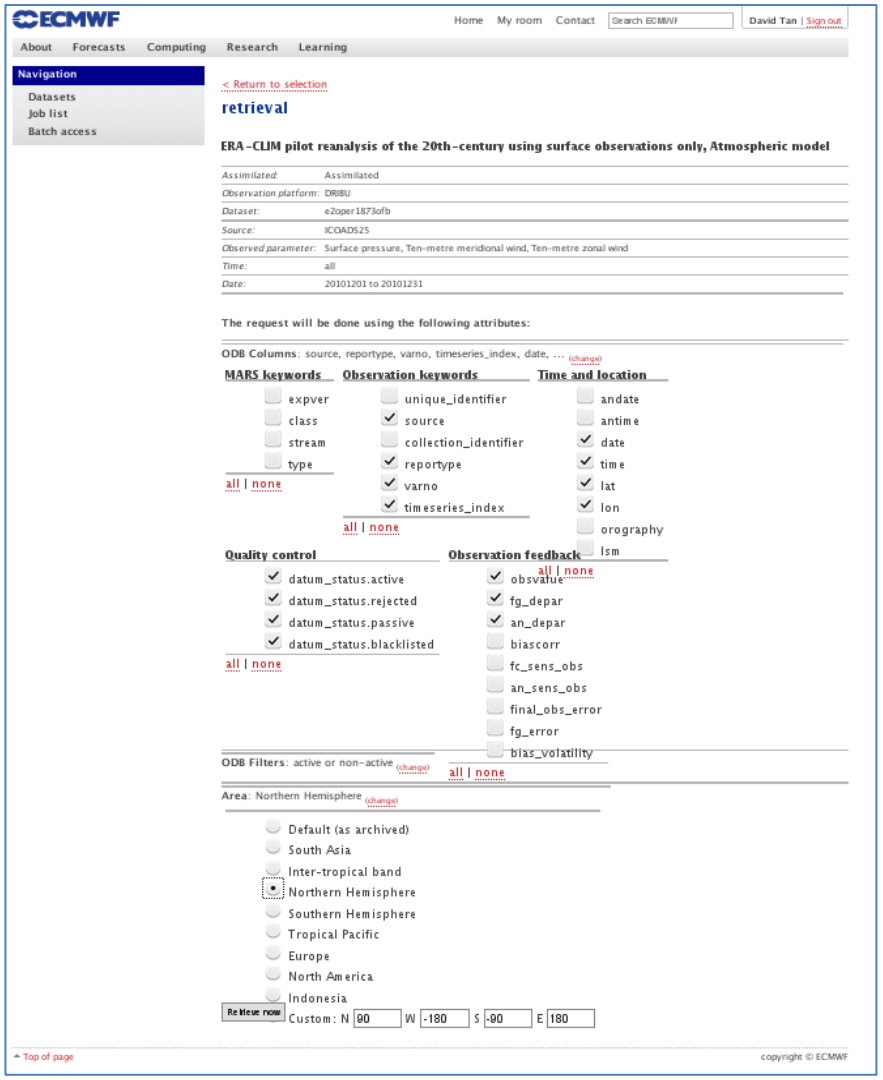


User Interface 3

- ECMWF *Public* Web browser
  apps.ecmwf.int/datasets
  - As users gain experience, batch-mode also desirable
  - GUI provides initial templates

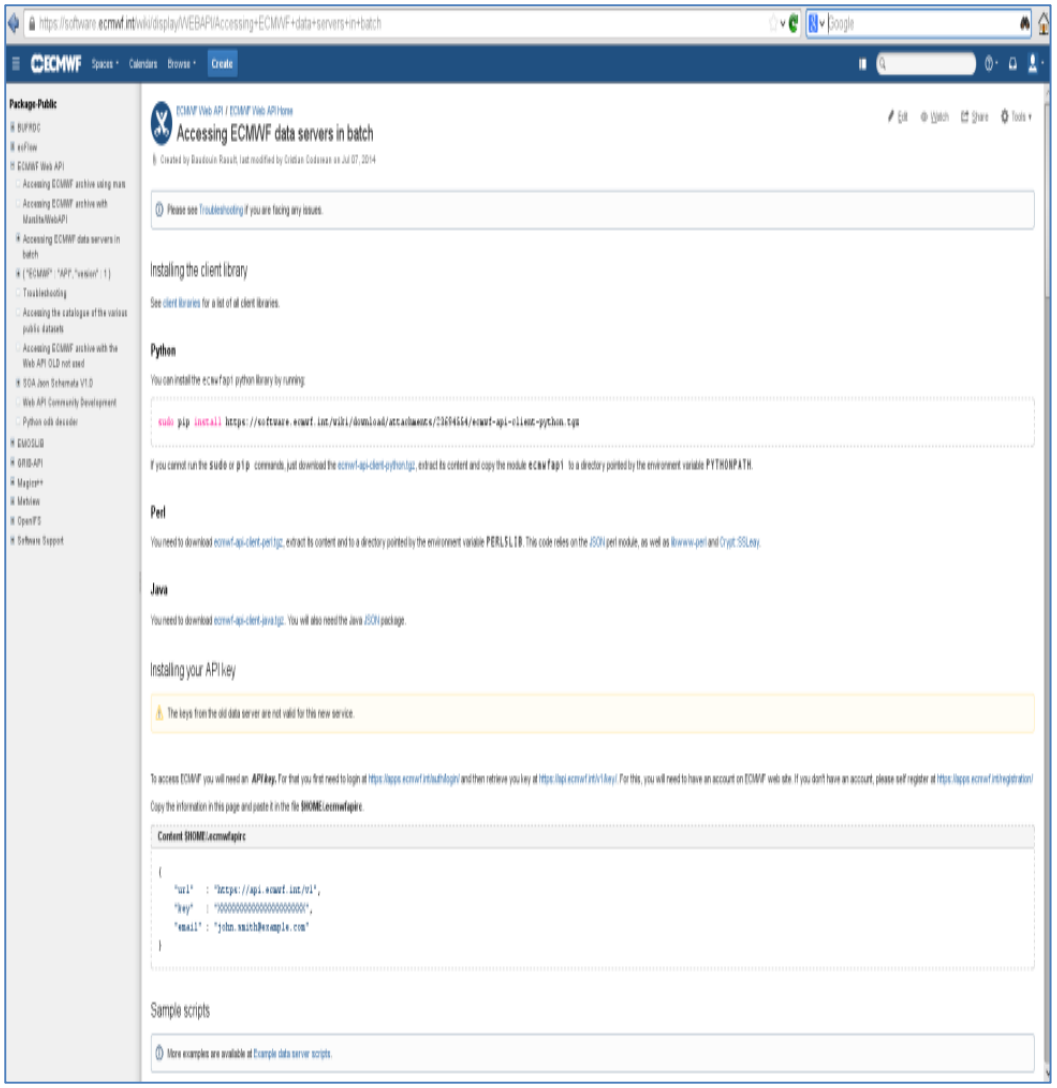


  - Requests more efficient when physical layout is known



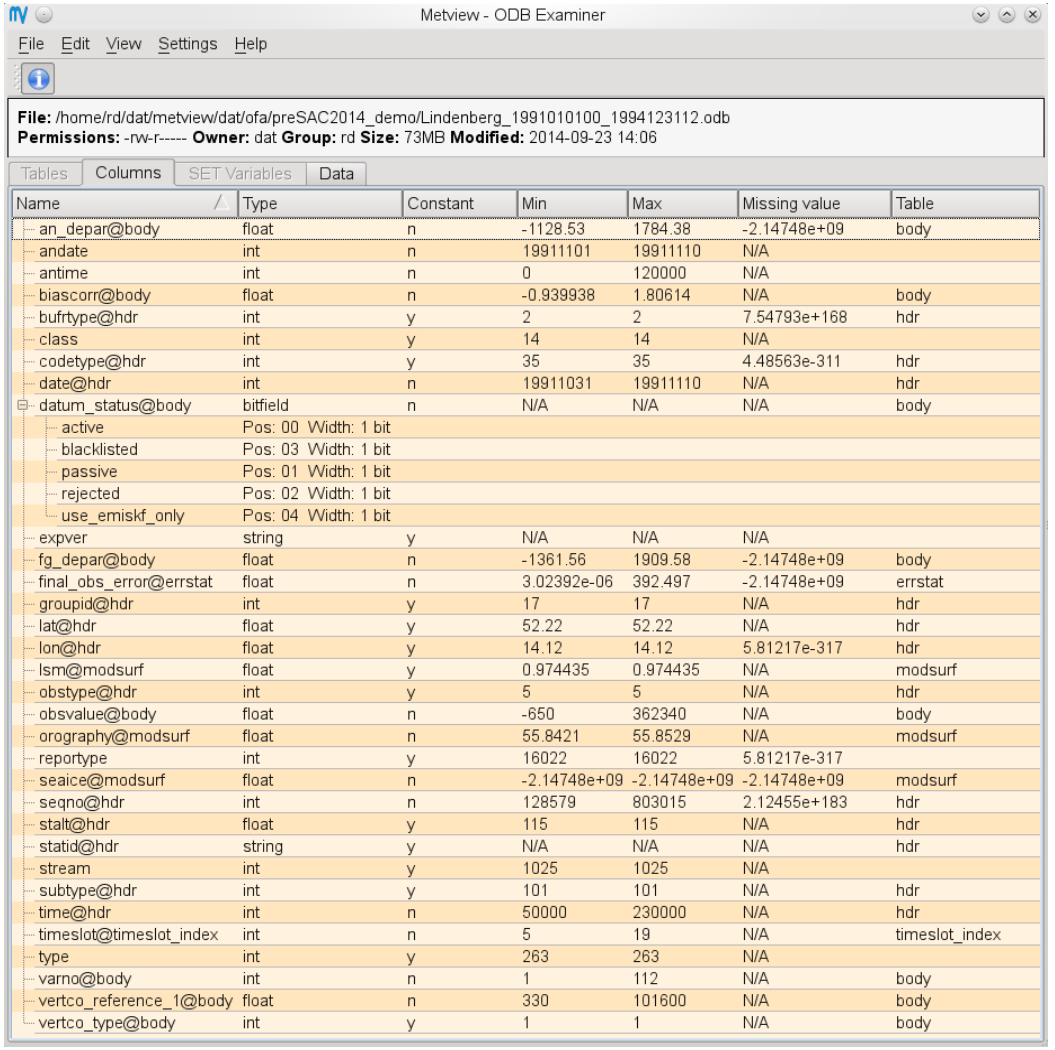
User Interface 4

- Batch-mode, APIs, Python
  - Initial use of Public browser
  - Provide syntactic translations of semantic selections
  - Users adapt/embed them within scripts and submit via data servers
  - Control of direct requests without overhead of ECMWF internal userids



Visualization Tools - Metview

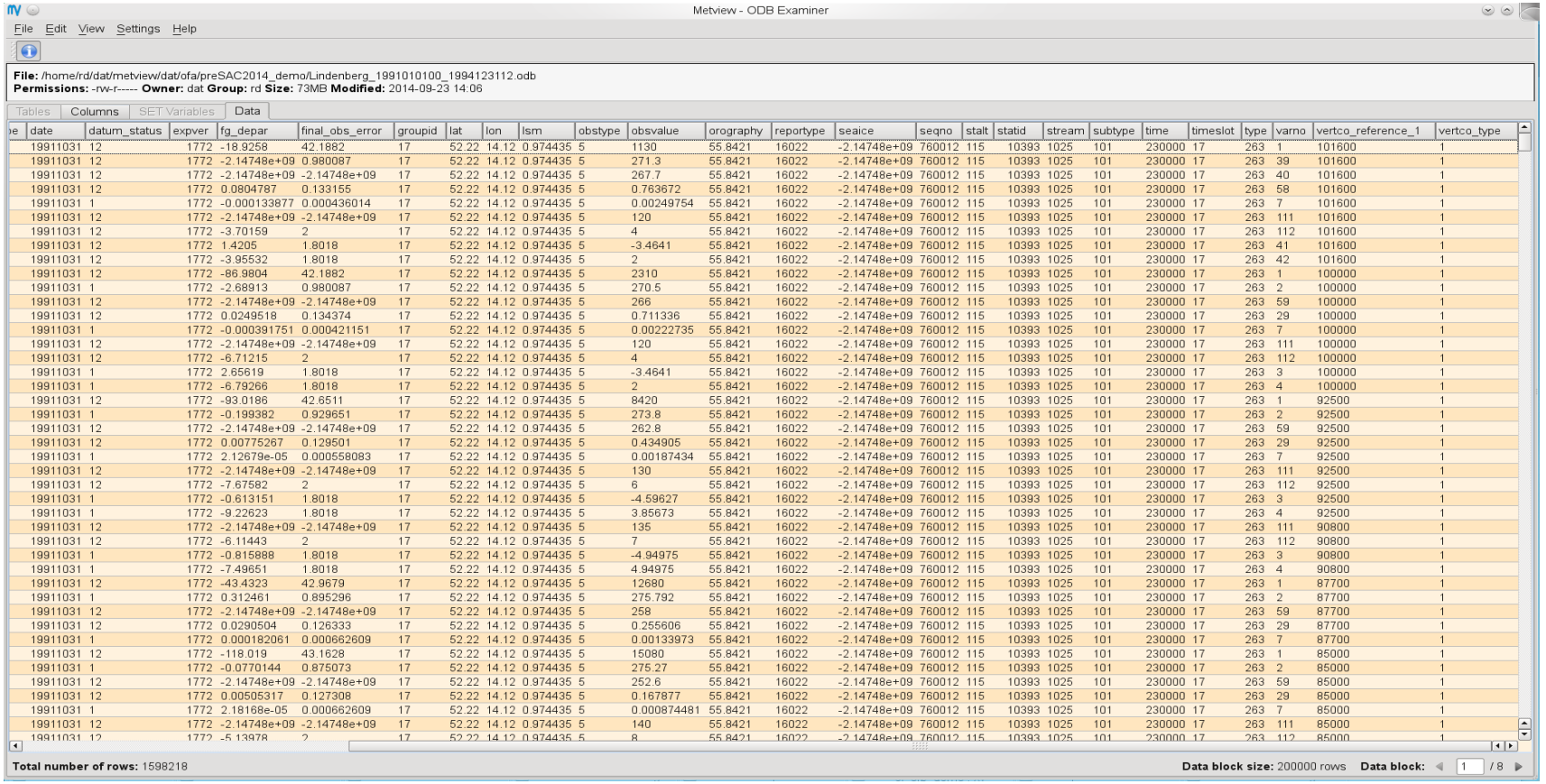
- In-house graphics package
- Permits inspection of data contents at dataset level



Name	Type	Constant	Min	Max	Missing value	Table
an_depar@body	float	n	-1128.53	1784.38	-2.14748e+09	body
andate	int	n	19911101	19911110	N/A	
antime	int	n	0	120000	N/A	
biascorr@body	float	n	-0.939938	1.80614	N/A	body
bufrtype@hdr	int	y	2	2	7.54793e+168	hdr
class	int	y	14	14	N/A	
codetype@hdr	int	y	35	35	4.48563e-311	hdr
date@hdr	int	n	19911031	19911110	N/A	hdr
datum_status@body	bitfield	n	N/A	N/A	N/A	body
active	Pos: 00 Width: 1 bit					
blacklisted	Pos: 03 Width: 1 bit					
passive	Pos: 01 Width: 1 bit					
rejected	Pos: 02 Width: 1 bit					
use_emiskf_only	Pos: 04 Width: 1 bit					
expver	string	y	N/A	N/A	N/A	
fg_depar@body	float	n	-1361.56	1909.58	-2.14748e+09	body
final_obs_error@errstat	float	n	3.02392e-06	392.497	-2.14748e+09	errstat
groupid@hdr	int	y	17	17	N/A	hdr
lat@hdr	float	y	52.22	52.22	N/A	hdr
lon@hdr	float	y	14.12	14.12	5.81217e-317	hdr
lsm@modsurf	float	y	0.974435	0.974435	N/A	modsurf
obstype@hdr	int	y	5	5	N/A	hdr
obsvalue@body	float	n	-650	362340	N/A	body
orography@modsurf	float	n	55.8421	55.8529	N/A	modsurf
reportype	int	y	16022	16022	5.81217e-317	
seaice@modsurf	float	n	-2.14748e+09	-2.14748e+09	-2.14748e+09	modsurf
seqno@hdr	int	n	128579	803015	2.12455e+183	hdr
stalt@hdr	float	y	115	115	N/A	hdr
statid@hdr	string	y	N/A	N/A	N/A	hdr
stream	int	y	1025	1025	N/A	
subtype@hdr	int	y	101	101	N/A	hdr
time@hdr	int	n	50000	230000	N/A	hdr
timeslot@timeslot_index	int	n	5	19	N/A	timeslot_index
type	int	y	263	263	N/A	
varno@body	int	n	1	112	N/A	body
vertco_reference_1@body	float	n	330	101600	N/A	body
vertco_type@body	int	y	1	1	N/A	body

Visualization Tools - Metview

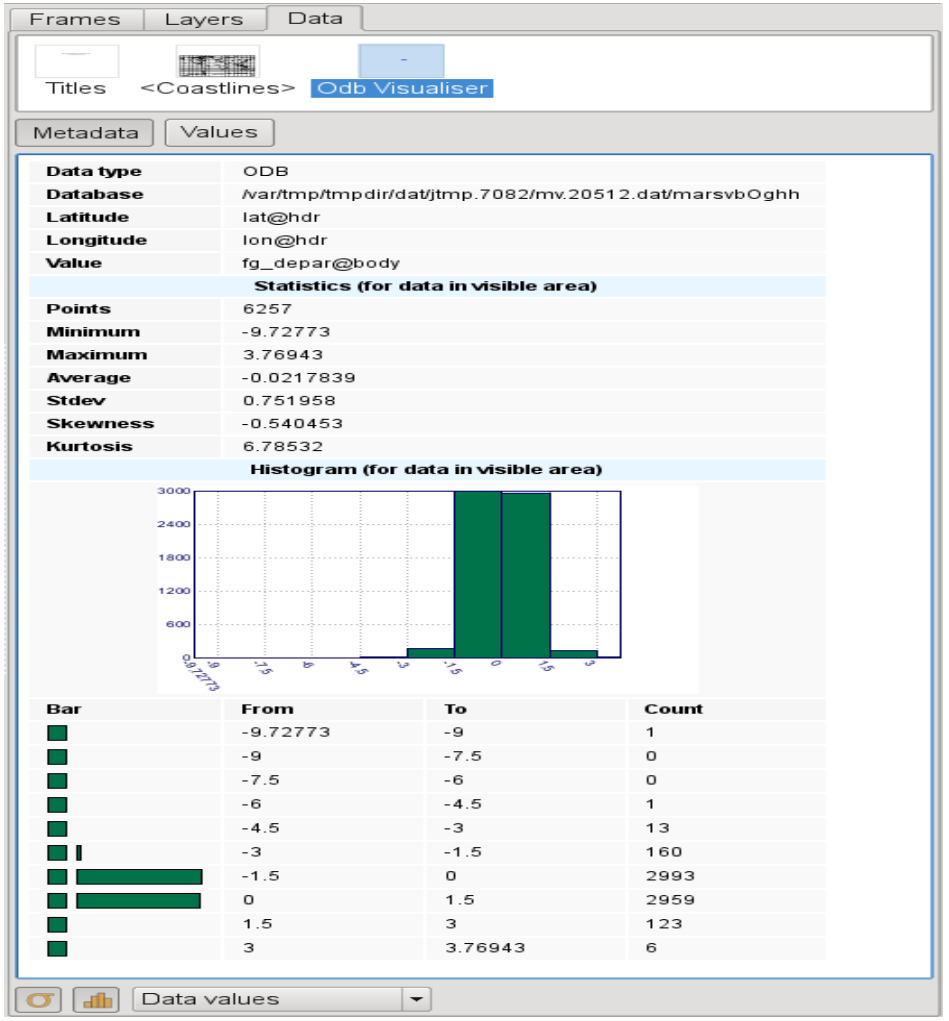
- Inspection of data values at individual datum level



date	datum_status	expver	fg_depar	final_obs_error	groupid	lat	lon	lsm	obstype	obsvalue	orography	reportype	seaice	seqno	stalt	statid	stream	subtype	time	timeslot	type	varno	vertco_reference_1	vertco_type
19911031	12	1772	-18.9258	42.1882	17	52.22	14.12	0.974435	5	1130	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	1	101600	1
19911031	12	1772	-2.14748e+09	0.980087	17	52.22	14.12	0.974435	5	271.3	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	39	101600	1
19911031	12	1772	-2.14748e+09	-2.14748e+09	17	52.22	14.12	0.974435	5	267.7	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	40	101600	1
19911031	12	1772	0.0804787	0.133155	17	52.22	14.12	0.974435	5	0.763672	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	58	101600	1
19911031	1	1772	-0.000133877	0.000436014	17	52.22	14.12	0.974435	5	0.00249754	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	7	101600	1
19911031	12	1772	-2.14748e+09	-2.14748e+09	17	52.22	14.12	0.974435	5	120	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	111	101600	1
19911031	12	1772	-3.70159	2	17	52.22	14.12	0.974435	5	4	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	112	101600	1
19911031	12	1772	1.4205	1.8018	17	52.22	14.12	0.974435	5	-3.4641	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	41	101600	1
19911031	12	1772	-3.95532	1.8018	17	52.22	14.12	0.974435	5	2	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	42	101600	1
19911031	12	1772	-86.9804	42.1882	17	52.22	14.12	0.974435	5	2310	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	1	100000	1
19911031	1	1772	-2.68913	0.980087	17	52.22	14.12	0.974435	5	270.5	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	2	100000	1
19911031	12	1772	-2.14748e+09	-2.14748e+09	17	52.22	14.12	0.974435	5	266	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	59	100000	1
19911031	12	1772	0.0249518	0.134374	17	52.22	14.12	0.974435	5	0.711336	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	29	100000	1
19911031	1	1772	-0.000391751	0.000421151	17	52.22	14.12	0.974435	5	0.00222735	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	7	100000	1
19911031	12	1772	-2.14748e+09	-2.14748e+09	17	52.22	14.12	0.974435	5	120	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	111	100000	1
19911031	12	1772	-6.71215	2	17	52.22	14.12	0.974435	5	4	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	112	100000	1
19911031	1	1772	2.65619	1.8018	17	52.22	14.12	0.974435	5	-3.4641	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	3	100000	1
19911031	1	1772	-6.79266	1.8018	17	52.22	14.12	0.974435	5	2	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	4	100000	1
19911031	12	1772	-93.0186	42.6511	17	52.22	14.12	0.974435	5	8420	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	1	92500	1
19911031	1	1772	-0.199382	0.929651	17	52.22	14.12	0.974435	5	273.8	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	2	92500	1
19911031	12	1772	-2.14748e+09	-2.14748e+09	17	52.22	14.12	0.974435	5	262.8	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	59	92500	1
19911031	12	1772	0.00775267	0.129501	17	52.22	14.12	0.974435	5	0.434905	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	29	92500	1
19911031	1	1772	2.12679e-05	0.000558083	17	52.22	14.12	0.974435	5	0.00187434	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	7	92500	1
19911031	12	1772	-2.14748e+09	-2.14748e+09	17	52.22	14.12	0.974435	5	130	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	111	92500	1
19911031	12	1772	-7.67582	2	17	52.22	14.12	0.974435	5	6	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	112	92500	1
19911031	1	1772	-0.613151	1.8018	17	52.22	14.12	0.974435	5	-4.59627	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	3	92500	1
19911031	1	1772	-9.22623	1.8018	17	52.22	14.12	0.974435	5	3.85673	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	4	92500	1
19911031	12	1772	-2.14748e+09	-2.14748e+09	17	52.22	14.12	0.974435	5	135	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	111	90800	1
19911031	12	1772	-6.11443	2	17	52.22	14.12	0.974435	5	7	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	112	90800	1
19911031	1	1772	-0.815888	1.8018	17	52.22	14.12	0.974435	5	-4.94975	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	3	90800	1
19911031	1	1772	-7.49651	1.8018	17	52.22	14.12	0.974435	5	4.94975	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	4	90800	1
19911031	12	1772	-43.4323	42.9679	17	52.22	14.12	0.974435	5	12680	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	1	87700	1
19911031	1	1772	0.312461	0.895296	17	52.22	14.12	0.974435	5	275.792	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	2	87700	1
19911031	12	1772	-2.14748e+09	-2.14748e+09	17	52.22	14.12	0.974435	5	258	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	59	87700	1
19911031	12	1772	0.0290504	0.126333	17	52.22	14.12	0.974435	5	0.255606	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	29	87700	1
19911031	1	1772	0.000182061	0.000662609	17	52.22	14.12	0.974435	5	0.00133973	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	7	87700	1
19911031	12	1772	-118.019	43.1628	17	52.22	14.12	0.974435	5	15080	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	1	85000	1
19911031	1	1772	-0.0770144	0.875073	17	52.22	14.12	0.974435	5	275.27	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	2	85000	1
19911031	12	1772	-2.14748e+09	-2.14748e+09	17	52.22	14.12	0.974435	5	252.6	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	59	85000	1
19911031	12	1772	0.00505317	0.127308	17	52.22	14.12	0.974435	5	0.167877	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	29	85000	1
19911031	1	1772	2.18168e-05	0.000662609	17	52.22	14.12	0.974435	5	0.000874481	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	7	85000	1
19911031	12	1772	-2.14748e+09	-2.14748e+09	17	52.22	14.12	0.974435	5	140	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	111	85000	1
19911031	12	1772	-5.13978	2	17	52.22	14.12	0.974435	5	8	55.8421	16022	-2.14748e+09	760012	115	10393	1025	101	230000	17	263	112	85000	1

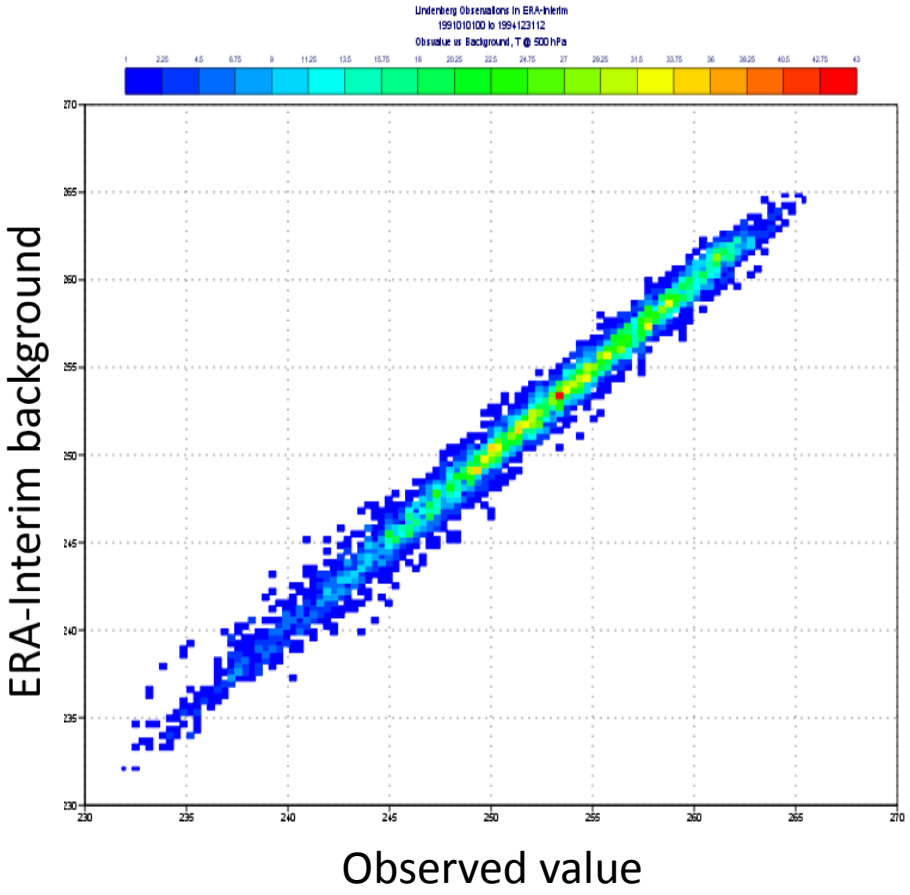
Visualization Tools - Metview

- Statistical summaries



Visualization Tools - Metview

- Filtering of data
- Plots for scientific analysis



Manipulation Tools – odb_api

- SQL-based interrogation
- Underlies Metview and data retrievals

```
linux% module load odb_api
load odb_api 0.9.24 Library (PATH, PYTHONPATH,ODB_API_MODE, ODB_API_VERSION, ODB_API_INCLUDE, ODB_API_LIB,
LAGS, EC_CXXFLAGS, EC_FLDFLAGS, EC_CLDFLAGS, EC_CXXLDFLAGS)
linux% odb sql -q "select distinct reportype, count(obsvalue)" -i ispd_ps_ManualLandSynop_active_2b.odb
000 2014-11-04 16:58:15 (I) Executing 'select distinct reportype, count(obsvalue) ;'
000 2014-11-04 16:58:15 (I) FileHandle::open ispd_ps_ManualLandSynop_active_2b.odb r 5
     reportype  count(obsvalue)
000 2014-11-04 16:58:16 (I) SELECT has aggregated and non-aggregated results
         16002     87765.000000
000 2014-11-04 16:58:16 (I) Matching row(s): 1 out of 87,765
000 2014-11-04 16:58:16 (I) Skips : 0
000 2014-11-04 16:58:16 (I) Execute: 0.025198 second elapsed, 0.02 second cpu
linux%
```

Concluding remarks

- Infrastructure needs are substantial
- Implementation well-advanced but still maturing
- Co-ordination would help to address:
  - Architecture: central or distributed/brokerage systems?
  - Common contents/formats?
  - Mappings, convertors, governance?
  - Community toolboxes?
  - Capacity building
    - Technical systems
    - Training users to access/interpret Observation Feedback
    - Providers of training and other services

Tools, by format

- BUFR: for linux and HPC
  - 'dump' and (linux:) 'viewer'
  - spaghetti Fortran programs that need tailoring for each type of BUFR message
- ODB1: for linux and HPC (preferred)
  - Fortran interface (quite heavy to implement)
  - SQL command-line (dump, search, sort, aggregate functions…)
  - Linux: viewer in metview/Magics++
- ODB2: for linux and HPC
  - API with Fortran, C++, and python bindings
  - SQL command-line (dump, search, sort, aggregate functions…)
  - Several wrappers at command-line for sub-setting, merging (adding blocks or attributes), comparing (attributes and numerical contents)
  - Linux: viewer in metview/Magics++

Observation identification tables at ECMWF

- Reportype:
  - Examples: **16002** indicates Manual Land SYNOP, **1005** indicates NOAA 19 AMSUA Radiances, …
  - http://data-portal.ecmwf.int/odbgov/ReportType/

- Geophysical variable numbers:
  - Examples: **7** indicates Specific humidity, **119** indicates Brightness temperature, …
  - http://data-portal.ecmwf.int/odbgov/Varno/