SatCloP

Satellite Remote Sensing of Clouds and Precipitation

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SatCloP Mission

AIM

- Contributing to the understanding of
  - atmospheric thermodynamic processes
  - properties of clouds and precipitation

ACTIVITIES

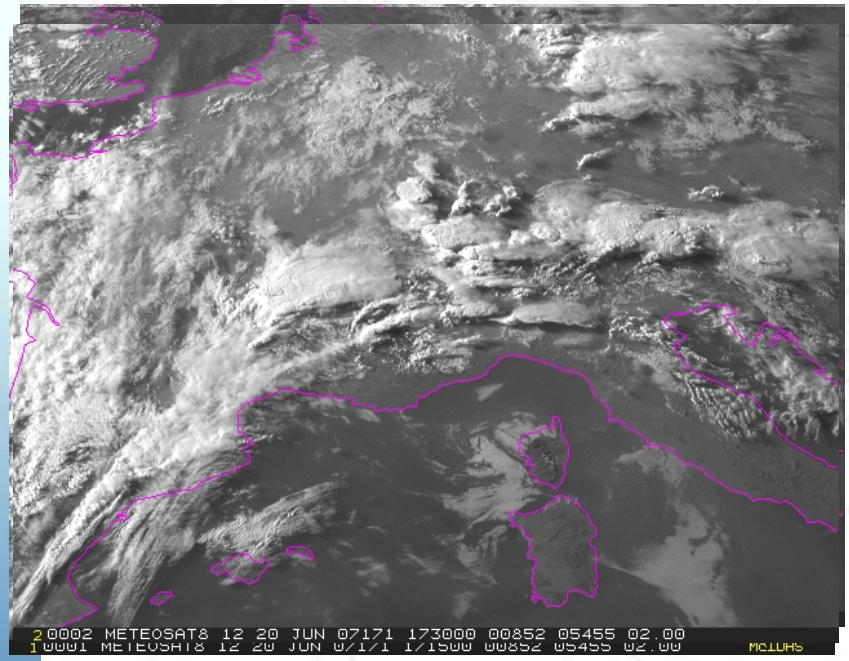
- Development of multispectral techniques (VIS/IR/MW) for
  - Detection and classification
    - Clouds
    - Aerosols
    - Precipitation
  - Quantitative estimates
    - Integrated water vapour
    - Cloud liquid/ice water column content
    - Temperature and humidity profiles
    - Rain rate
    - Solar irradiance at Earth surface (all-sky conditions)

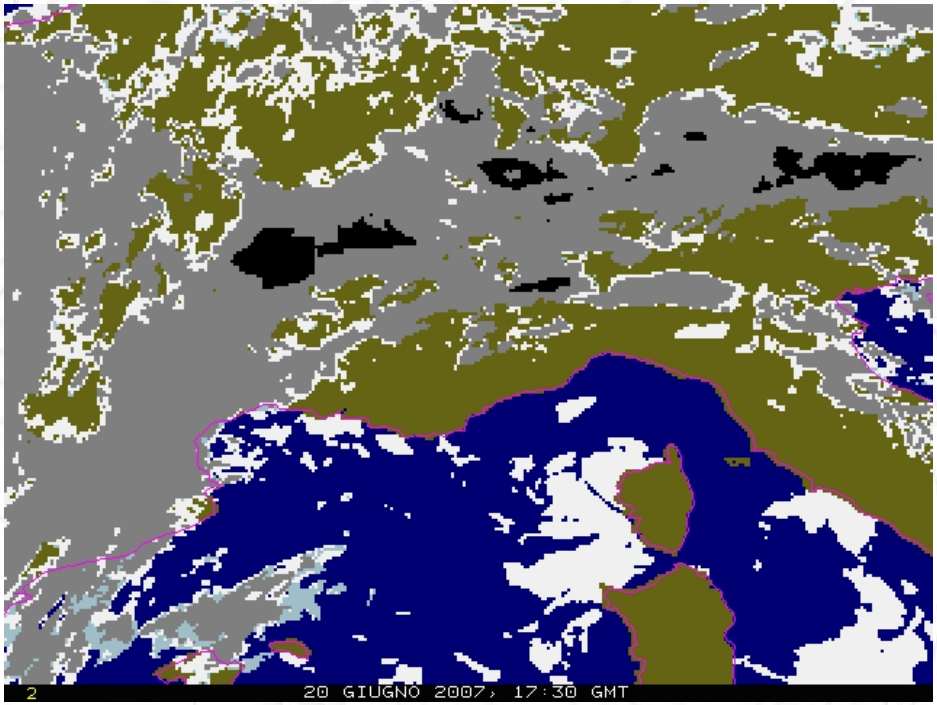
Cloud detection and classification

C_MACSP: Cloud-classification Mask - Coupling of Statistical and Physical Methods

clear: sea, land
low/mid clouds
high thin clouds
high thick clouds
convective clouds

MSG/SEVIRI HRV 13:45-17:30 GMT 20-06-2007



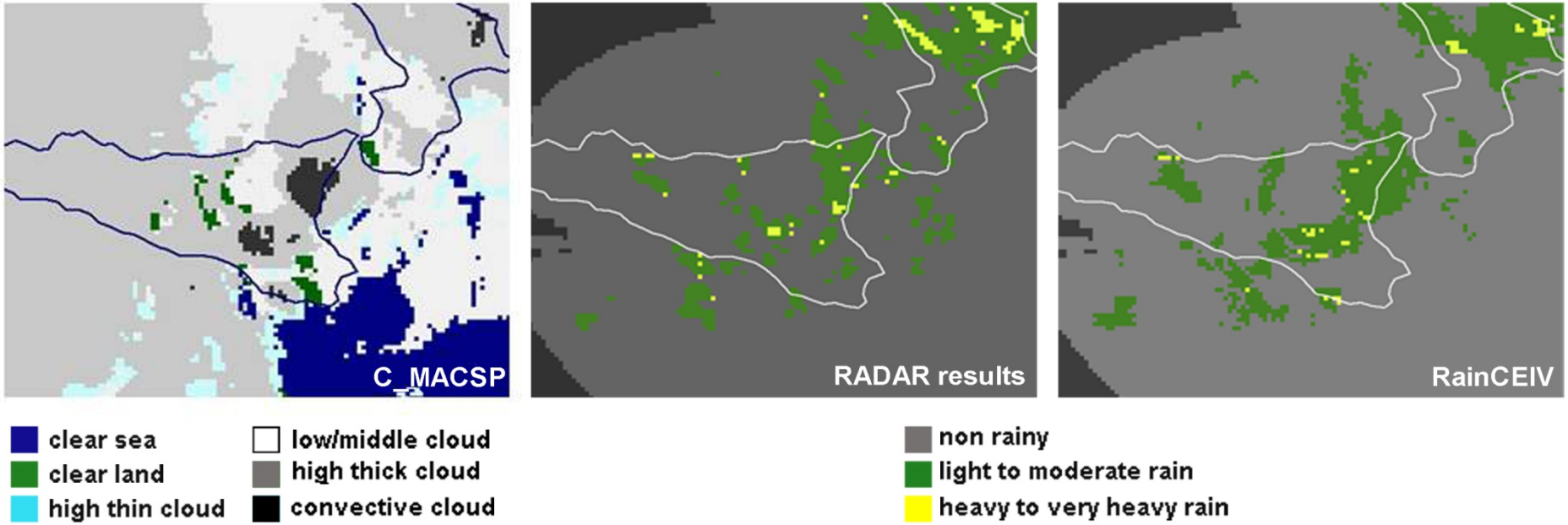


Ricciardelli et al., *Rem. Sens. Env.*, 2008

Rain detection and classification

RainCEIV: Rain Class Evaluation from Infrared and Visible observations

Catania Flash Flood occurred on 21 February 2013



Ricciardelli et al., *Hydrol. Earth Syst. Sci.*, 2014
Di Paola et al., *J. Hydromet.*, 2014

Validation of RainCEIV

RainCEIV has been validated against weather radar network data

Contingency table

		Radar- derived rain rate results		
RainCEIV results		yes	No	marginal total
	yes	34,434	26,140	60,574
	no	17,882	417,844	435,726
	marginal total	52,316	443,984	496,300

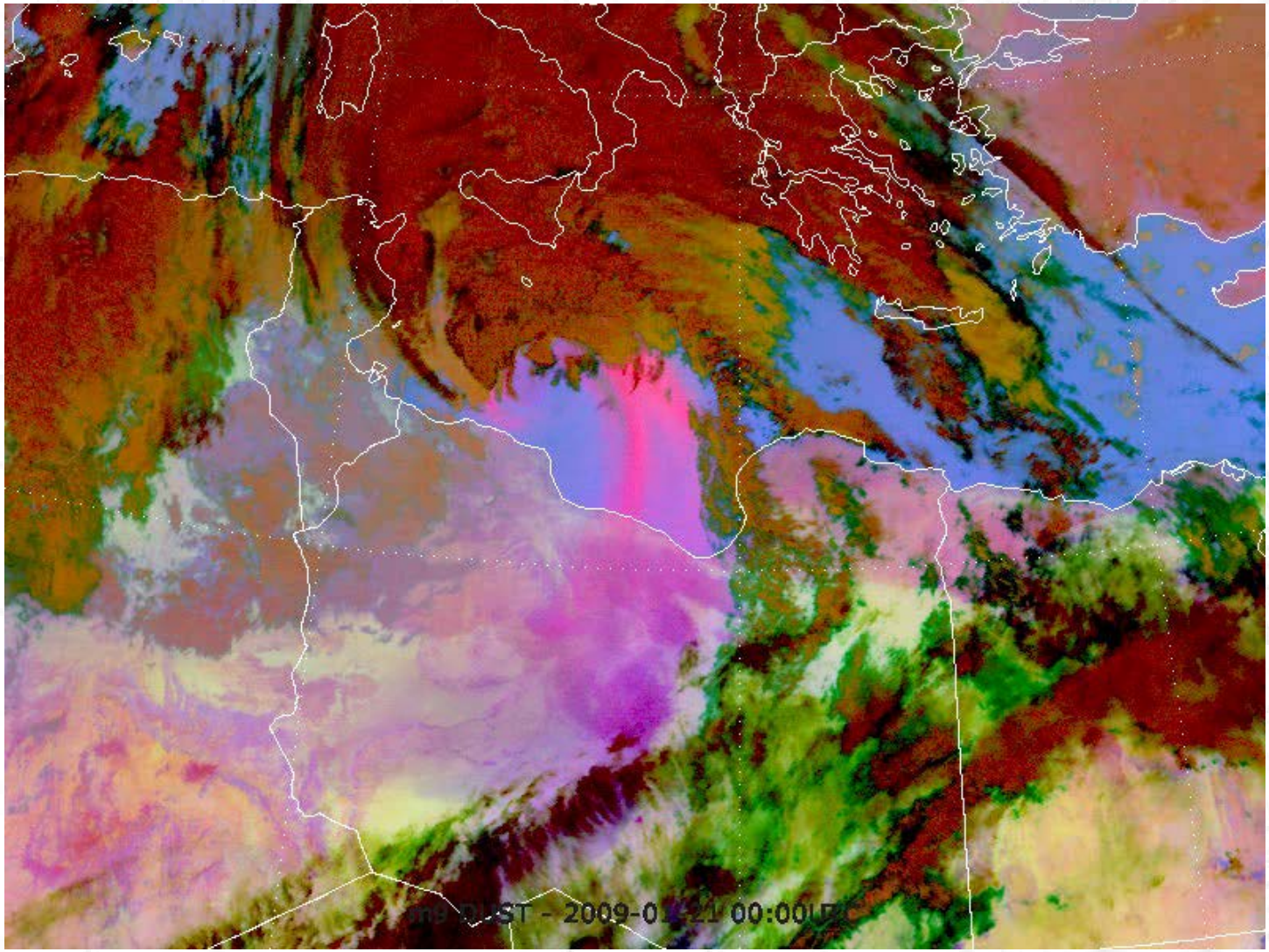
Dichotomous Statistical scores

Statistical Scores	C_1, C_2 (ALL)	C_1 (light-mod)	C_2 (mod-heavy)
Accuracy	0.91	0.91	0.99
Bias	1.16	1.13	2.88
POD	0.66	0.63	0.64
FAR	0.43	0.44	0.78

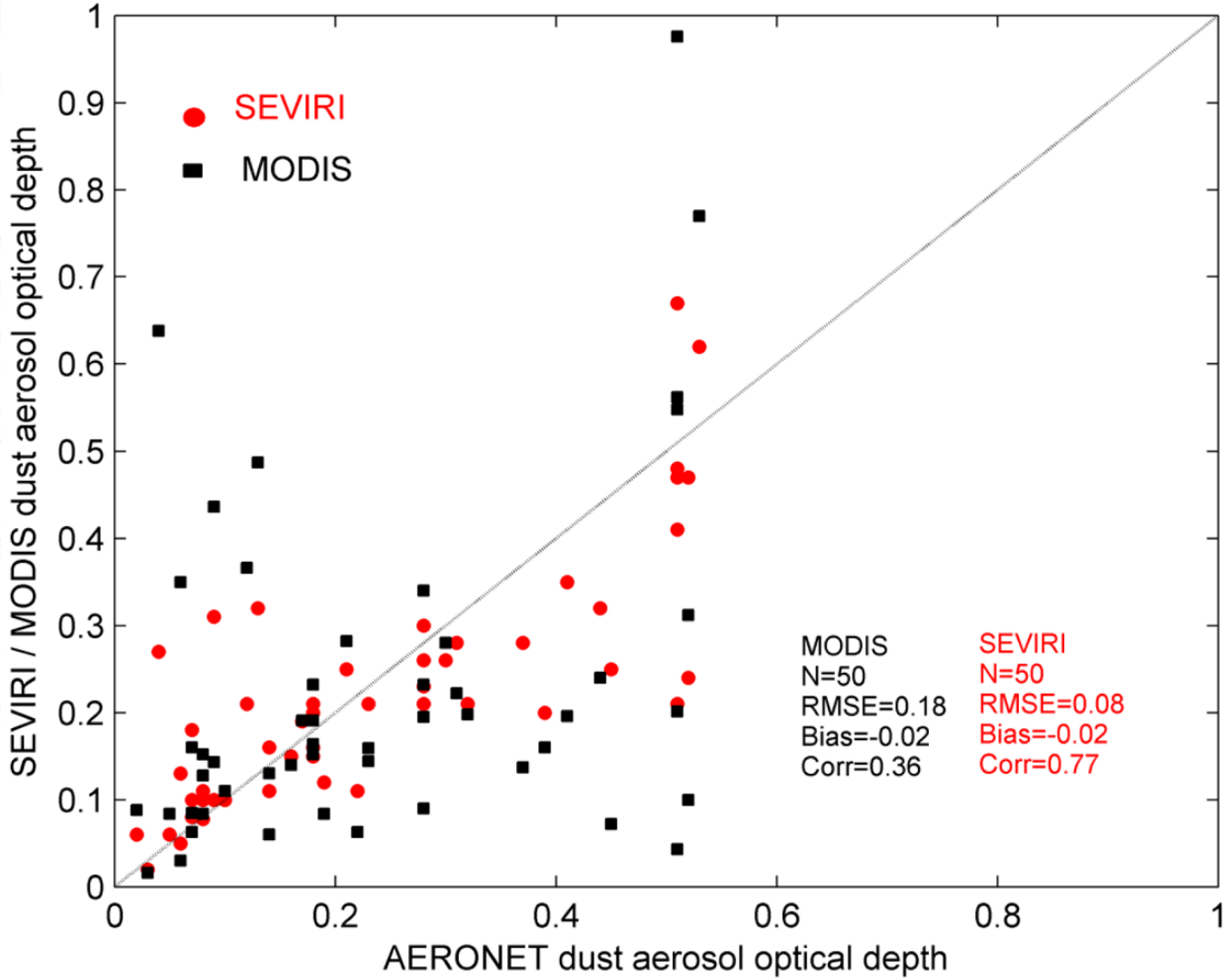
Ricciardelli et al., *Hydrol. Earth Syst. Sci.*, 2014

Aerosol detection and classification

Saharan dust detection from MSG-SEVIRI imagery



Validation of quantitative dust OD estimation



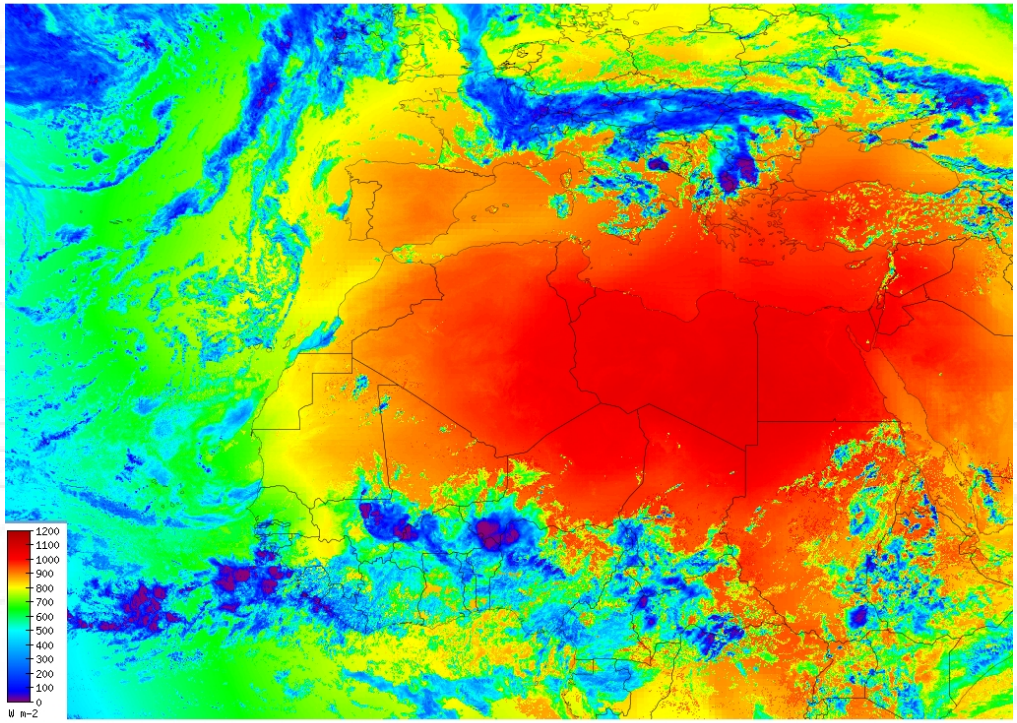
Romano et al., Atmosphere, 2013

Surface solar irradiance estimate

AMESIS - Advanced Model for Estimation of Surface Irradiance from Satellite

based on MSG/SEVIRI

- Spatial Resolution: 1km
- Temporal Resolution: 15 min



Geraldi et al., *IEEE Trans. Geosci. Rem. Sens.*, 2012

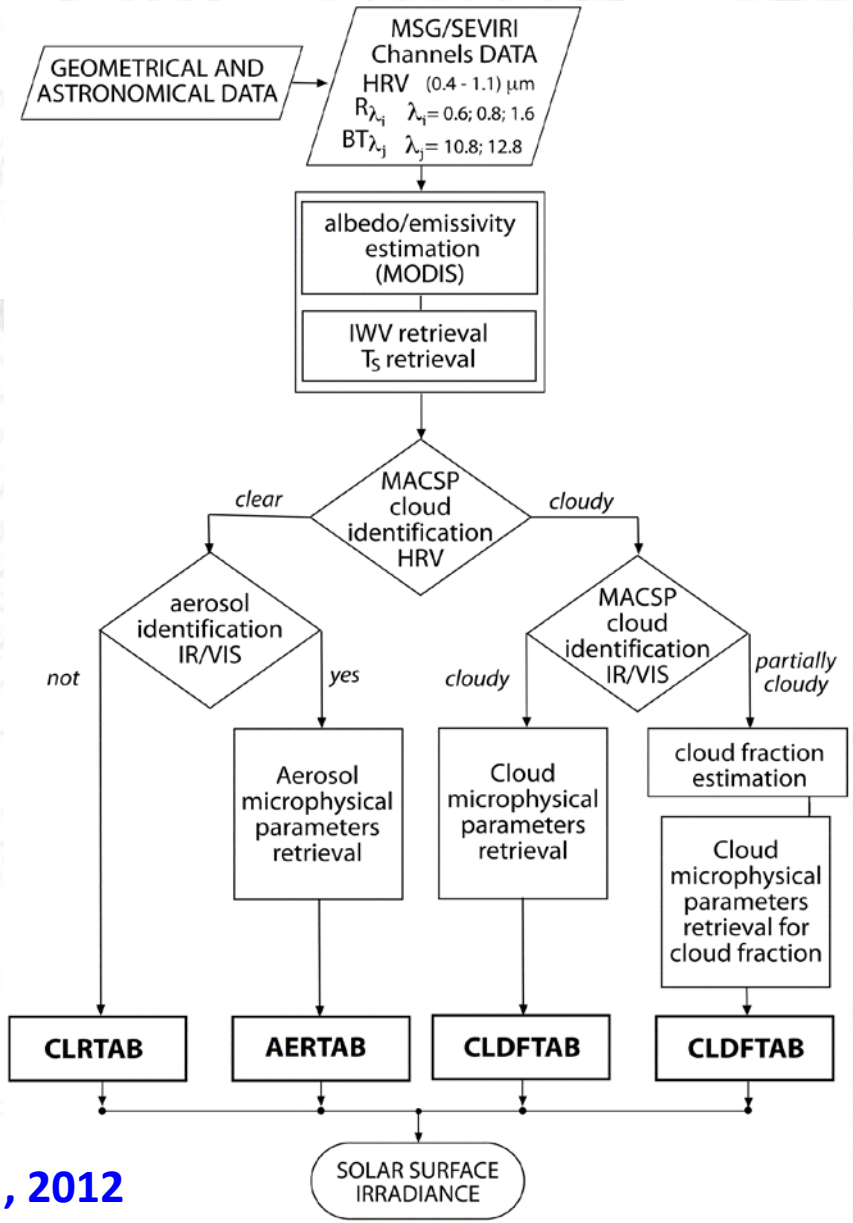
Surface solar irradiance estimate

AMESIS Diagram

Aerosol and cloud

1) **Detection**

2) **Quantitative estimate**

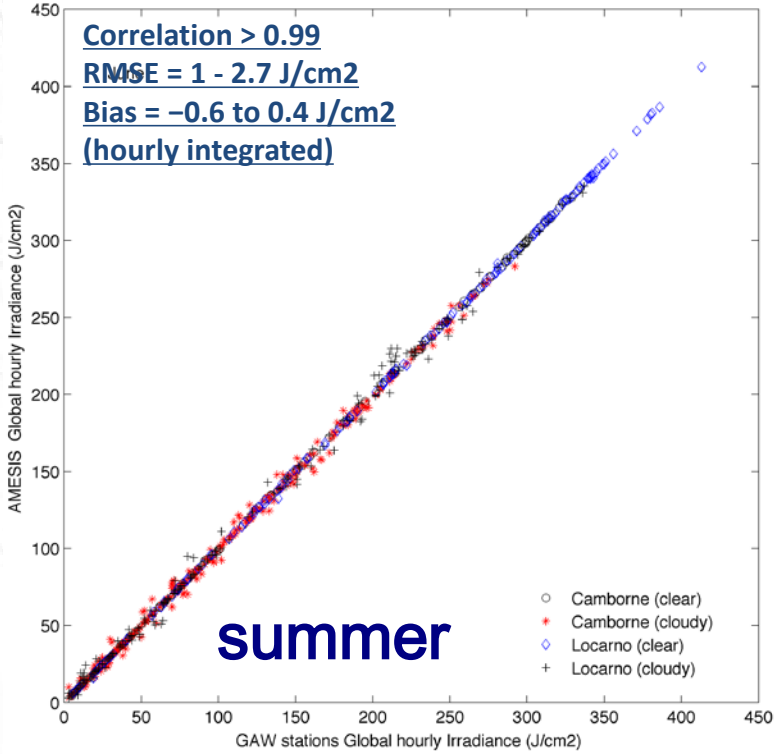


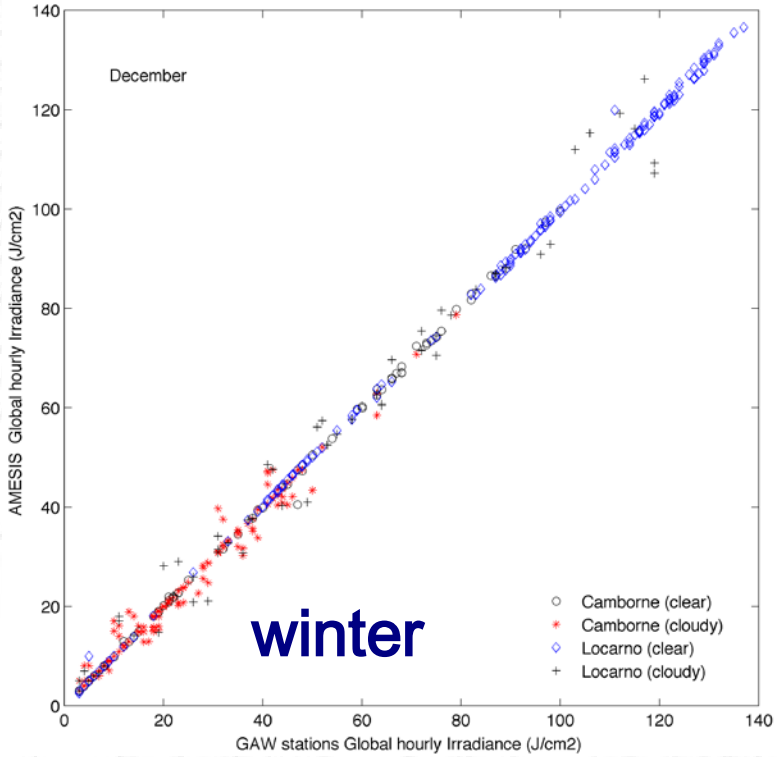
Geraldi et al., *IEEE Trans. Geosci. Rem. Sens.*, 2012

Validation of irradiance estimate

AMESIS vs. WMO GAW (Global Atmosphere Watch) data

AMESIS data





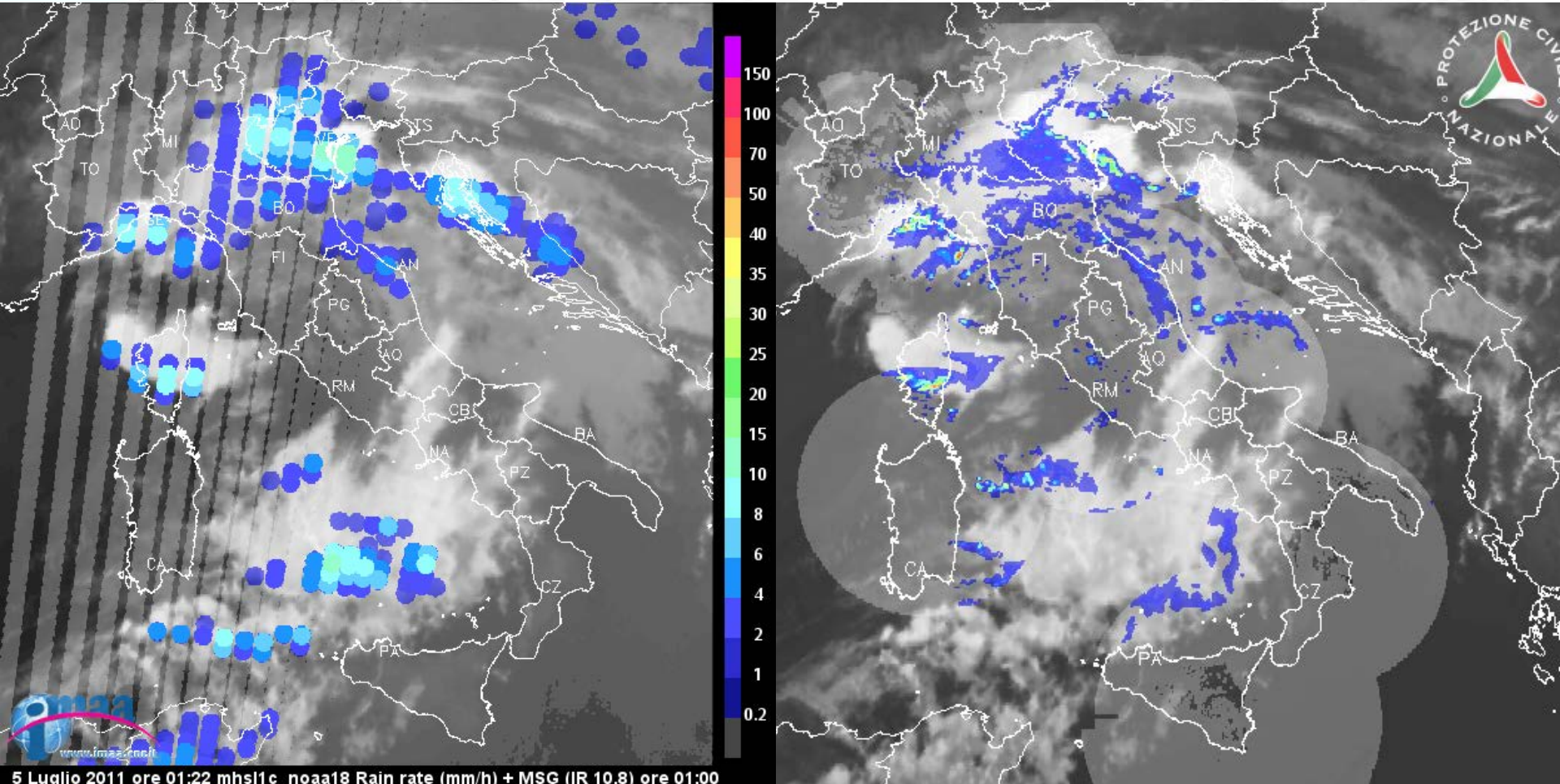
GAW data

Geraldi et al., *IEEE Trans. Geosci. Rem. Sens.*, 2012

Quantitative Precipitation Estimation

PEMW: Precipitation Estimation at Microwave Frequencies

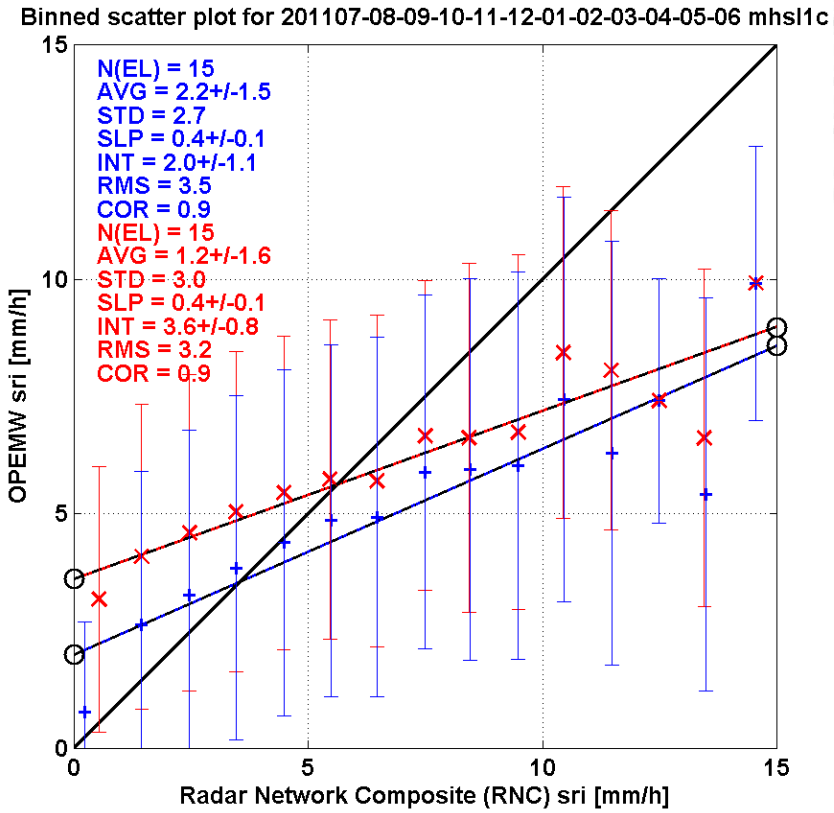
PEMW (IMAA-CNR) **RADAR (DPC)**

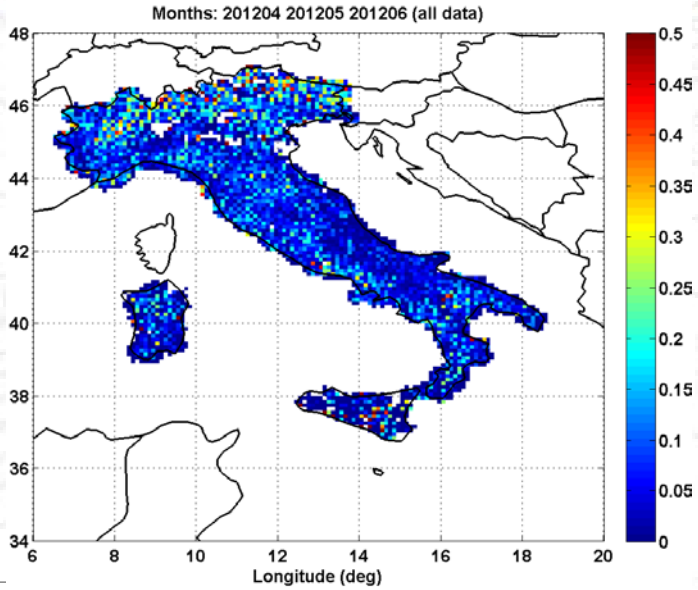


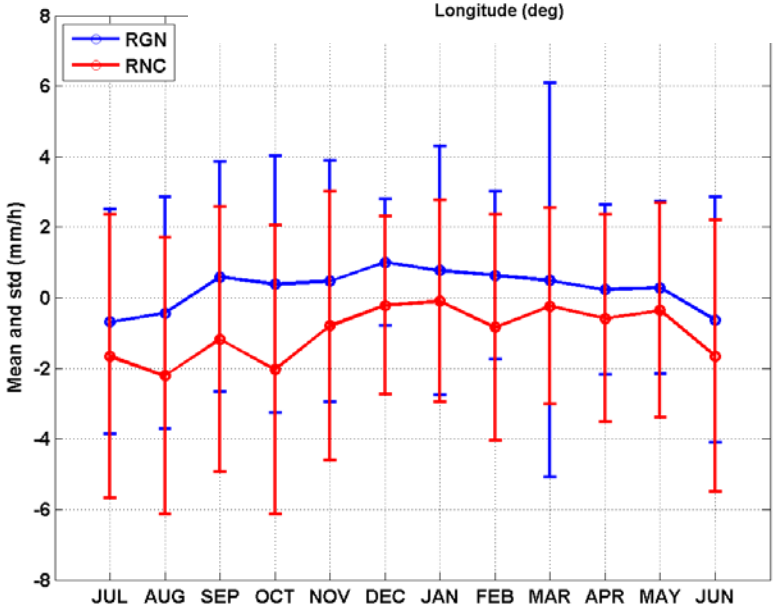
Validation of PEMW

PEMW validated against

- Weather radar network
- Raingauge network





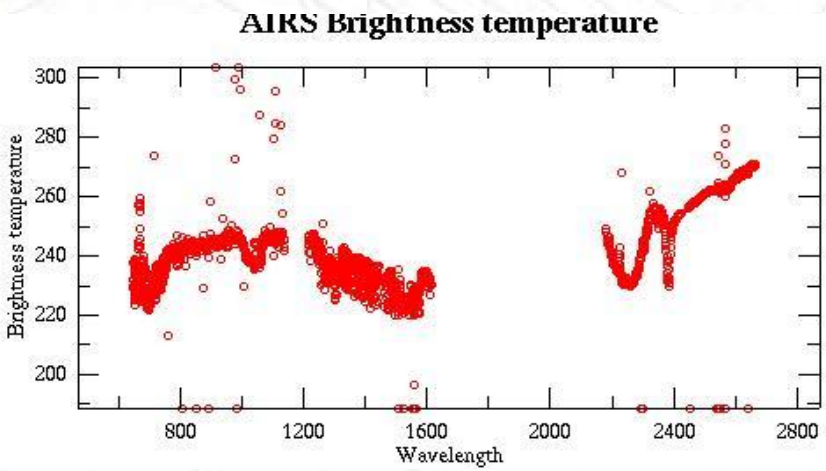


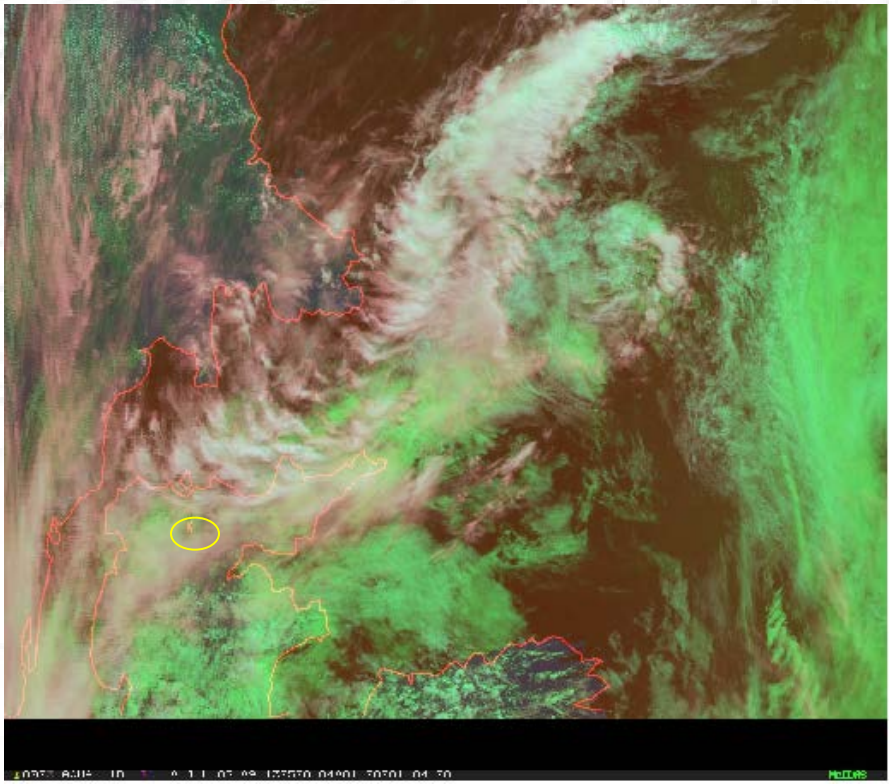
Cimini et al., *Atm. Meas. Tech.*, 2013

Optimal estimation (RTIRMW)

Iterative retrieval combining MODIS, AMSUA-B and AIRS

RTIRMW searches for values that minimize the difference between simulated and measured radiances



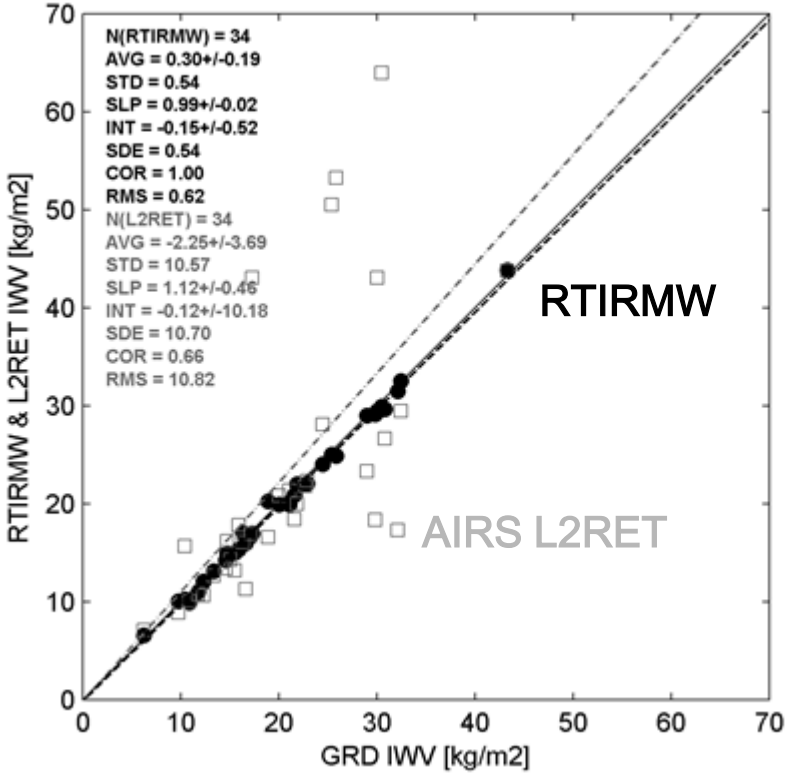


Romano et al., J. Geoph. Res., 2007

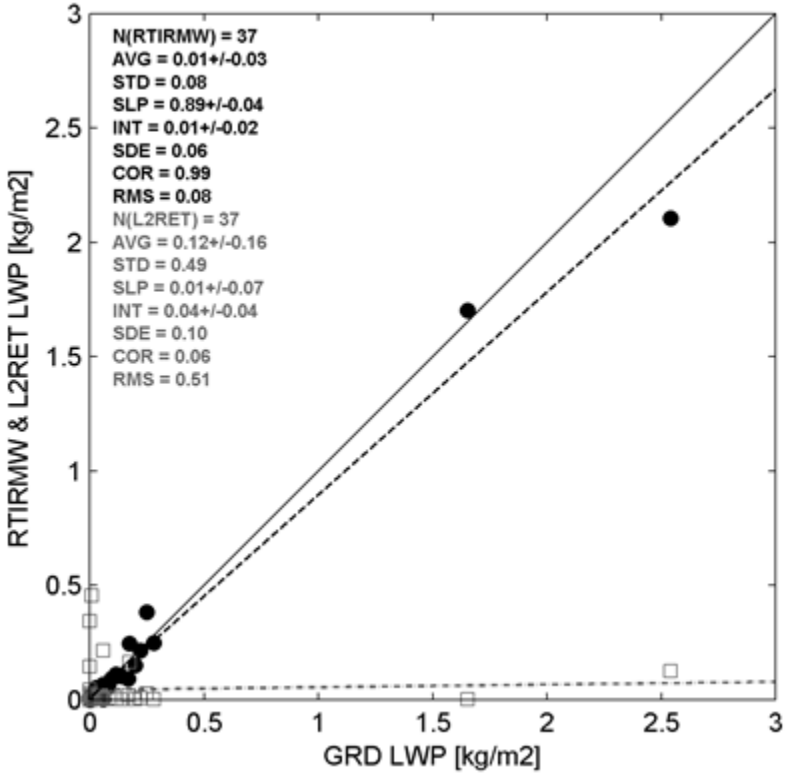
Validation of RTIRMW

RTIRMW validated against ground "reference"

IWV



LWP



Ground-based MWR

Romano et al., J. Geoph. Res., 2007

Summary and Conclusions

- SATCLOP mission:
  - develop and improve algorithms for estimating atmospheric properties
    - Thermodynamics
    - Clouds & Precipitation
    - Aerosols
    - Radiation

Thank you very much for your efforts!

- New methods need to be validated against «reference»
  - Quantify performances
  - Validate the estimated uncertainty
- GRUAN certified products (profiles + uncertainties) are the obvious choice for the validation source

F-AMESIS

Energy & Meteorology
Weather & Climate for the Energy Industry
2nd International Conference
25–28 June 2013, Météo-France International Conference Centre, Toulouse, France

Solar irradiance forecast (F-AMESIS)

Results (mean daily):
correlation: 0.5 – 0.8
rmse: 540 – 720 J/cm2
bias: -360 –720 J/cm2