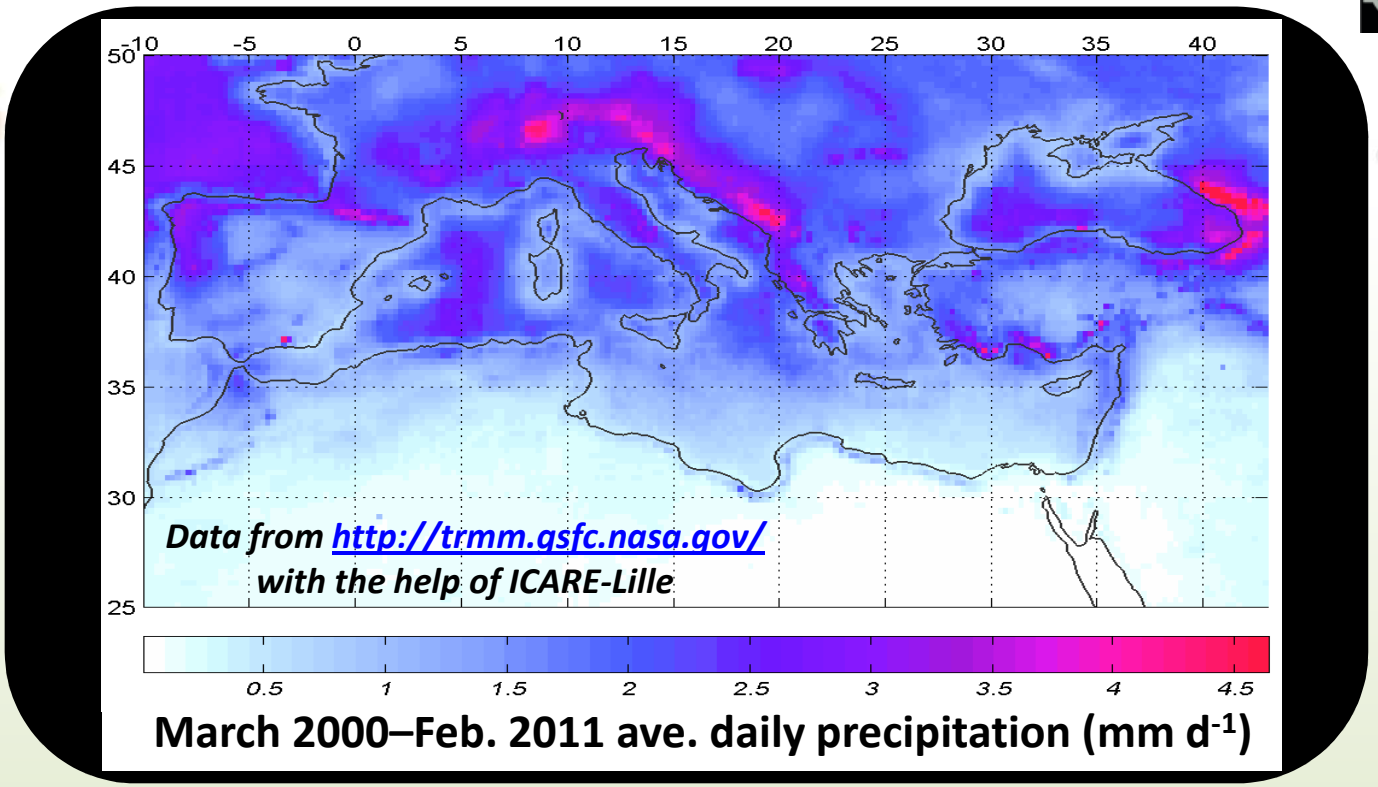
L.S.C.E.

PRECIPITATION IN THE MEDITERRANEAN BASIN AS SEEN FROM THE 2000-2010 TRMM-3B42-V6 DATABASE

EGU 2012



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Objectives and strategy

⇨ **Main objective:**

- **Evaluation of the TRMM-3B42 product in the context of 2 regional projects addressing the Mediterranean water budget and atmos. input to surface waters, respectively HyMeX and ChArMeX**

⇨ **Strategy:**

- **Comparison to coincident daily surface observations with a focus on the western basin**
  - **in terms of both precipitation amount and occurrence**
  - **computing success rates based on a factor of 2 agreement for rain amounts and on a classification in dry and wet days for occurrences**
- **Comparison to other available monthly gridded products, namely HOAPS, CMAP, and ERAI**

TRMM-3B42 : the product

⇨ **Issued from the NASA-JAXA Tropical Rainfall Monitoring Mission**

http://trmm.gsfc.nasa.gov/

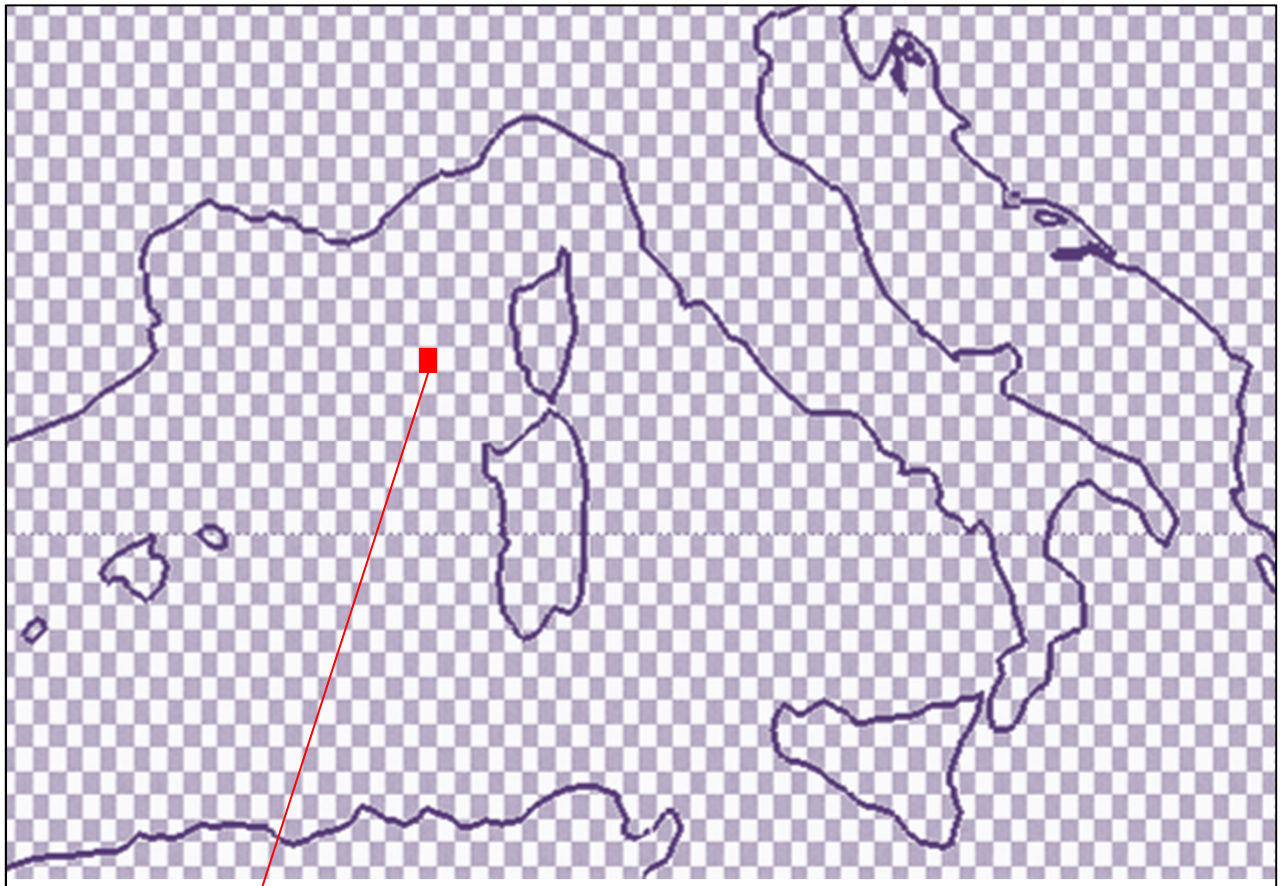
A complex combination of multi-satellite obs. :

- **infrared** (only since March 2000 in the 40-50° latitude band),
- **passive micro-waves,**
- **and radar** (between ~38°N and 38°S),

somewhat constrained by monthly observations

Since 01/01/1998

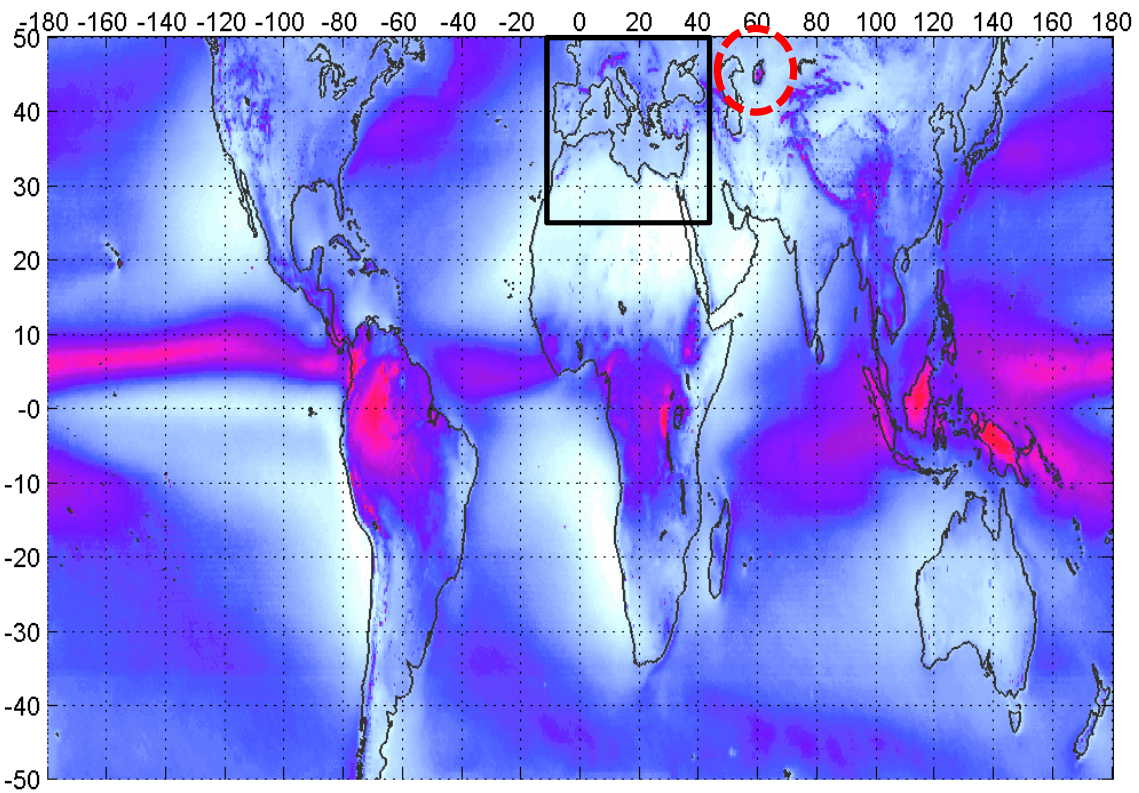
Period considered here: March 2000 – Feb. 2011 (11 yrs)



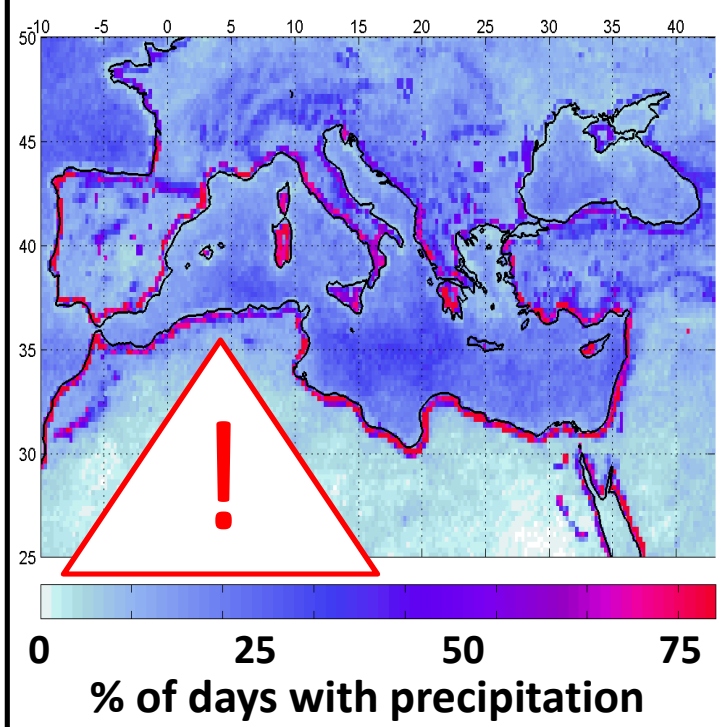
TRMM-3B42 resolution: 0,25° x 0,25°, 3 hours

TRMM-3B42 : autumn 2004-winter 2005 issue

March 2000-Feb. 2011



24 Sept. 2004 – 31 March 2005

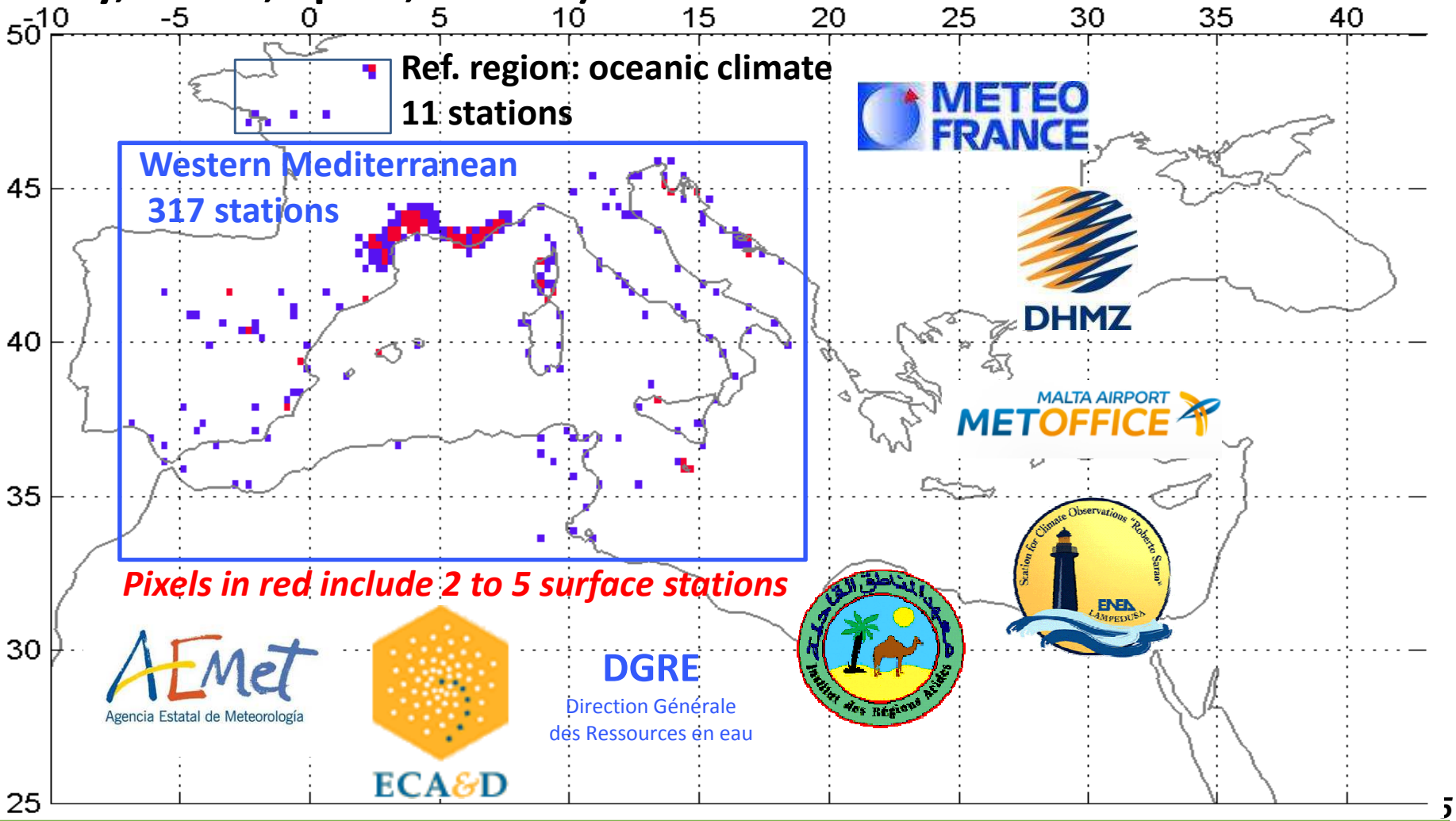


Problem identified: AMSR-E estimates (G. Huffman, pers. comm.)

⇨ **Elimination of this period for comparison to surface data**

Surface database

⇨ Almost 10^6 daily data from 7 countries (Algeria, Croatia, France, Italy, Malta, Spain, Tunisia) over 2000-2010

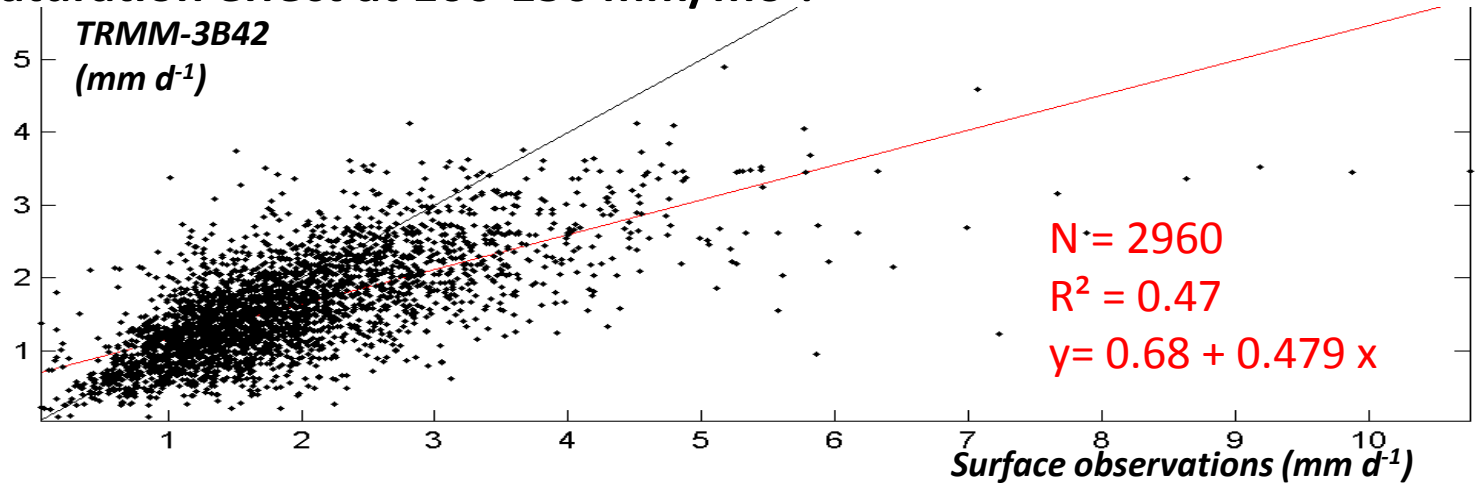


Correlation between TRMM-3B42 and surface obs.

- ⇨ **Poor correlation between daily precipitation (R^2 = 0.24)**
- ⇨ **Best correlation at monthly time scale probably due to the algorithmic scaling**
- ⇨ **Slopes ~1/2, saturation effect at 100-150 mm/mo ?**

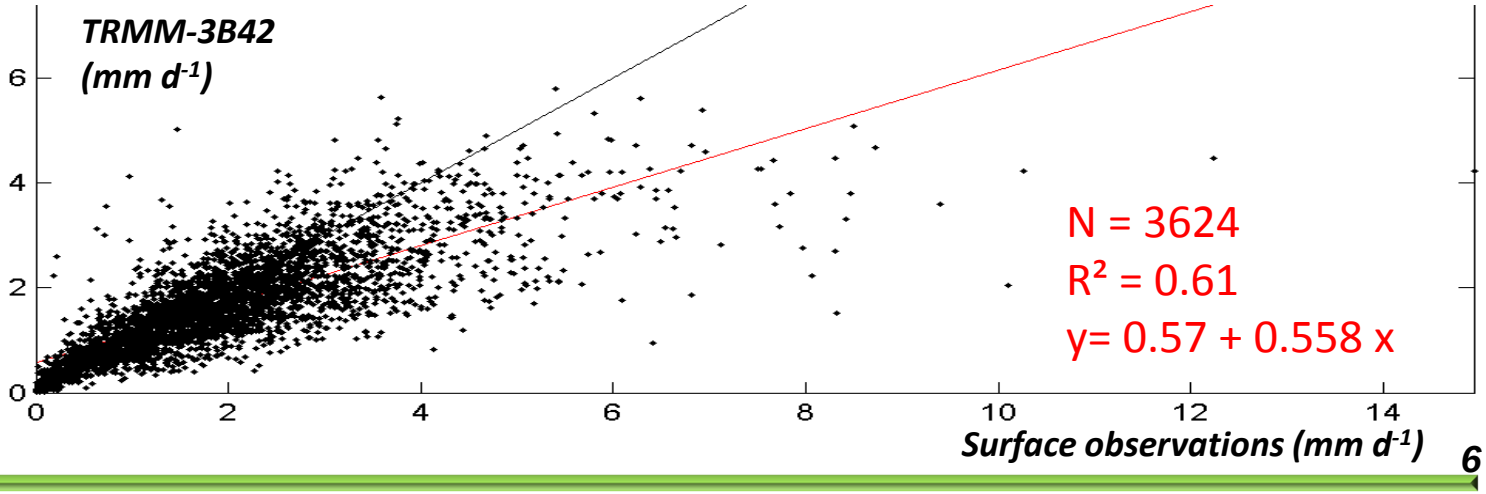
annual

years with at least 100 pairs of daily data avalaible



monthly

months with at least 19 daily pairs of data available



Classification of dry vs. rainy days

Success rate (all days)

Mediterranean region average: 76%

Range:
54% *(Renno, Corsica, FR)*
to 93% *(Kebili, S Tunisia)*

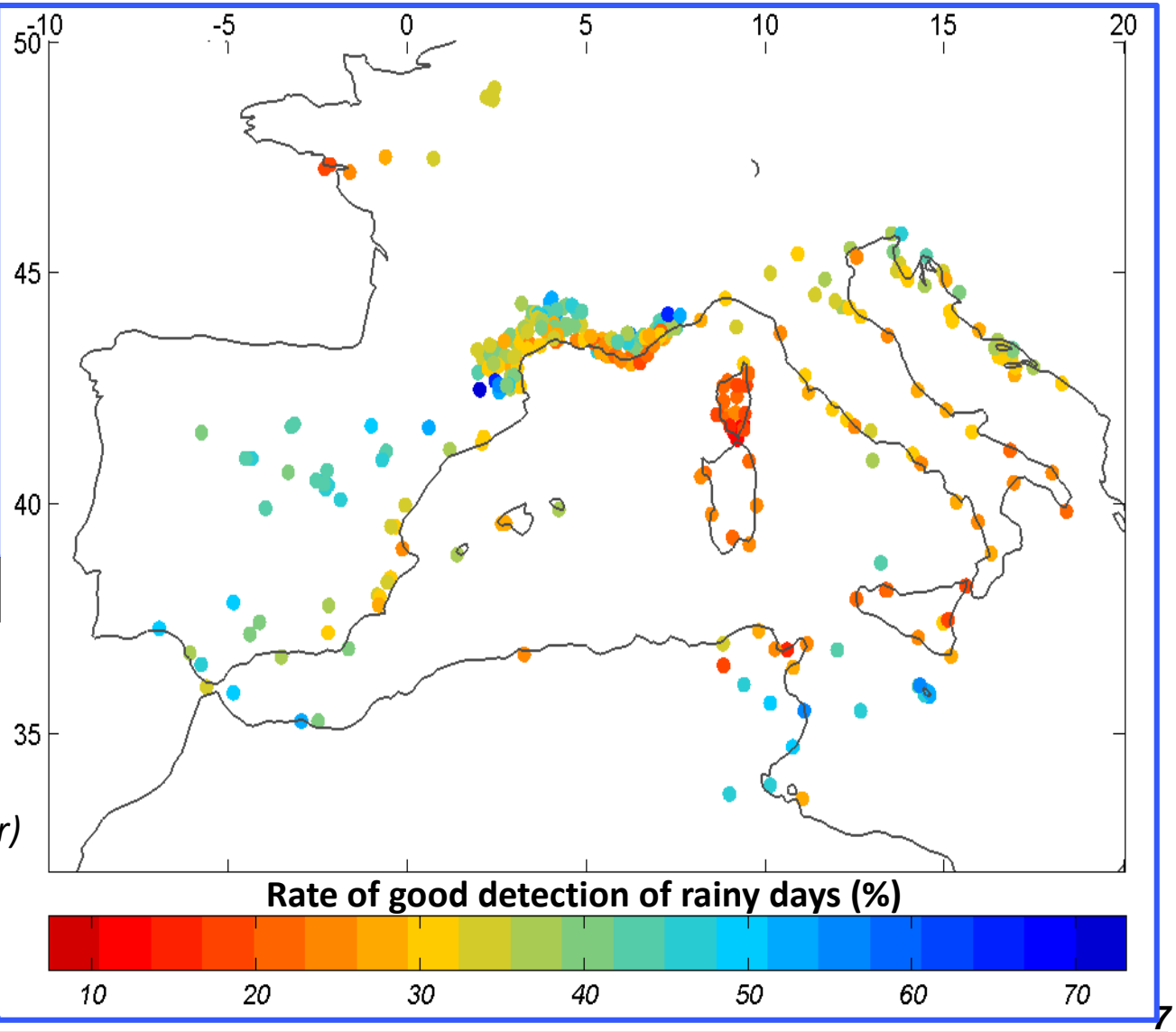
But >3/4 of days are dry

Success rate (rainy days)

Average: 35%

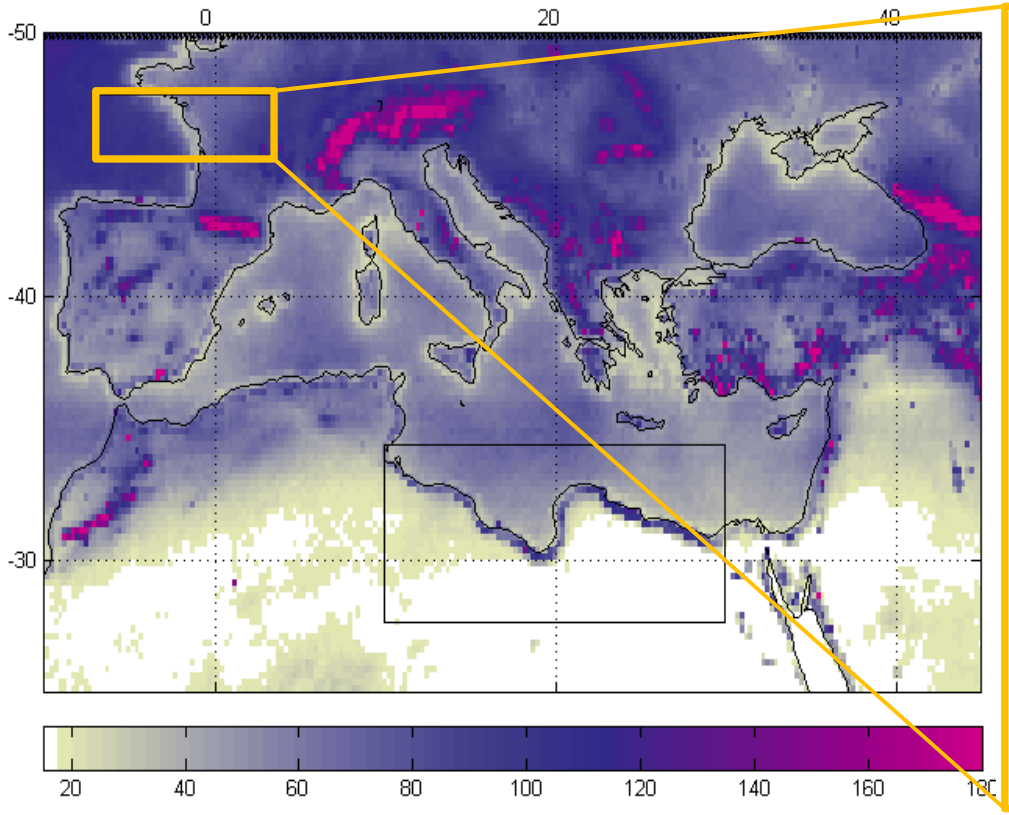
Range:
11% *(Cap Pertusato, Corsica, Fr)*
to 73% *(Sainte-Léocadie, FR)*

⇨ **Coastal issues ?**

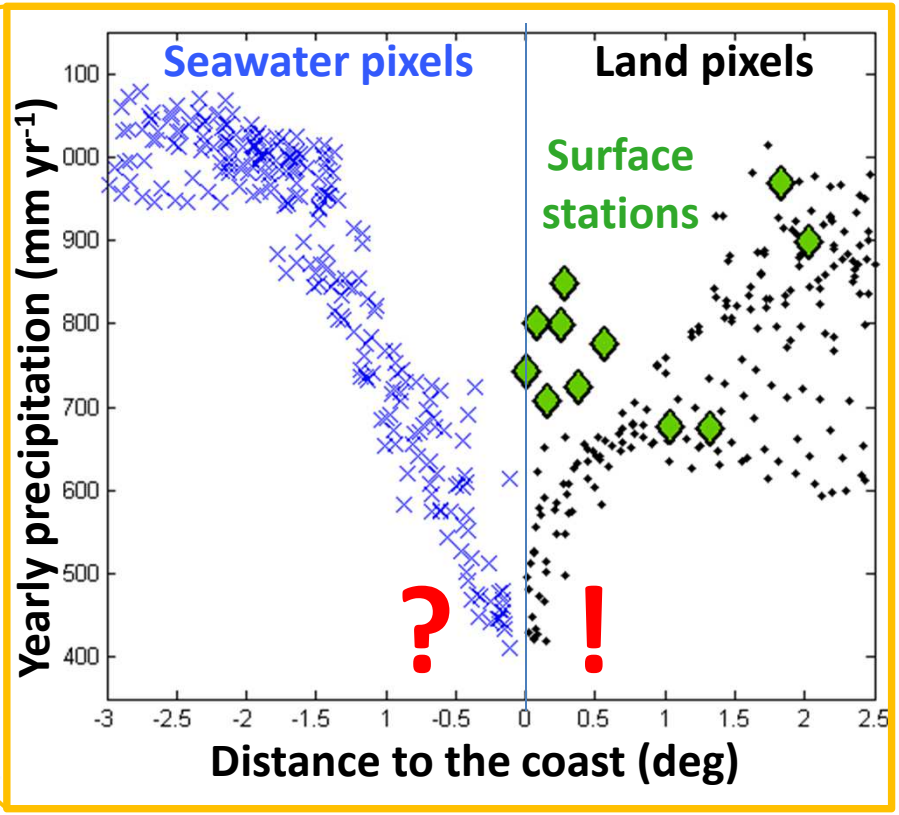


Coastal issues

2001-2010 average of precipitation days (d yr^{-1})



Average of precipitation (mm yr^{-1})



⇨ First 2-3 inland TRMM-3B42 pixels appear strongly under(over) estimated North(South) of 36° N

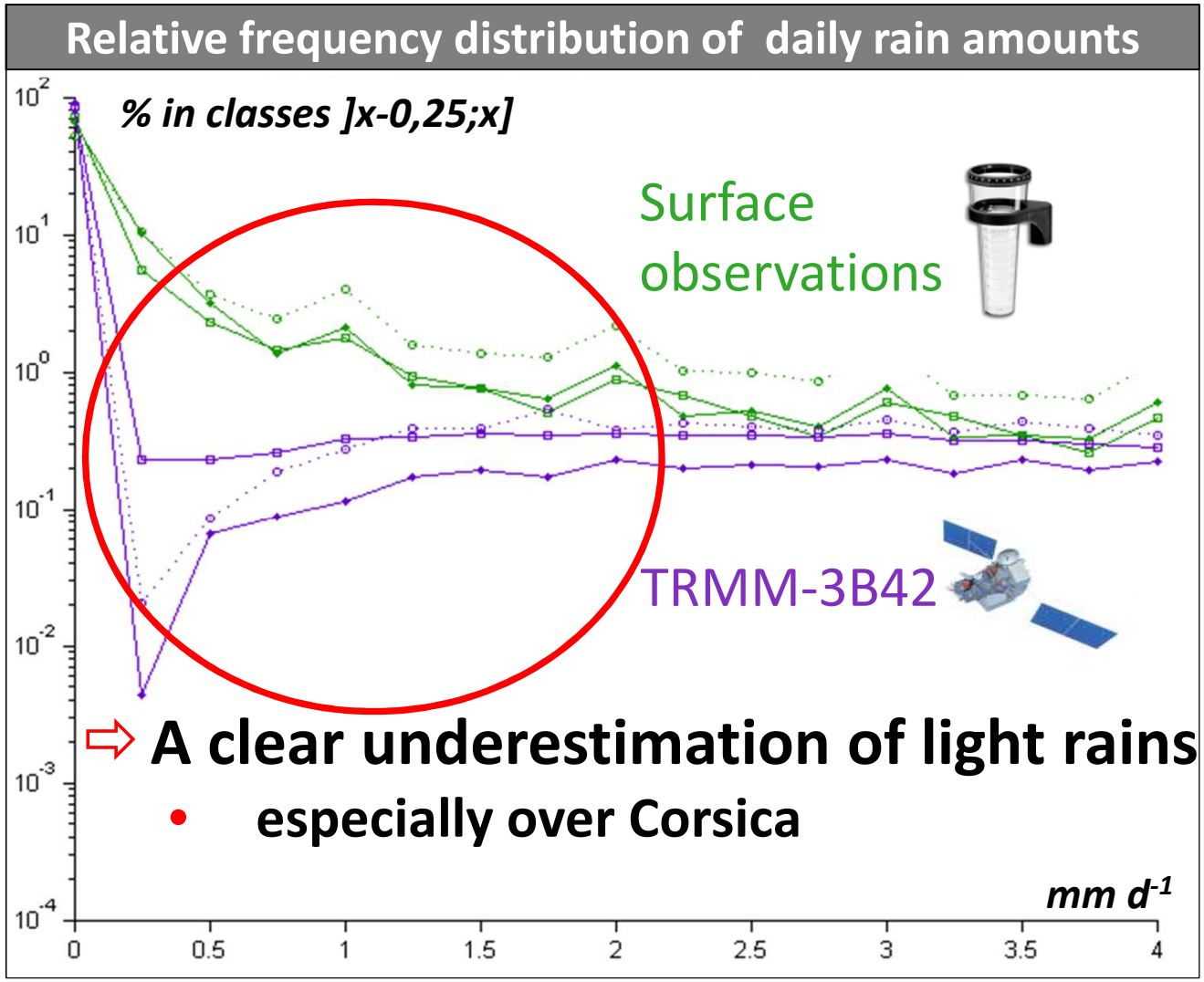
⇨ First 4-5 TRMM-3B42 marine pixels are most likely underestimated

Under detection of light precipitation

North-western France (oceanic climate)

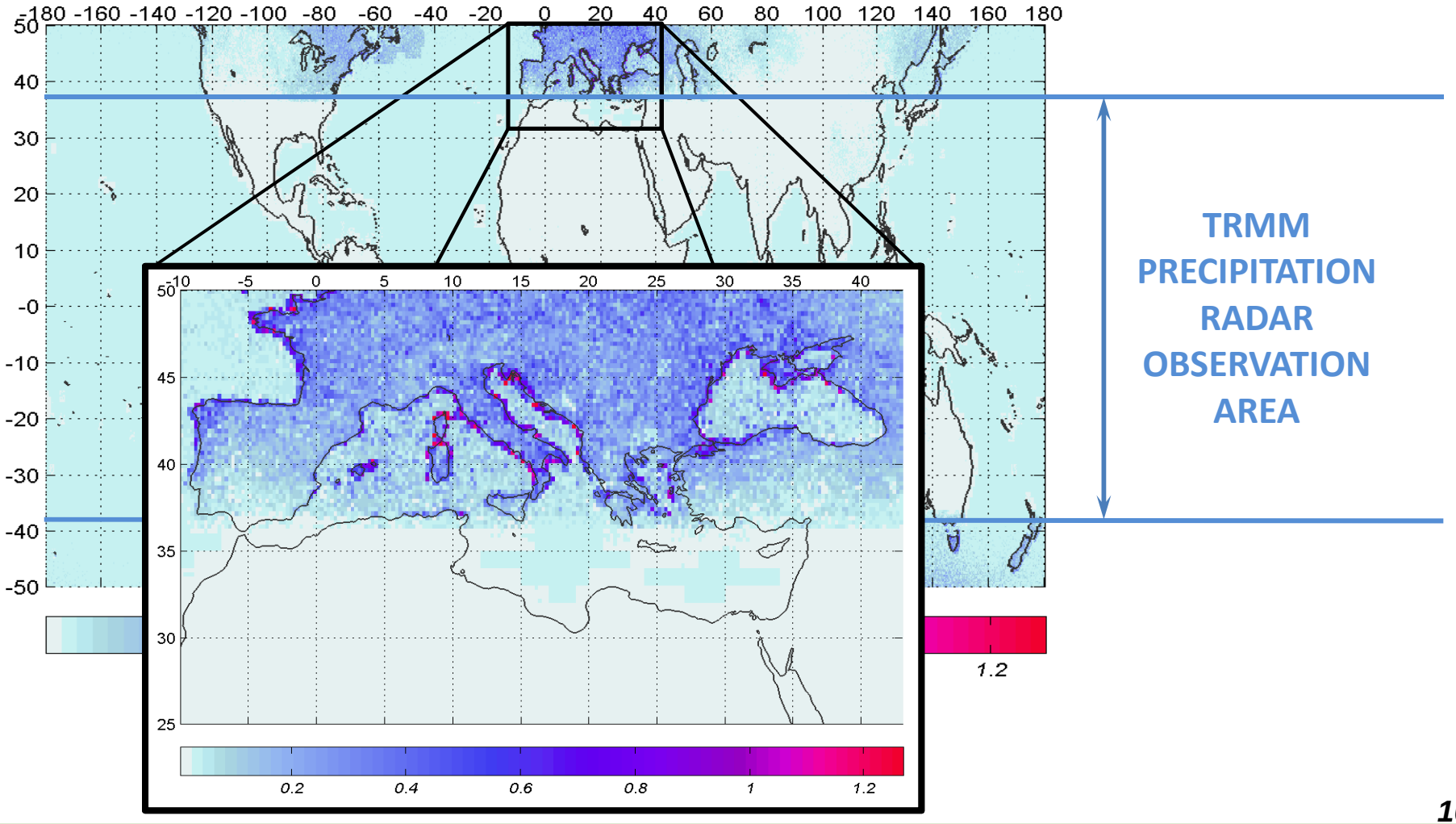
Mean of all Mediterranean stations

Corsica Isl.



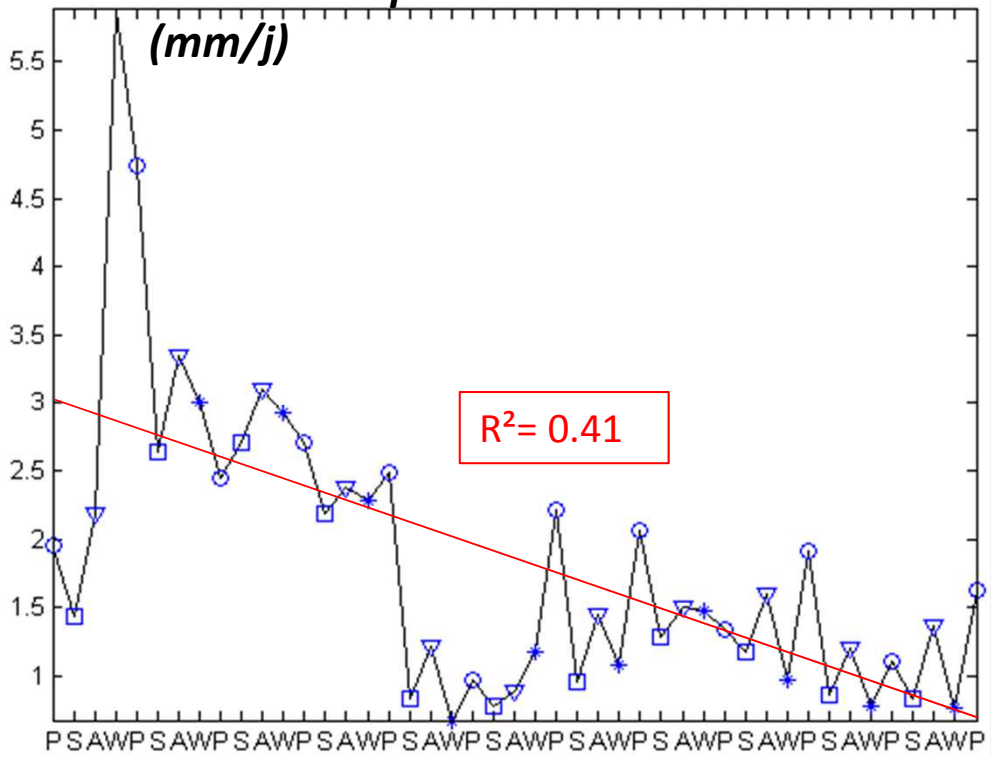
TRMM-3B42 detection threshold issue

Minimum non-zero daily rain (mm d^{-1}) observed between Jan. 2000 and Feb. 2011



Improvement of the detection with time

Median of detected non-zero minima over western Med. pixels

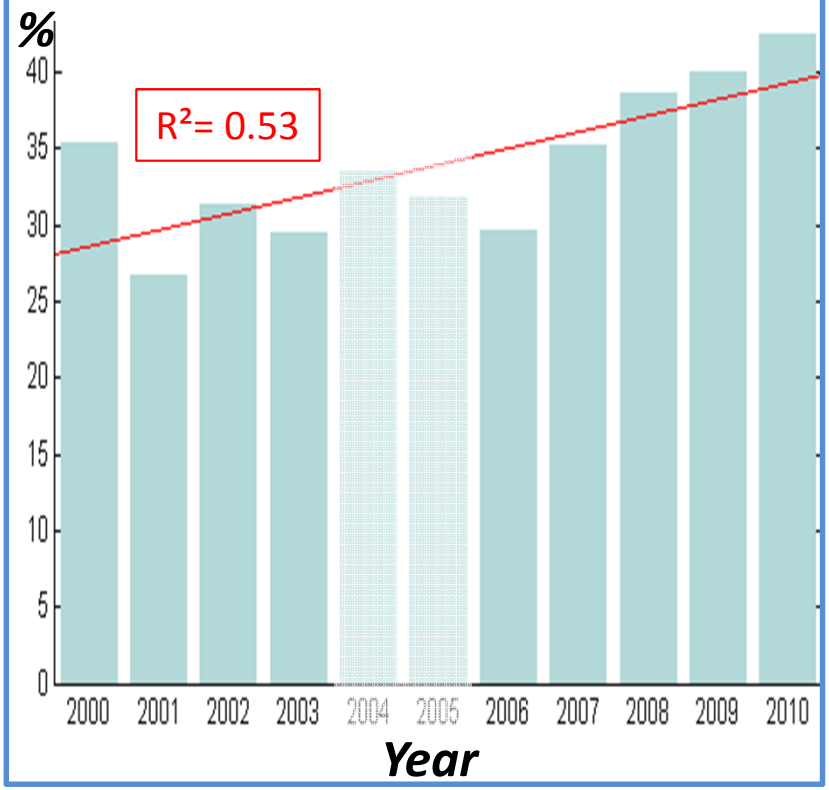


Season from Spring 2000 to Spring 2011

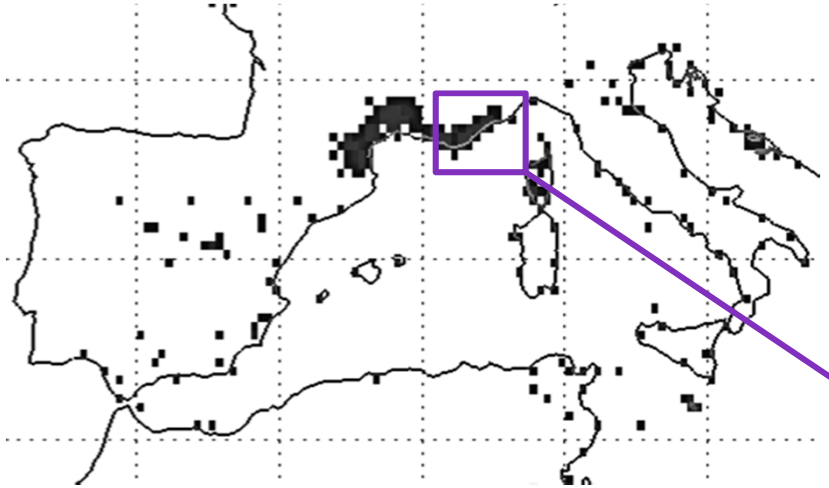
P: Spring ○, S: Summer □, A: Autumn ▽, W: Winter +

POSSIBLE EFFECT ON THE RATE OF SUCCESS OF THE DETECTION OF RAINY DAYS

Rate of good detection of rainy days



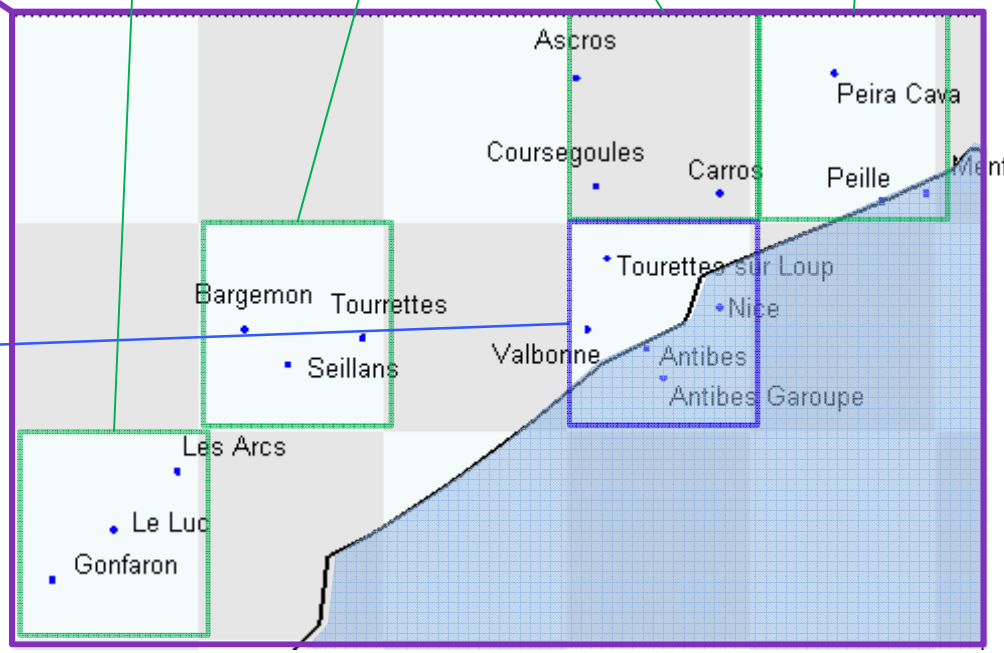
Small scale variability



Pixels with 3 stations

Success rate on precipitation amount (factor 2) when the station observed precipitation

7 to 19%	11 to 17%	17 to 19%	12 to 19%



Pixel with 5 stations

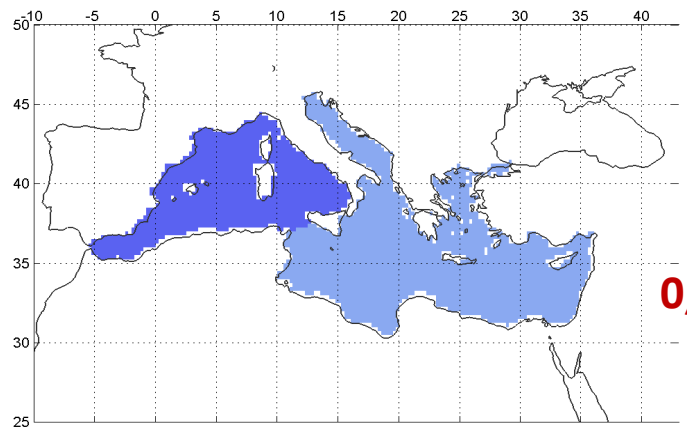
Success rate in rainfall amounts on rainy days

9 to 13% depending on station

22% with at least 1 station (when the 5 have data)

⇨ **Small scale variability probably does not explain relatively poor comparison to stations** (additional work on-going with Catalonia data)

Comparable gridded products

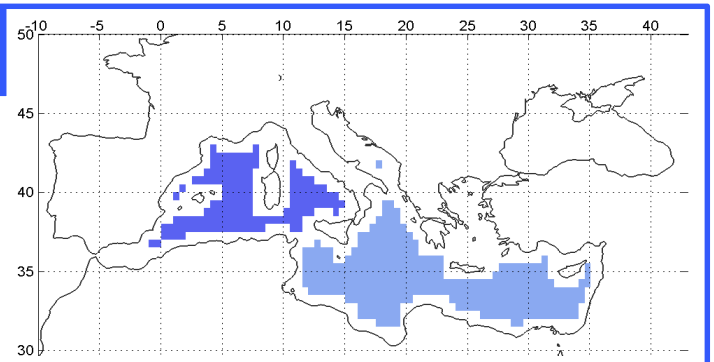


TRMM

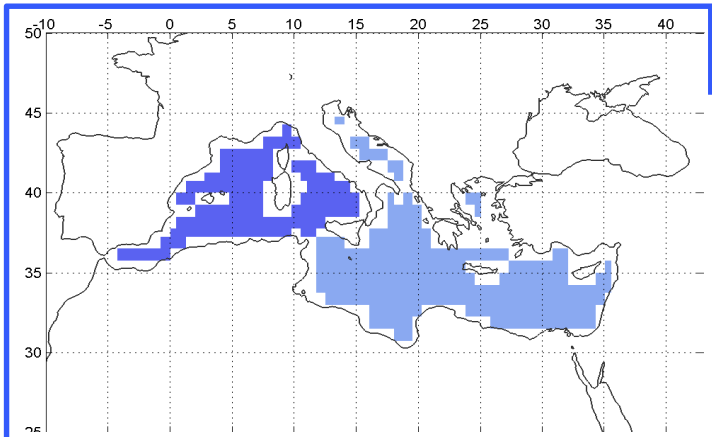
03/2000
02/2011
3 hours
0,25°x0,25°

HOAPS

09/1987
12/2005
3 hours
0,5°x0,5°



Multi satellite-derived Hamburg Ocean Atmosphere Parameters and fluxes from Satellite data *(Andersson et al., Earth Syst. Sci. Data, 2010)*



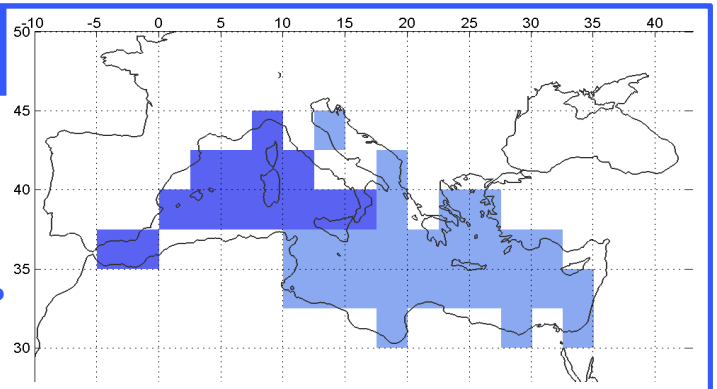
ERAI

01/1989
09/2009
12 hours
0,7°x0,7°

The ECMWF Re-Analysis Interim high resolution global reanalysis *(Dee et al., QJRMS, 2011)*

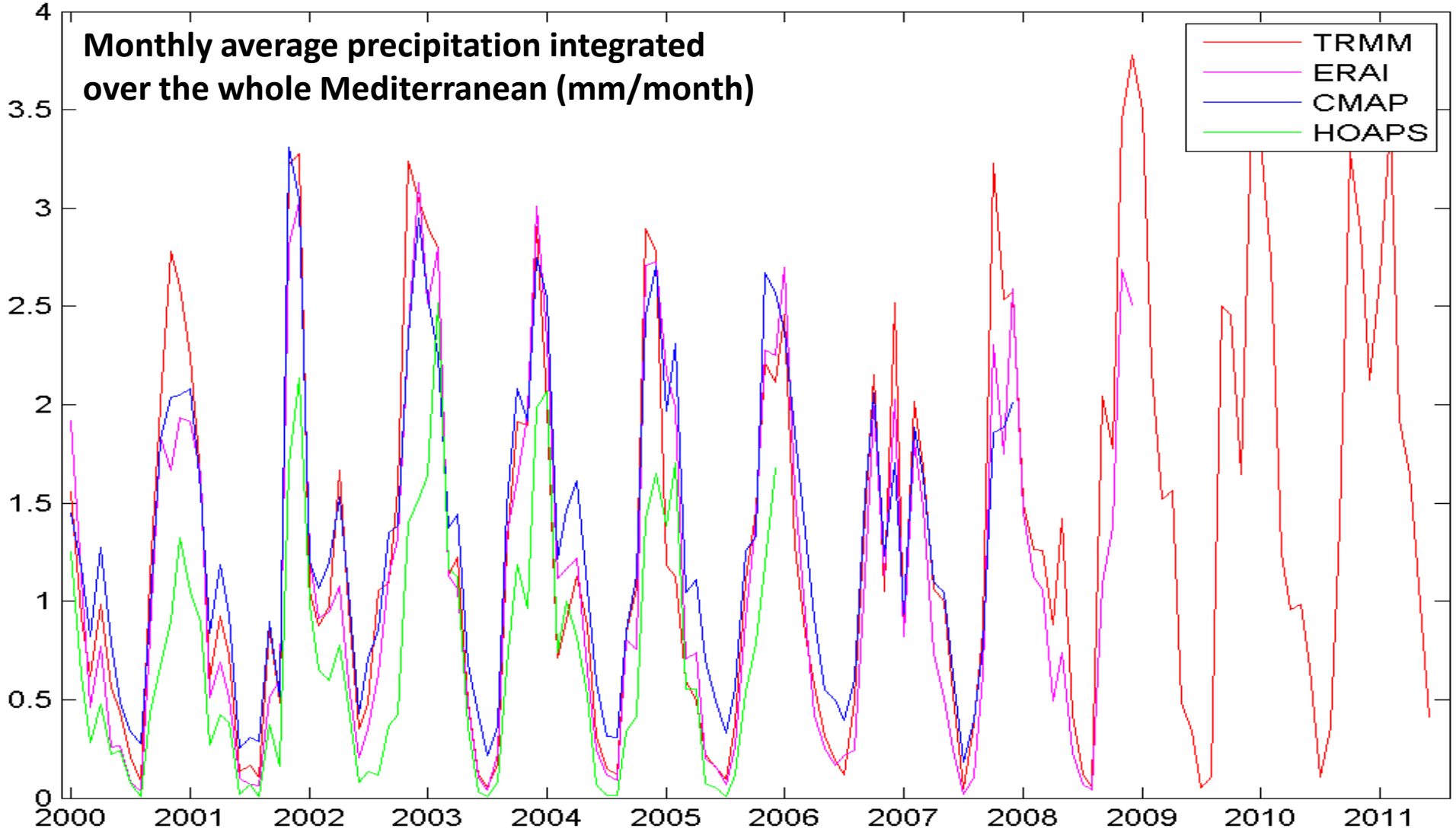
CMAP

01/1979
07/2008
monthly
2,5°x2,5°



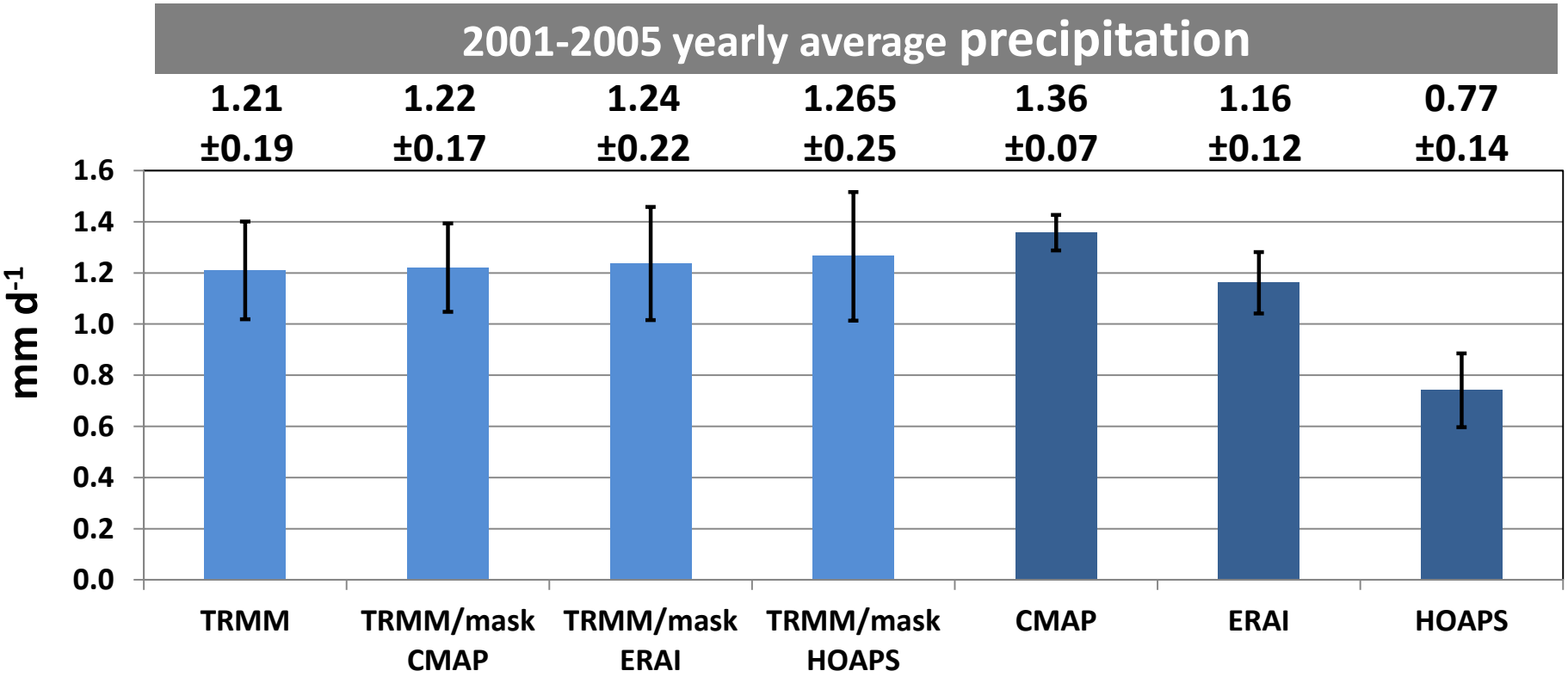
The Climate prediction center (CPC) Merged Analysis of Precipitation, global gridded dataset is based on gauge measurements, satellite data and reanalyses *(Xie and Arkin, BAMS, 1997)*

Comparison of monthly series



⇨ **Similar trends from all databases; HOAPS systematically lower**

5-yr average comparison



⇨ **Over the 5-yr common period (2001-2005) of TRMM-3B42-v6, CMAP, ERAI and HOAPS,**

- **TRMM is compatible with CMAP and ERAI**
- **TRMM shows significantly more inter annual variability**

CONCLUSIONS

- **Detailed evaluation of the 2000-2010 TRMM-3B42 version 6 precipitation product in the Mediterranean region including**
  - **comparison to ~10^6 daily surface observations in the western basin and Adriatic in terms of both precipitation amount and occurrence**
  - **comparison to monthly, basin-scale integrated precipitation from ERAI, HOAPS and CMAP databases**
- **TRMM-3B42-v6 average precipitation budget over the basin (1.2 mm d^{-1} over 2001-2005) is compatible with CMAP and ERAI but shows more inter-annual variability**
- **TRMM-3B42 limitations including**
  - **severe light rain under-detection which causes far too low number of rainy days, but with a tendency to improve with time (which could bias trends)**
  - **possible saturation effect at 100-150 mm/mo ?**
  - **problematic temporal and geographical discontinuities in coastal areas**
- **Need for comparison with measurements over sea from surface radars and buoys**
  - **New version 7**