Release Notes for SAFNWC/PPS version 2014
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10 October 2014   .
Updated 12 November 2014

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=====================
0) About this release
=====================

This is release 2014 of the SAFNWC/PPS software package. It
contains four sub-packages, packed in totally six tar-balls
(versioning of the individual packages are git/svn-release
tags):

        - ahamap-r1_69
        - acpg-r3_07
        - cpp-svn42
        - pps_nwp-v0.4.10

  packages containing data:
        - acpg_testdata-r3_07 (example data)
        - cpp_ancdata_v2014 (necessary for CPP-processing)

In addition the PPS-2014 release contains a "reference
dataset".

=======================
1) Why you should care!
=======================
*) Major performance improvements to CMA, CTTH and CPP
*) New netcdf format
*) Easier to install (binary installation)

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2) Summary of main changes since version 2012
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NB! For v2014 PPS output will be in a new output format: Both
    netcdf- and hdf-files can be created. New file names
    (also for the hdf-files); new node names with-in the
    files; new class definitions (cloud mask, cloud type and
    cpp phase); changes in attributes.


The main changes in PPS v2014 are:


* Improved CMA (Updates include: New lookup tables, new
  tests, tuning and bug corrections)
* Faster and more accurate CTTH with less nodata
* Improved CPP (improved algorithm; phase also for night)

* Easier installation (binary; without aapp)
* New output format. (see 6b)
  Both hdf and netcdf are available, and have similar
  formats. Netcdf will be the only format in next version.
* New way of calling the python scripts. (see 6c)
* Possible to process AVHRR data from Metob B. (also
  available as a patch to 2012)
* Allowing for more types of NWP and OSISAF data.
* PPS-Task Manager is no longer delivered


For a detailed description of the changes see section 6).



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3) Installation
===============
There are now two alternatives to install PPS:
* Using source code (as before)
* With precompiled binaries, which is an easier way to
  install. There are binaries available for a few operating
  systems.


Please find descriptions in Installation_Notes_PPS_v2014.txt,
and in installation notes for each binary distribution,
respectively.



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4) Configuration of the PPS-system
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Environment:
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Make sure that your PYTHONPATH point at where the needed
python packages (numpy, scipy, h5py, etc) are found!

.profile_pps: (or source_me)
        (Both these files are generated automagically from
```

the source_me.in and the profile_pps.in upon running
the autoconf configure script. So changes to these
files will be overwritten next time you run
   "./configure", "make", "make install".)

If you are going to process Global Metop data, set
AAPP_PREFIX to the path where your AAPP installation
is found.

Apart from AAPP_PREFIX, you can use default settings,
but you might want to change these:
SM_OVERWRITE Decides whether to overwrite (1) files
or not (0), if you re-run a certain scene.
SM_WRITE_NETCDF Decides whether to write netCDF-
files.
SM_LATLAT_IN_NETCDF_<pge> Decides whether to have
latitude and longitude information inside the
netCDF-files or not.

You can also change the paths of different types of
input data, if not using the default paths.

configure command:

When starting the compilation and installation process, you
run the 'configure' command. See installation note for an
example. Use:
%> ./configure --help
to see the available options.

Configuration files:
----

pps_basic_configure.py
     * Perhaps you need to adjust the parameters
     NWP_TIME_RESOLUTION, NWP_FIELD_PREFIX,
     NWP_MAXIMUM_TIME_DEVIATION and ALLOWED_ANALYSIS_HOURS
     to match your NWP model.

     * Perhaps you want to adjust the python dictionary
     IMAGES, controlling which satellites and products
     that will have images generated, and in which format.
     CPP_PRODUCTS_IMAGE sets which of the CPP products
     that will have images.

     * Perhaps you want to adjust the parameter
     THUMBNAIL_IMG_SIZE to control the size of the
     thumbnail images. It is currently set to xsize/3
     times ysize/3 (where xsize,ysize are the dimensions
     of the original product images).

     * There are more settings too that may be changed by
     the user, but all of them already have reasonable
     default values.

region_config.cfg:
     In case you plan to do remapping with PPS: Do you

have all the region definitions needed available in
here?

pps_config_common.cfg:
        The default settings works as is.
        We recommend you to configure the output of all PGE
        products, according to default settings. Eg. you
        should generate all three CTTH products (i.e.
        GENERATE_TEMPERATURE:yes; GENERATE_PRESSURE:yes;
        GENERATE_HEIGHT:yes)

        We recommend not to use the cloud type phase flag
        (GENERATE_PHASE_FLAG:no). If you are interested in
        cloud phase we rather recommend the CPP (PGE05)
        cloud phase product instead.

        It could also be that you do not want to use OSISAF
        ice maps, then you set WITHOUT_SEAICE to yes. You
        find this parameter under PGE01 in the same config-
        file. This is for instance if you do not have access
        to OSISAF Ice products in real time or if you are
        anyhow processing over a region far from the Arctic
        or Antarctic Oceans where Sea Ice is present.

pps_nwp.ini:
        This file comes from pps_nwp.ini, but should be made
        available in acpg/cfg, if any non-default
        configuration is to be used.

        If you use NWP-files with a sub-set of NWP-levels,
        (eg. 91 levels of originally 137) you need to set
        hybrid_level_selection. Set it to a list of the
        levels that you use.

        All other possible settings in this file is to
        specify if you want to get a certain NWP-measure from
        a different list of NWP-parameters than is set as
        default.

==
5) Configuration changes since PPS version 2012
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The changes in configuration files from PPS v2012 to PPS
v2014 are quite substantial. So do not try to re-use any
configuration files from earlier PPS installations.

Not all changes are described below, only those that might be
of interest for the user to change.

Changes in calling 'configure':

ACPG: We now recommend to use --without-aapp.
CPP: The parameters --disable-command_line and
      --disable-generate_anc has been added (already in
      v2012-patch). Will disable some code in CPP that any

way will not be used in PPS.

Changes in .profile_pps/source_me:

Changed:
 AAPP_PREFIX has to be set manually, if you intend to run
          GlobalMetop data.
 SM_COASTALZONE_LIMIT has got a changed default value. (from
                64 to 0)
 SM_CFG_DIR is used for getting cfg-directory

New:
 SM_WRITE_NETCDF 1=Create netCDF-files, beside the hdf-files
 SM_LATLON_IN_NETCDF_<pge> 1=Create latitude/longitude
                    datasets in the netCDF file of
                    <pge>. (To set per PGE.)
 SM_CPP_<indata>_MANDATORY 1=This indata is mandatory to the
                      CPP processing.
                    0=This indata will be used if
                      available.
                    <indata>=CTTH,
                          SNOWDATA (from NWP),
                            ICEMAP (from OSISAF)
 SM_LINENO_IN_FILENAME 1=start scanline and end scanline will
                      be written in filename. (Use together
                  with --startline and --endline in the
                  python calls.)
 MODIS_LVL1_DIR path to MODIS input data, use if processing
          MODIS scenes.

Changes in pps_basic_configure.py:

CTTH:
 CTTH_SEMITRANS_INTERPOLATE   If CTTH data may be inter-
                       polated between pixels.
 RUN_CTTH_PARALLEL   If CTTH should run in parallel
 CTTH_NUMBER_OF_CORES_TO_USE The number of cores to use, in
                       case of parallel processing.
 CTTH_WITH_SHIFT_PLATFORM   Should be set to 0, as moving
                       window no longer has a role to
                       play -it just wastes time now.
CPP:
 CPP_GENERATE_PROCESSING_FLAG, CPP_GENERATE_ERROR_ESTIMATES
              Which datasets to generate in CPP.
 CPP_PRODUCTS_IMAGE Which datasets to make images from.
 CPP_REDUCE_ANGLES   Whether data should be generated in a
              lower maximum sun/sat-angle than
              possible. (In order to keep a higher
              quality in the product.)
 CPP_PHASE_MAX_ANGLE, CPP_LWP_MAX_ANGLE
              When CPP_REDUCE_ANGLES is active, these
              give the maximum angles wanted.
              Recommended values are 72 (LWP) and
              180 (phase). 180 means no reduction.
Control functions:
 CONTROL_TXT The quality control shall be presented as a
          text file.

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  CONTROL_XML  The quality control shall be presented as an
            xml file.
  PPS_STATISTICS_DIR  Directory for the quality control output


MODIS processing:
 H4TOH5_EXEC  Your path to h4toh5


Changes in pps_config_common.cfg:
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A new variable:
 GENERATE_MULTILAYER_FLAG yes=produce the dataset
                   ct_multilayer in CloudType.


Changes in region_config.cfg
----------------------------
Added six pre-defined regions and removed one.


Changes in pps_nwp.ini:
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New:
 hybrid_level_selection  See description in 4).
NB! In v2012-patch20130619/patch20140509 this feature was
    set in pps_nwp/pps_nwp_configure.py, but for v2014 it
    should be pps_nwp.ini.


New files in cfg-directory
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<satellite id>_sst.ini     eg. metop01_sst.ini, noaa19_sst.ini
These files need to be present. They should not be modified.



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6) Software changes since PPS version 2012
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6a) Products
6b) Interfaces: output
6c) Interfaces: calls
6d) Post processing
6e) Intermediate data processing
6f) Technical changes


6a) Products


CMa
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Threshold test scheme:
* Update of the threshold test logic, and related bug
  corrections
* Tuning of threshold offsets
* Revised which tests to be active in different situations
* New cloud mask tests in v2014:
    arcticIceCrackTest (not used yet)
    arcticwarmCloudTest_v2014 (not used yet)
    arcticwarmCloudTestSalomon
    brightCloudTest_v2014
    brightCloudTestNoSunglint3ALand
    cirrusCloudOverWaterTest (not used yet)
```

```
    coldBrightCloudTest37
    coldClearArcticAreaTest
    coldCloudTest_v2014
    coldCloudTestDay_v2014
    coldWatercloudTestDay
    DriedOutLakesAndRiversTest
    SaltLakeTest
    snowSeaTest3A_v2014
    SpatialCloudTestLand
    sstDaytimeTest
    sstNighttimeTest (not used yet)
* Added 8.5 micron tests for VIIRS and MODIS.
```

Indata:
* Solar contribution included explicitly in day-land look-up
  tables
* New emissivity maps (updated from MODIS version 4.1 to 5)
* Rough terrain replaces high terrain, when selecting
  whether to use cloud mask mountain schemes.
* Possible to use OSISAF-maps also for GAC. (A full GAC-
  scene takes two files, one for north and one for south
  hemisphere.)
* Possible to use OSISAF reprocessed ice maps in netcdf, as
  an alternative to the OSISAF operational ice maps in grib.

Others:
* Added cloud mask binary dataset. (derived from the cloud
  mask dataset)
* New coast definition
* Less nodata in product over arctic

CT
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* The changes in cloud mask has quite some implicit effects
  on cloudtype.
* Changed the mode of calculating phase flag. (But still the
  CPP phase dataset is the recommended one.)
* Added a multi-layer cloud dataset.

CTTH

Improved:
* Faster retrieval
* Higher retrieval rate: much less cloudy pixels without a
  a CTTH estimate.
* Improved accuracy

Methods:
* The curve fitting algorithm in the semi-transparent CTT
  scheme has been exchanged, optimized and parallelized,
* More clouds are now being treated as semi-transparent, by
  taking into account both cloud type and brightness
  temperature differences, leading to improvement of height
  for high level clouds and multilevel clouds.
* Strategies to identify best fit of cloud top temperature to

NWP height profile were refined, by adding uncertainties to
the NWP temperature, in order to better fit clouds to
corresponding temperature inversions
* The strategy for use of RTTOV simulations has been
  simplified. Now only cloud-free land and cloud-free sea
  Tb11 temperatures are simulated and used to calculate the
  atmospheric corrections at the surfaces. They are then used
  together with the specific humidity profile to find a
  temperature profile corrected for atmospheric absorption.
* Possibility for interpolation of semi-transparent clouds
  from neighbouring pixels
* Bug corrections

Others:
* RTTOV9 has been replaced with RTTOV11
* Moving window functionality is default turned off. It
  gives almost no benefit any more, as the retrieval rate
  in CTTH now is much higher than before.

PC
----
* Stop the PC processing when AMSU data is missing -unless
  configured for running without AMSU data.
* In ppsRunAllParallel.py: Do not derive precip for npp,
  terra and aqua.

CPP

Algorithm:
* Generation of new look-up tables (LUTs) based on DAK
  radiative transfer simulations.
  The most important changes in the LUTs are:
  - correction of ice particle shape for the 3.8 ~m channel
    (which was erroneously set to spheres instead of hexagons
    in the previous version)
  - extension of the range of solar zenith angles (SZAs) and
    viewing zenith angles (VZAs)
  - increase of the number and range of effective radii.
* Implementation of a new cloud phase algorithm. The new
  cloud phase algorithm closely follows the approach taken by
  the PATMOS-x team as described in Pavolonis et al. (2005).
* Inclusion of observational sea ice and numerical weather
  prediction (NWP) snow cover data to better characterize the
  surface albedo.

Implications:
* More balanced phase algorithm
* Phase available also during night
* LWP available down to 84 degrees. (but we recommend to use
  it down to 72 degrees as previously, due to quality
  considerations.)
* Option to use CTTH as input (preferable, but not mandatory)
* Option to use OSISAF-ice as input (preferable, but not
  mandatory)
* Option to use NWP-snow depth and NWP-snow albedo as input

(preferable, but not mandatory)

Others: (PPS specific, not in the CPP-s.w. package)
* Fewer classes in cloud phase, only liquid, ice and nodata.
* Added dataset cloud phase extended, with more classes.
* Corrected LWP and IWP appearance when CWP is nodata
* More configurations added (which datasets/images to
  produce)
* The CPP s.w. creates an intermediate CPP-product file.
  Before new information was added to that file by ACPG. Now
  that file is read, removed and replaced by ACPG.

6b) Interfaces: output

For a detailed description of the new output format, see
NWC/CDOP2/PPS/SMHI/SW/DOF.

* New netCDF 4 file format, CF compliant as far as possible.
  Output in HDF5 is also available, but will not be supported
  from next version and onwards.
* Changed filenames both for output products and intermediate
  files.
* Changed dataset names in hdf-files.
* Changed class definitions used for Cloud Mask, Cloud Type
  and CPP phase.
* The previous cloudmask dataset is now called cma_extended.
* Added cloud binary mask: the dataset is called cma.
* Changed units for CTTH pressure (hPa to Pa),
  CPP cpw/lwp/iwp (kg/m2 to g/m2) and
  CPP reff (m to micro meter)
* Replaced the quality flags in the products.
* Added a number of attributes in output files, removing a
  few and correcting a few.
* Added scripts for transforming hdf-files to netcdf-files.
* Added scripts for transforming files of old (v2012) format
  to files of new (v2014) hdf-format.
* GlobalMetop filenames no longer use orbit number, instead
  they use the number 00000.

6c) Interfaces: calls

For a detailed description of how to call the scripts, see
NWC/CDOP2/PPS/SMHI/SW/UM/2.

* New main script interfaces using the argparse module.
  New way of calling, eg.:
  from   to
   ppsCmask.py noaa19 12345   ppsCmask.py -p noaa19 12345
   ppsGacCmask.py /data/NSS...   ppsGacCmask.py -f /data/NSS..
   ppsCmaskGlobalMetop.py AVHR... ppsCmask.py -f AVHR...
  from: ppsRunAll Parallel.py noaa19 12345
  to: ppsRunAllParallel.py -p noaa19 12345

* Removed the task manager.

* Added the main script ppsRunAllParallel.py (already in
  v2012-patch, but improved since)
* Changed names of these python scripts:
   from: to:
   CloudMaskCloudTypePrepare.py ppsCmaskPrepare.py
   CloudMask.py   ppsCmask.py
   PrecipPrepare   ppsPrecipPrepare.
   Precip.py   ppsPrecip.py
* Removed all GlobalMetop-python scripts, now use the same
  scripts as for direct-readout. Eg. ppsCmask.py instead of
  ppsCmaskGlobalMetop.py
* ppsRunAllParallel.py can process also Global Metop data.
* Added ppsPrepareModis.py (corresponding to
  ppsMakeAvhrr.py), a processing step that previously had to
  be done outside PPS.
* Added ppsGacControl.py, a GAC-interface to the control
  functions.

6d) Post processing

Control functions (getting statistics):
* Added possibility to get output in xml format (options:
  ascii and/or xml files)
* Created pps_check_statistics.py. A stand alone script to
  check selected parts of the xml-file. (for CMa, CT and
  CTTH)
* For CTTH added 1st and 99th percentile
* Can direct output to another directory (PPS_STATISTICS_DIR)
* Time savings, re-structuring of code, bug fixes, etc.

Remapping:
* Updated how to select nodata masking.
* Do not let pixels further apart then 100km influence each
  other.
* While using ppsRunAllParallel, set a max allowed time to
  spend on remapping.

Images:
* Changed some of the colour scales (changes in hdf/netcdf-
  files, to better match the png:s)
* Changed PIL import to be more up-to-date. This also allows
  for using Pillow instead of PIL.

6e) Intermediate data processing

PPS data:
* Less dependence of AAPP. (PPS no longer needs to be
  compiled with AAPP, in any situation)
* When running Global Metop data AAPP_PREFIX must be set.

PHYSIOGRAPHY data:
* Added topography roughness data set.

NWP data:
Most NWP changes were already in v2012-patches:

* Can handle GRIB-files with up to 137 levels.
* pps_nwp can be configured to handle NWP files with a
  subset of levels, eg. 91 out of 137 levels. (Functionality
  has been improved in v2014.)
* Can handle the special case of GRIB-files with different
  NWP fields in different resolution.
* Bug fixes

More NWP changes, in v2014:
* Added reading of snow depth, snow albedo and tropopause
  pressure.
* Bug correction: before not always the best (according to
  time) NWP-file was chosen.
* NWP-prefix configuration is now a list of several options.

EMISSIVITY:
* Change emissivity data from MODIS version 4.1 to MODIS
  version 5.
* Removed environment variable EMISS_FALLBACK_DIR, always use
  SM_EMISSSOURCE_DIR.
* allow emissivity files both with suffix .h5 och .hdf

6f) Technical changes

Functionality:
* Can process Metop-B data (already in v2012-patch)
* Improved logging functionality when running PPS without the
  Task Manager; log messages can either be sent to a file or
  written on screen, instead of always being written on
  screen. (already in v2012-patch)
* More consequent in using GMT, not local time (time stamp
  inside file, logs)
* Updated check of compilers and s.w. versions that are
  expected, in configure.
* Improvements for better MODIS processing.
* Use h4toh5tools for MODIS-processing

Cleaning:
* Better nodata-handing.
* Fixing some memory leaks.
* Change UTF to utf
* Better code formatting (for python: pep8)
* General cleaning: replacing hard coded variables, remove
  variables/files/functions that are not used any more, etc.
* A number of smaller bug fixes.

Testing:
* Added some python unit tests.
* Replaced NPP case in test data, which for v2012 was a case
  of synthetic data, and now is a case of real data.
* Improved regression test; replace noaa16 and noaa17 test
  cases with an npp test case.

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7) Third Party Software
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If you use the installation with binaries, they will include
the third party software that you need.
Installation from source code provides you have the necessary
3rd-party software installed. See also the software users
manual!

For recommended versions of third party software, see also
the Software Version Document (SCVD), the help desk, or the
installation notes (Installation_Notes_PPS_2014.txt).


Some notes on needed versions:

* You need hdf5 version 1.8.1, or later.

* You need hl-hdf version 0.8.0, or later

* For python versions >= 2.7 argparse is included. If you
  have an earlier python version, argparse need to be
  installed separately.

* It is recommended that you use AAPP of version 6.6 or
  later. It is recommended to install PPS without AAPP
  support. If you run PPS on global Metop data, you must
  have an AAPP installation available. If you run PPS on
  other data, you do not need AAPP at all.

* When GRIB-API is built with JasPer support, the JasPer
  library must be available as a shared library. If you
  build JasPer from source, add --enable-shared to the
  JasPer configure command.

* For GRIB-API version 1.9.5 should _not_ be used.


Changes in third party software needs since v2012:
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* New dependencies are:
  The Unidata netCDF4-C library
  netcdf4-python
  argparse

* Not used any more:
  Tk/Tcl
  Pmw (Python Mega Widgets)


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8) Documentation
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There is a new validation report. All other documents
available have been updated since PPS v2012.
All of the documents have got a changed document code and
some of them have got a changed name. Some changes worth to
notice are:
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"User Manual for the SAFNWC/PPS Application: Software Part"
(SAF/NWC/CDOP/SMHI-PPS/SW/SUM/1)
has been split into two parts:
"User Manual for the NWC/PPS Application: Software Part,
1. Installation" (NWC/CDOP2/PPS/SMHI/SW/UM/1) and
"User Manual for the NWC/PPS Application: Software Part,
2. Operation" (NWC/CDOP2/PPS/SMHI/SW/UM/2)

"Product User Manual for the SAFNWC/PPS Application"
(SAF/NWC/CDOP/SMHI-PPS/SCI/PUM/1)
has changed name to
"User Manual for the NWC/PPS Application: Science Part"
NWC/CDOP2/PPS/SMHI/SCI/UM/1

"Product Output Format for the Polar Platform System Software
 Package of the SAFNWC" (SAF/NWC/CDOP/SMHI-PPS/SW/ICD/3)
has been replaced by
"Data Output Format for the SAFNWC/PPS"
(NWC/CDOP2/PPS/SMHI/SW/DOF)

Please download the documentation from the NWCSAF Help Desk!

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9) Reference data
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One sets of reference data with final results and
intermediate (temporary) output of PPS running version 2014
on the test data is available:

    PPS_refdata_v2014_c14475.tgz

There are three cases of hrtp data, noaa18, metop02 and npp.
There are one Global Metop case and one GAC case.
The hrpt noaa18 and metop02 cases use OSISAF ice
concentration data.

It contains intermediate and final output of running the PPS
on the test data included in the acpg-subpackage. This
reference dataset was generated on the development
environment at SMHI (Red Hat Enterprise Linux Server
release 6.2 (Santiago) with gcc/fortran 4.4.7).

The following local environment was used:

AHAMAP Version: r1_69
ACPG Version :   r3_07
CPP Version   :   svn-41
pps_nwp version: 0.4.10

AAPP: 6.12

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RTTOV:     11.1
GRIB-API:  1.9.9

HL-HDF:           0.8.1
HDF5 Version  :   1.8.5-patch1
PROJ Version  :   4.7.0
Python version:   2.6.6
PIL:              1.1.6
ZLIB Version  :   1.2.3
jpeg:             6b

Python packages:
pygrib version:   1.8.4
  (http://code.google.com/p/pygrib/downloads/list)
h5py version:     2.0.1
  (http://code.google.com/p/h5py/downloads/list)
pyresample version: 0.7.9
  (http://code.google.com/p/pyresample)
pyproj version:   1.8.9
  (http://pypi.python.org/pypi/pyproj)
scipy version:    0.9.0
  (http://www.scipy.org/Download)
NumPy version:    1.6.1
  (http://www.scipy.org/Download)
netcdf-python version:     1.0.2
  (https://github.com/Unidata/netcdf4-python)

The following settings are used:
SM_COASTALZONE_LIMIT = 0
SM_LANDSEA_FRACTION_MAX = 255
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10) Optional software packages
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There are two optional software packages included in the
PPS release: ImageViewer and TrainingManager.

ImageViewer is a tool for viewing the PPS hdf-products;
presenting data in a more visible way than eg. hdfview.

TrainingManager is a pre-requisite to use ImageViewer.
(TrainingManager should not be mixed up with the previous PPS
TaskManager -they have nothing in common.)

Installation instructions are included in each of the
packages.

Image viewer is started by the script:
 ImageViewer/bin/twin_window.sh

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11) Known open issues and disclaimers
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Open issues:
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Disclaimers:
* The Cloud Physical Properties product Liquid Water Path
is only properly validated over sea, but not over land.

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2014-10-10