Validation for TPW (PGE06)

NWC SAF PAR Workshop

17-19 October 2005

Madrid, Spain

P. Fernández

General Validation Objectives

The main goal is to compare the TPW values obtained from SEVIRI data with a true pattern TPW.

To this end datasets are being created in real time containing the necessary parameters to provide statistical results.

Two different sources have been used:

- SEVIRI TPW data matching Radio-sounding sites.
- SEVIRI TPW data compared with TPW ECMWF grid point data.

Methodology outline

Data have been processed twofold:

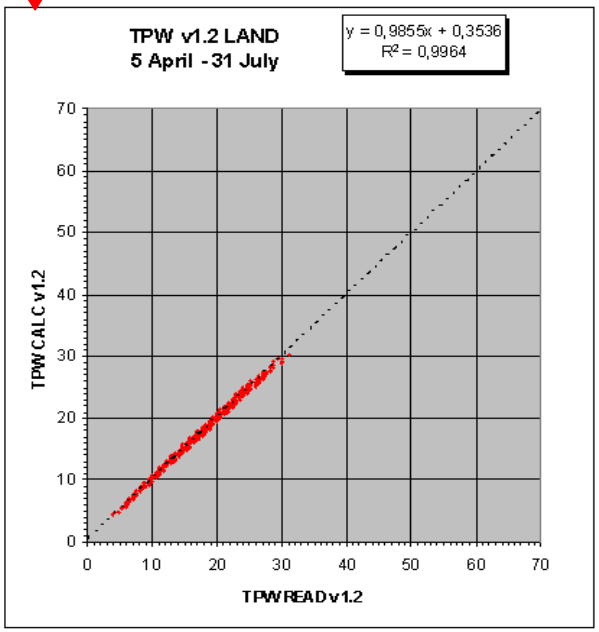
- The product correlation has been obtained by linear regression displayed as scatter plots with the BIAS, RMS and Correlation parameters. Radio Sounding data and ECMWF numerical model data have been used.
- In order to know the spatial behaviour of the errors, the ASCII datasets created with ECMWF data have been reprocessed to convert the TPW values in images in a McIDAS AREA format. This method allows operating the brightness image values performing the statistical parameters in a geographical pattern.–

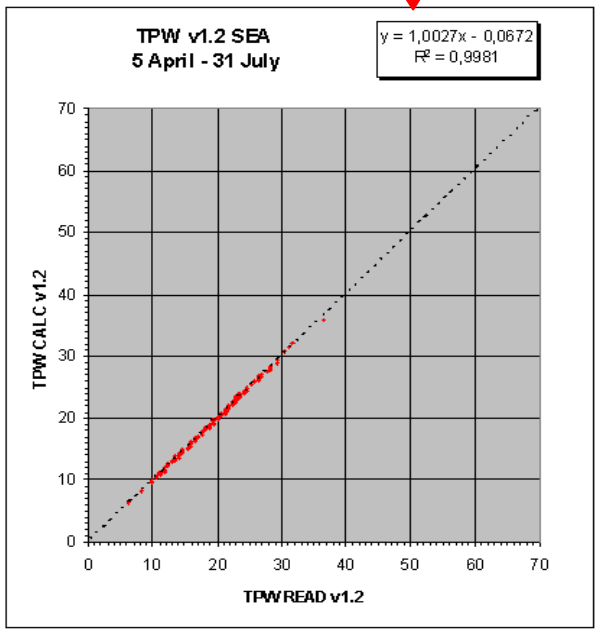
- Earlier TPW SEVIRI data than the 4th April 2005 (SAFNWC/MSG v1.2 running at INM from the 5th April 2005) have been added without reprocessing the corresponding images, just calculating the TPW by using the same SAFNWC v1.2 algorithm and conditions for each Radio Sounding site or ECMWF GRID point.

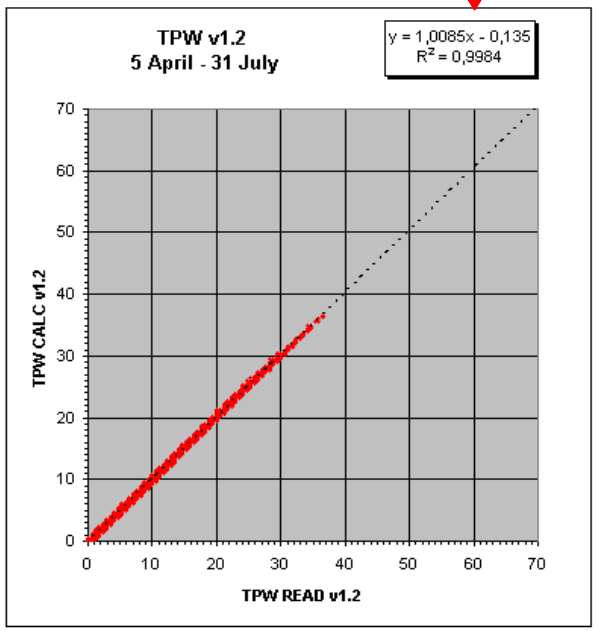
TPW v1.2 versus Radio Sounding TPW data

Observed TPW data versus calculated TPW by using the same SAFNWC v1.2 algorithm and conditions for each Radio Sounding site after SAFNWC/MSG v1.2 running start.

Same for each ECMWF GRID point







TPW v1.2 versus Radio Sounding TPW data

- LAND TPW has been validated with 00, 06, 12 &18 UTC Radio Sounding data from the **1st January 2005** to the **31st July 2005** (previous dates were used for the tuning).

- A few Radio Sounding stations over the coastline were assumed to be SEA pixels by the LAND/SEA mask used into the SAFNWC process and hence originally processed with the TPW SEA algorithm.

- The Radio Sounding validation for SEA TPW has been done with a full year of data from the **1st August 2004** to the **31st July 2005** (tuning made with ECMWF data).

TPW v1.2 versus Radio Sounding TPW data

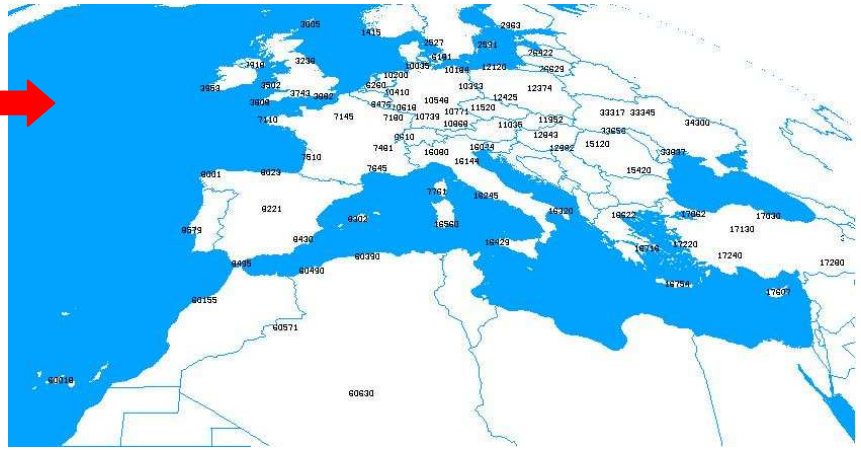
FILTERING:

In order to assure clear air conditions, the next Radio Soundings were rejected during the process using the next flags included in the dataset creation:

- Soundings with FLAG >0 (number of times with profile differences (T-Td) less than 1)
- Soundings with NLEV<20 (profile number of levels)
- Soundings with ULEV>100 HPa (profile upper level)
- Soundings with CLOUD>=5 (cloud octas obtained from SYNOP)

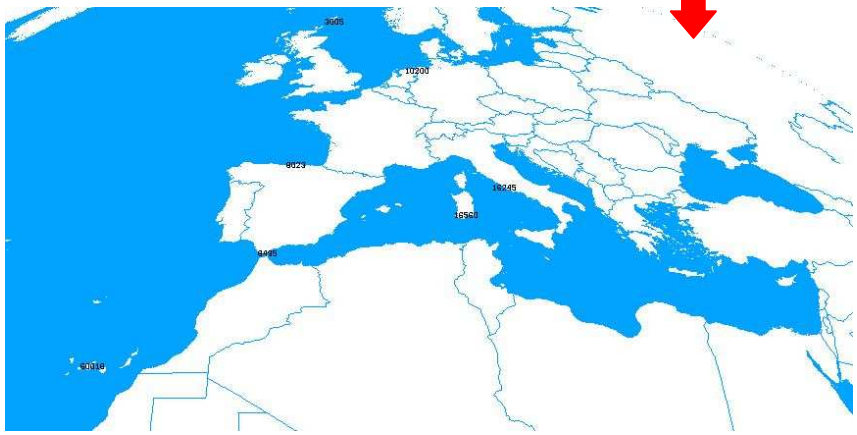
TPW v1.2 versus Radio Sounding TPW data

Radio Soundings used for the dataset creation



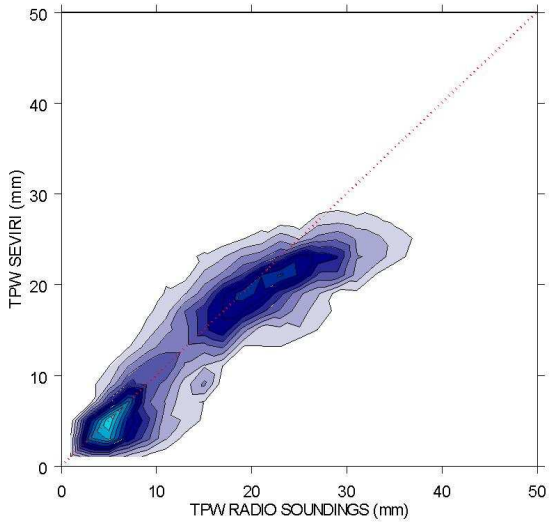
Radio Soundings used for LAND validation after filtering

Radio Soundings used for SEA validation

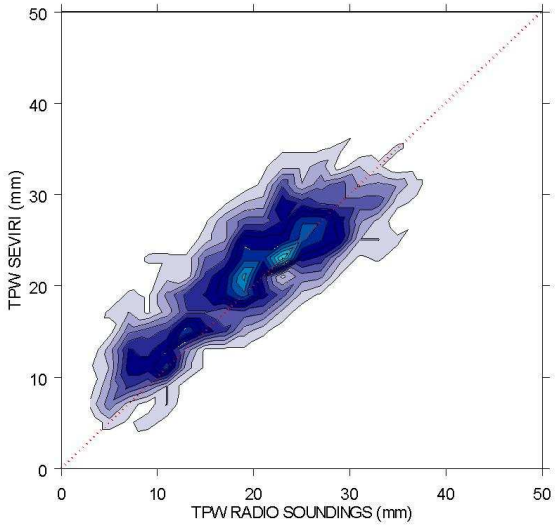


TPW v1.2 versus Radio Sounding TPW data

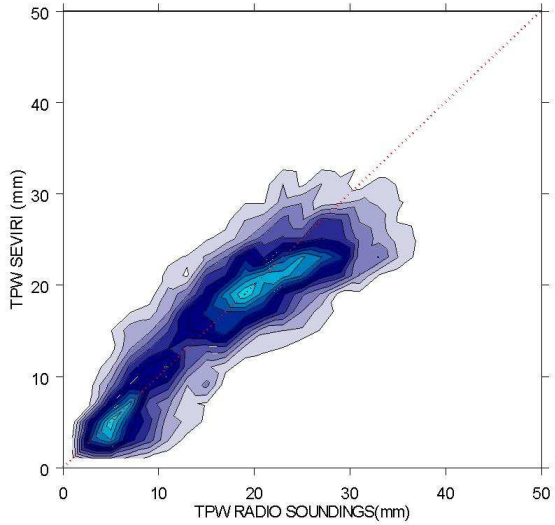
LAND (01/01/2005 - 31/07/2005)



SEA (01/08/2004 - 31/07/2005)



ALL (01/08/2004 - 31/07/2005)



BIAS	**1.78**	**-1.85**	**0.66**
RMS	**4.66**	**4.99**	**4.80**
R	**0.87**	**0.81**	**0.84**
NDATA	**2184**	**1244**	**3428**

TPW v1.2 versus ECMWF TPW data

- ECMWF analysis data at 00 and 12 UTC from the **1st January 2005** to the **31st July 2005** were processed to obtain the **scatter plots** for LAND and SEA (previous dates were used for the tuning).
- As the X-PLUS processing tool does not allow managing more than 33000 data, a selection of one day over three has been made as well as one grid point each 1.5 degrees latitude and longitude.

- ECMWF analysis data at 00 and 12 UTC from the **1st August 2004** to the **31st July 2005** were processed to perform the **spatial behaviour** of the statistical parameters.
- The full dataset has been used (0.5 degrees latitude and longitude)

Desert points contain all the grid points with latitude lower than 35ºN.

TPW v1.2 versus ECMWF TPW data

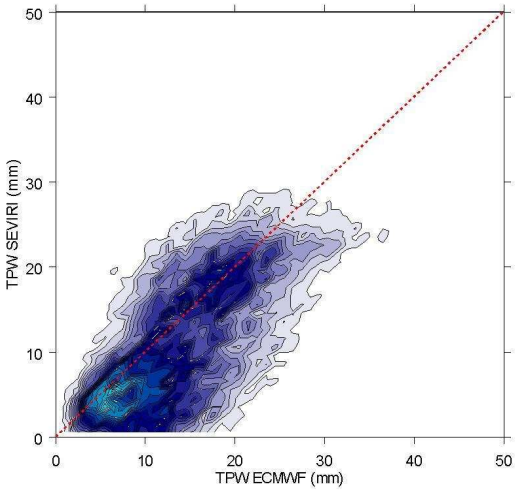
FILTERING:

In order to assure clear air conditions, a number of grid points were rejected using the next flags included in the dataset creation:

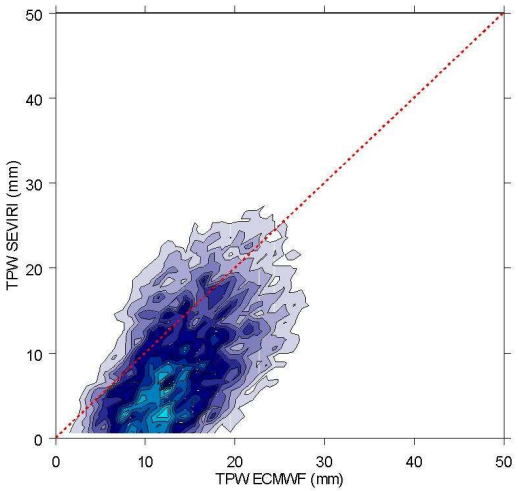
- GRID points with FLAG >0 (number of times with profile differences (T-Td) less than 1)
- GRID points with CLOUD COVER>=70%(cloud cover obtained from ECMWF analysis)

TPW v1.2 versus ECMWF TPW data

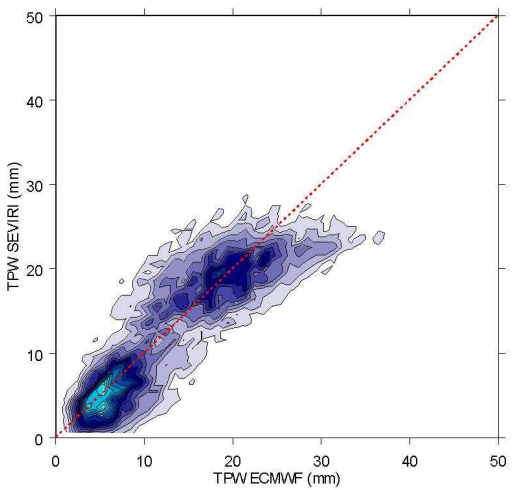
LAND



DESERT



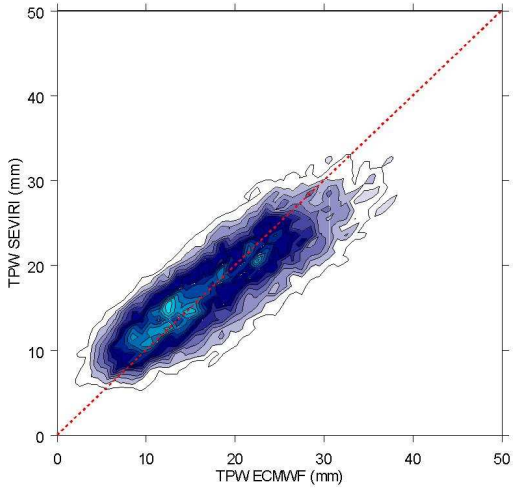
LAND WITHOUT DESERT



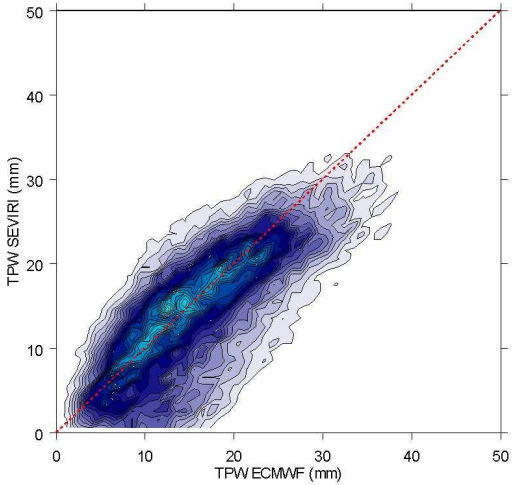
BIAS	**2.90**	**4.63**	**0.75**
RMS	**6.45**	**7.63**	**4.58**
R	**0.67**	**0.52**	**0.83**
NDATA	**15945**	**8844**	**7101**

TPW v1.2 versus ECMWF TPW data

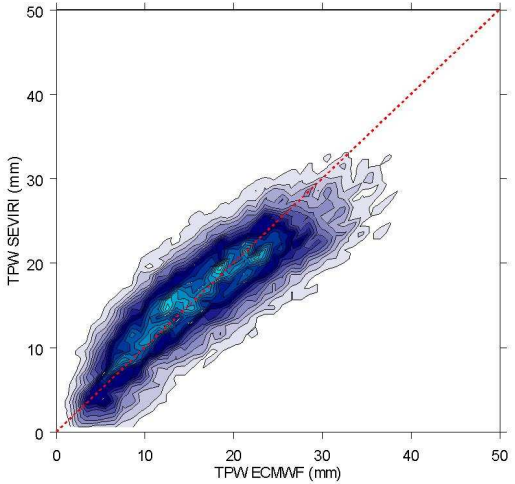
SEA



ALL



ALL WITHOUT DESERT



BIAS	**0.47**	**1.78**	**0.57**
RMS	**4.34**	**5.58**	**4.42**
R	**0.83**	**0.75**	**0.84**
NDATA	**13633**	**29578**	**20734**

Spatial Behaviour

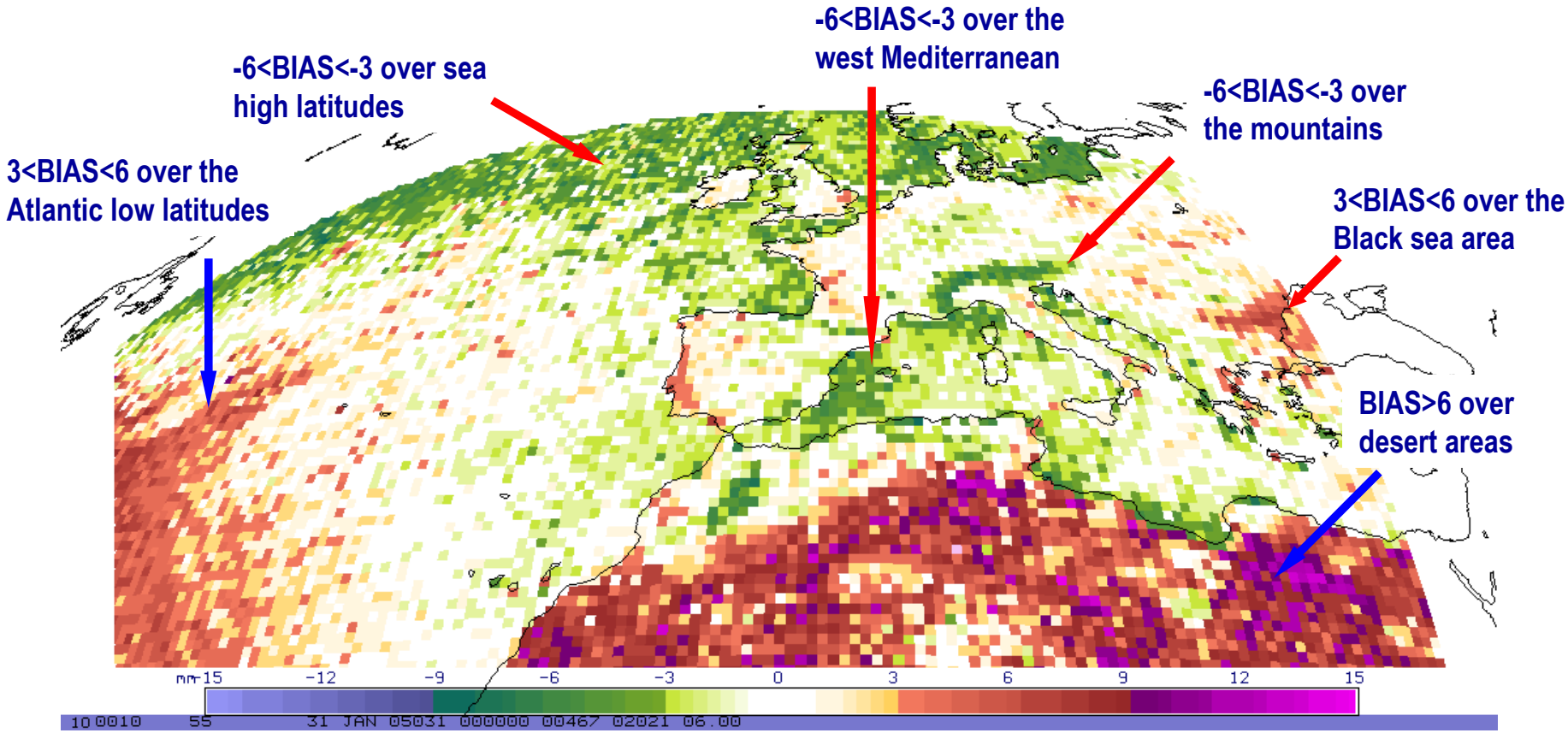
In order to test the performance of the TPW product in each grid point, a grid spatial distribution for two statistical parameters (BIAS and RMS) has been created.

That allows:

- to evaluate the deviation from the truth in a geographical pattern
- to visualize the areas in which the product has to be improved.

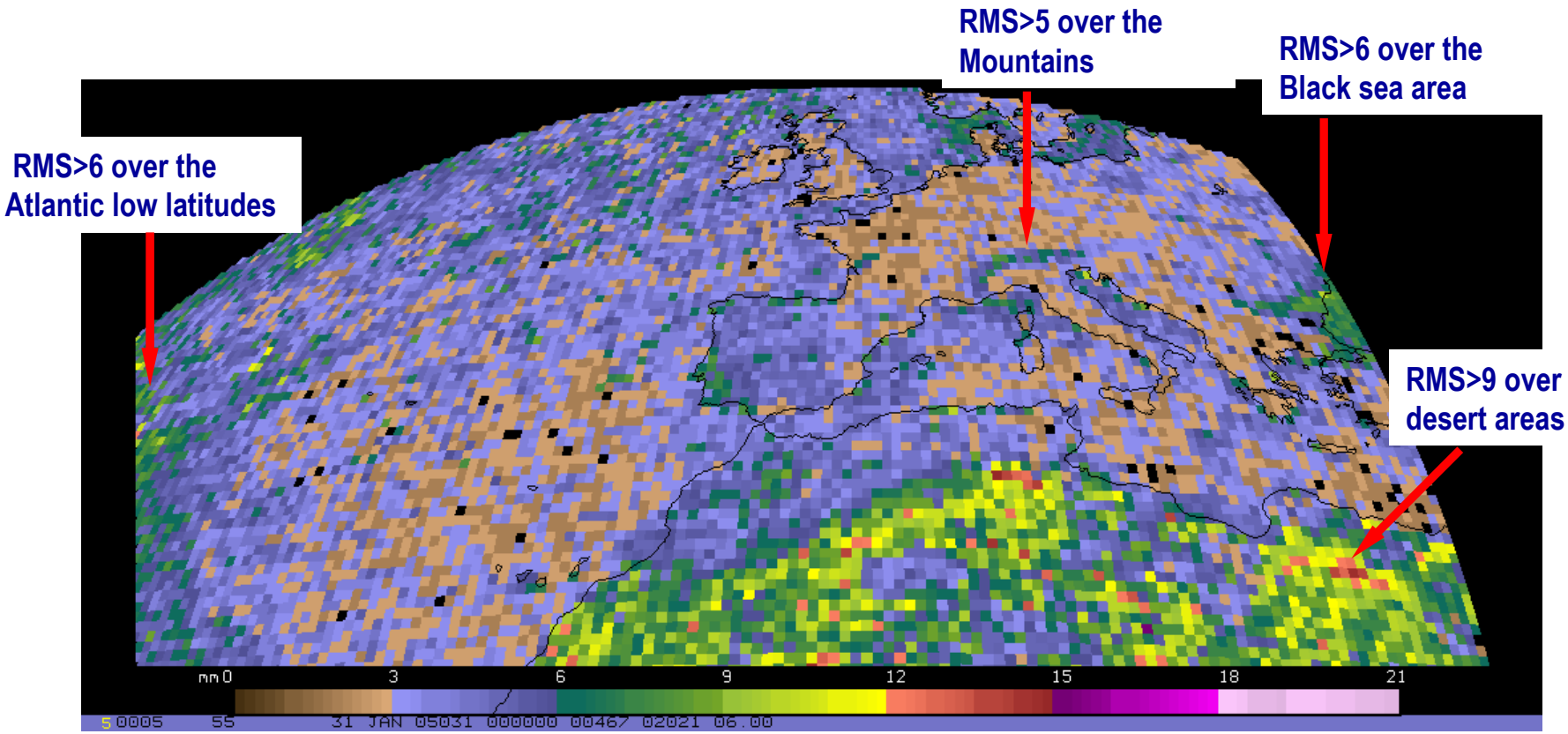
BIAS Spatial Behaviour

In average -3.0 < BIAS < 3.0

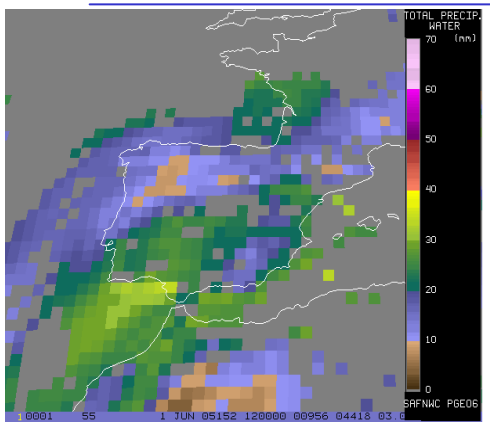


RMS Spatial Behaviour

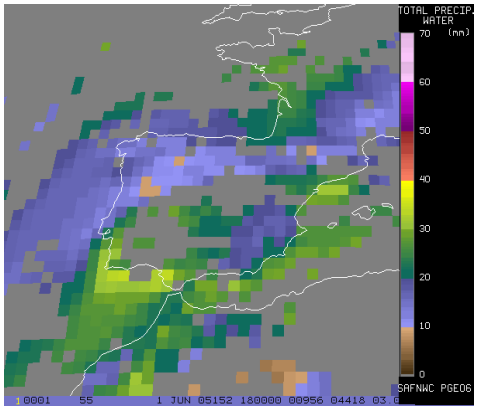
In average RMS < 6.0



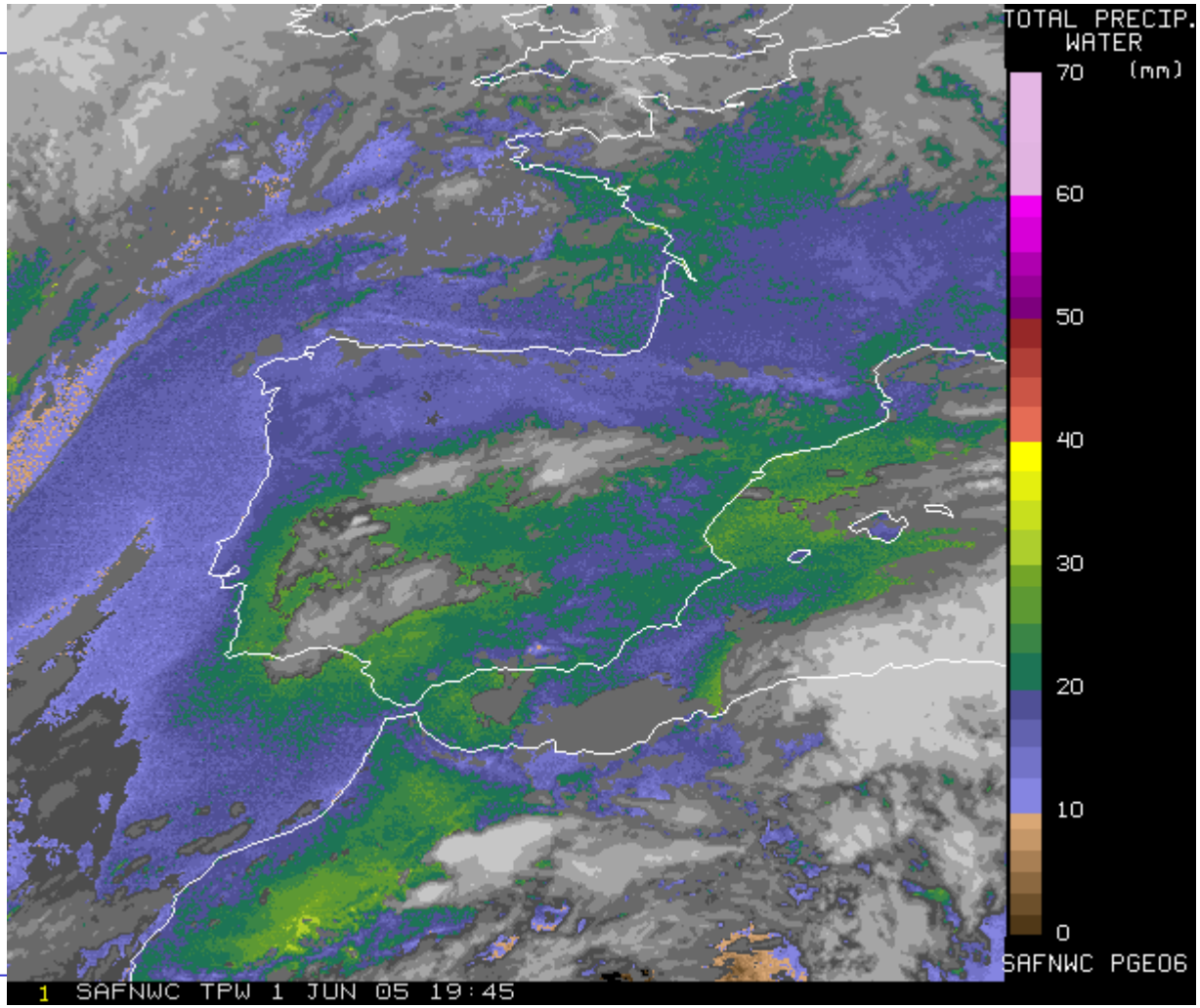
TPW Loop 1 JUN 2005



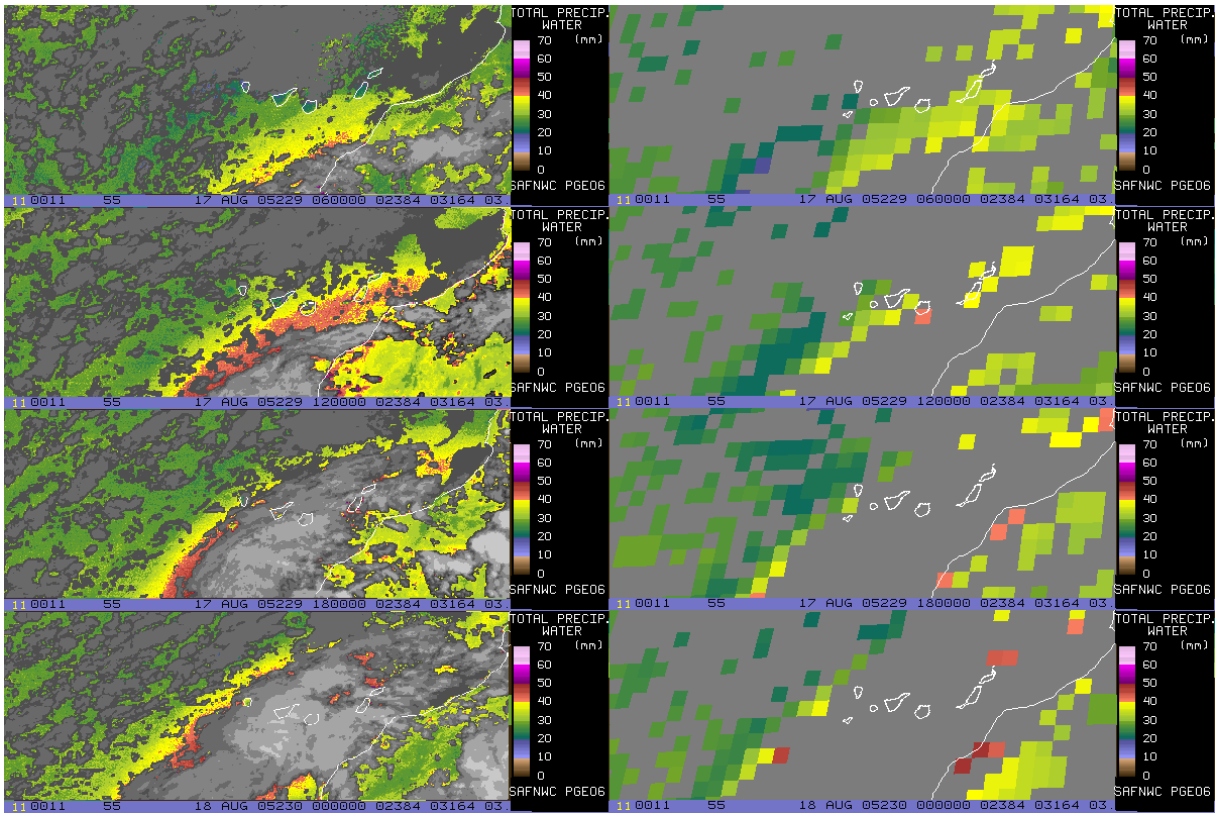
TPW ECMWF 1 JUN 2005 12:00

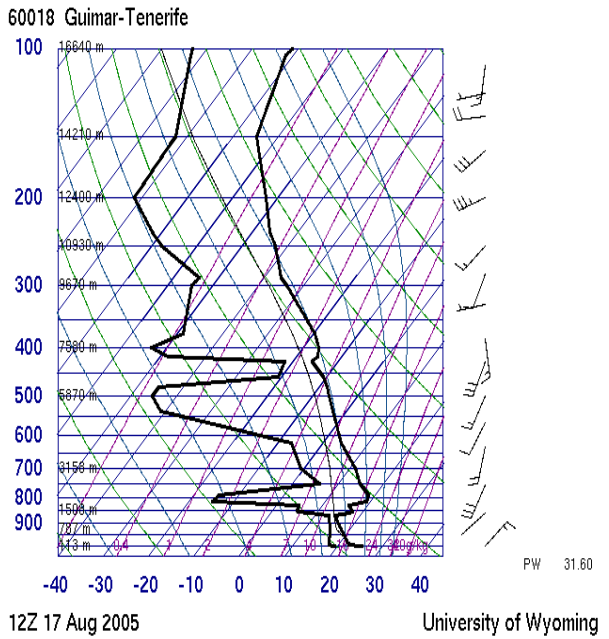


TPW ECMWF 1 JUN 2005 18:00



Canary Islands Case 17-18 AUGUST 2005





PW Sounding=31.60

Conclusions

The PGE06 TPW v1.2 correlates well with the "truth patterns" used in validation, but:

- The TPW image features has shorter range values than the "truth".

Some geographical areas present difficulties to be well monitored, mainly:

- Desert areas
- High latitudes SEA areas
- Mountain Areas

Nevertheless:

- The TPW highest values obtained have been proved to be useful in situations prior to convection.
- The PGE06 TPW v1.2 is then fully usable for Now casting purposes

Future Developments

- Emissivity data incorporation to the algorithm to improve desert areas features.

- Better representation of Diurnal and Seasonal cycles (Surface Temperature or other air mass low levels indicator)

- Impact of the use of the other channels added to the main algorithm.

PGE06 Quality Analysis

- ✓The quality of the product has been assessed indirectly, through the validation of DSLF using TPW (v1.0) from NWCSAF and ECMWF forecasts; the latter tends to perform better.
- ✓Rather good for spatial features distribution.
- ✓Lack of sensitivity (actual range is quite reduced).
- ✓Diurnal cycle still too much apparent.
- ✓There is lower gradation of Precipitable values than LPW-PGE07.
- ✓ Land/Sea not homogenize.

Improvements and modifications to PGE06 requested/suggested by users

- ✓ **Reduce LPW (total) and TPW to just one product.**

Not foreseen.

- ✓ **Improve the sensibility.**
- ✓ **Improve the diurnal cycle.**

Same problem and solution:

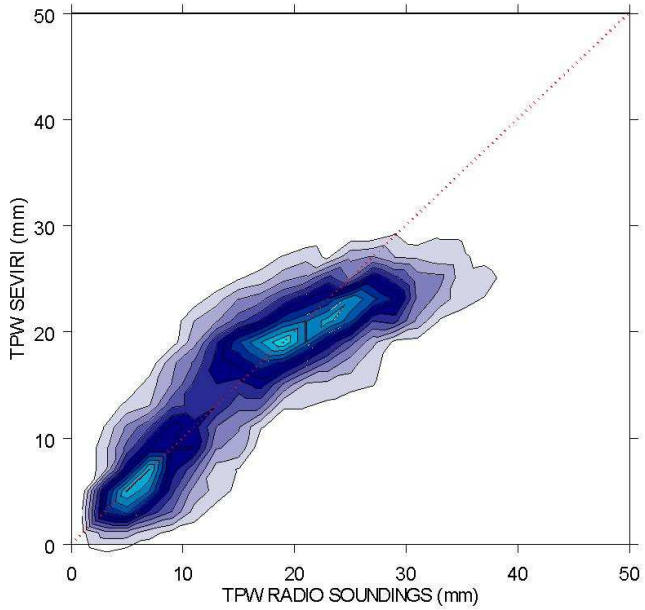
Better representation of Diurnal and Seasonal cycles (Surface Temperature or other air mass low levels indicator)

- ✓ **Land/Sea homogenization**

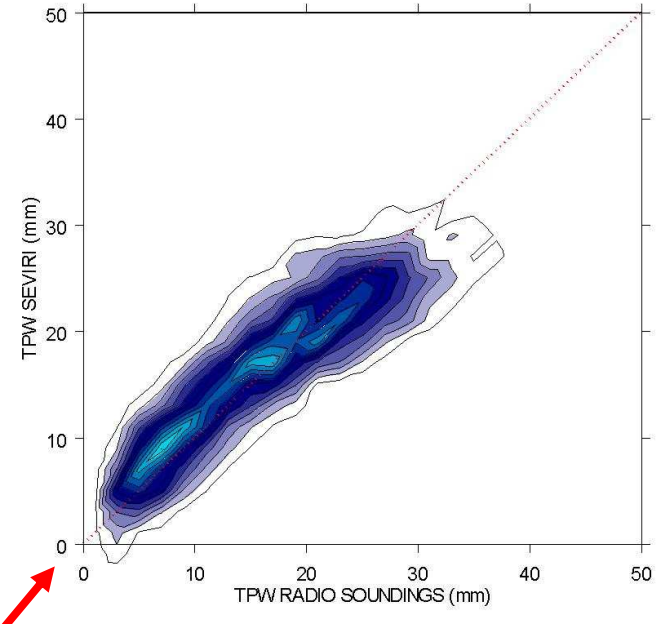
Not further idea at present time.

TPW TEST with Radio Sounding TPW data

TPW v1.2 (01/08/2004 - 31/07/2005)



TPW TEST (01/08/2004 - 31/07/2005)



Seasonal Cycle modulated with Sounding Surface Temperature

Improvements and modifications to PGE06 requested/suggested by the developer

- ✓ *Impact of the use of the other channels added to the main algorithm.*
- ✓ *Determine if IR8.7 is fully useful (emissivity problems).*
- ✓ *New tuning with Integrated Water Vapor GPS.*