Aerosol_cci products & achievements 2013

**Thomas Holzer-Popp (DLR), Gerrit de Leuuw (FMI)
and the Aerosol_cci team**

Aerosol_cci products

Parameter	Sensor (Algorithms)	Coverage (planned) - status
AOD, up to 4 wavelengths	ATSR-2 + AATSR (ADV, SU, ORAC)	2008 (2000), global - mature (1995 – 2012 in processing)
	MERIS (ALAMO)	2008, over ocean - mature
	PARASOL	2008, over ocean - mature
	MERIS (BAER, standard)	2008, global - experimental
	SYNAER	3,6,9,12/2008, global - experimental
Absorbing Aerosol Index	OMI (GOME, TOMS)	1978 – 2012, global - mature
Stratospheric extinction	GOMOS (SCIAMACHY)	2008, global - mature

All products contain pixel level uncertainties

AOD total error

low 0.0000 0.3000 0.6000 high
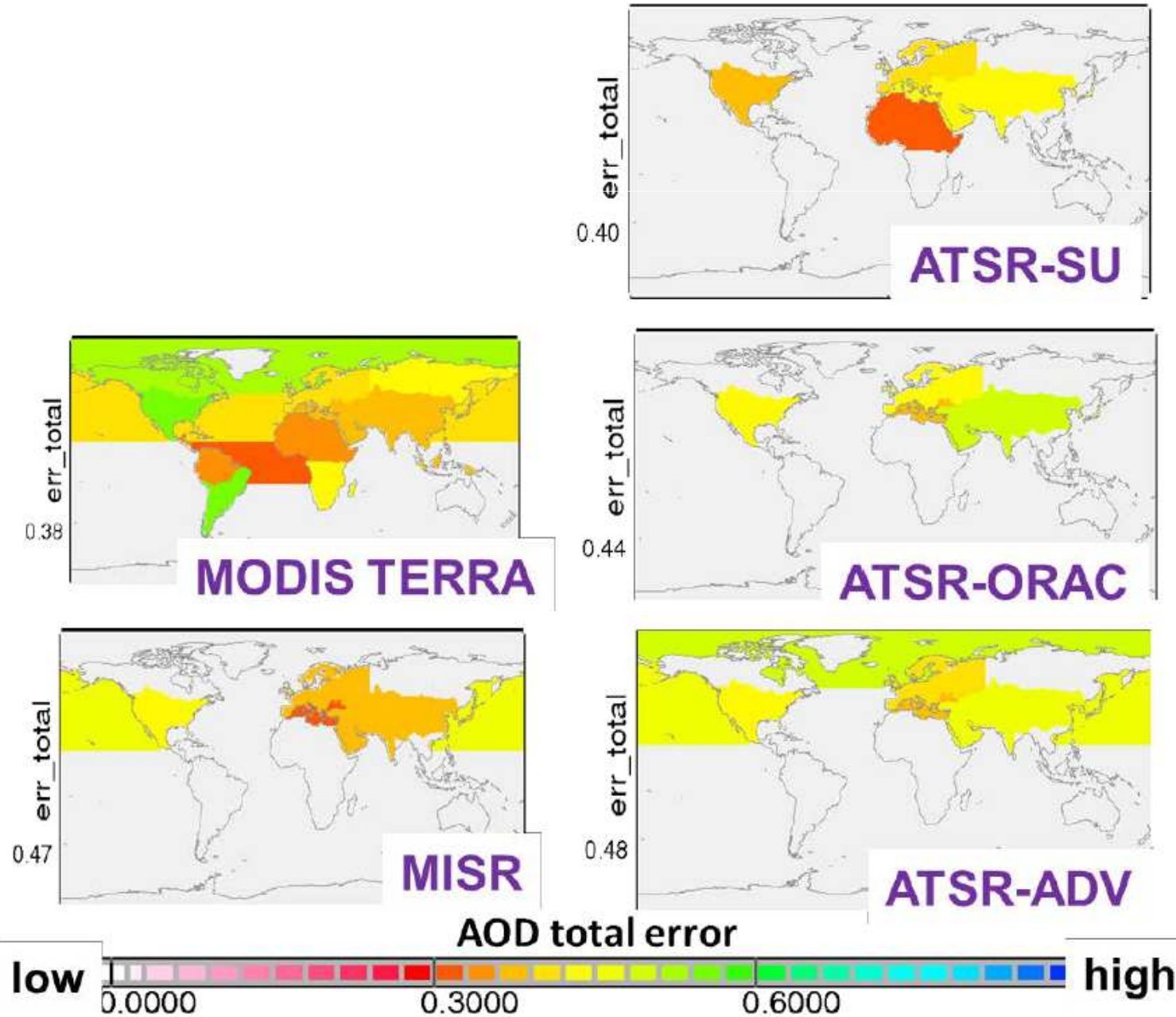
Lv3: AATSR4Land
Common point filter

Model name	NumObs #	R-CORR	RMS	NMB %	RMSbc
AATSR_ADV.v1.42	1394	0,822	0,102	-29,7	0,105
AATSR_ORAC.v2.02	1394	0,823	0,091	-9,4	0,091
AATSR_SU_v4.0	1394	0,863	0,081	-7,7	0,083
MISR_V31_1x1	276	0,856	0,085	-11,2	0,081
MODIS5.1aqua	1185	0,749	0,114	7,1	0,108
MODIS5.1terra	1285	0,744	0,114	1,5	0,113

- AATSR: in general high correlation, low RMS
- SU v4.0 has highest R, lowest RMS, better than all reference data sets
- All AATSR retrievals outperform MODIS5.1

No filter

Ranking:

Filter	ADV	ORAC	SU 3.1	SU4.0
China	1	4	2	3
India	3	2	1	4
East asia	1	4	2	3
Europe	1	3	4	2
Samerica	2	3	4	1
Nafrica	2	3	1	4
Namerica	1	4	3	2
DJF	1	2	4	3
MAM	2	4	1	3
JJA	1	3	2	4
SON	4	2	2	1

Average: 1,75 3 2,625 2,5

Average excluding china, india and east asia due to low number of measurements

Common point filter

Ranking:

Filter	ADV	ORAC	SU 3.1	SU4.0
China	3	2	1	4
India	3	2	1	4
East asia	3	2	1	4
Europe	2	4	3	1
Samerica	3	2	4	1
Nafrica	3	4	2	1
Namerica	2	4	3	1
DJF	2	3	4	1
MAM	3	4	1	2
JJA	1	4	2	3
SON	4	2	3	1

Average: 2,5 3,375 2,75 1,375

Lv3: AATSR4Sea
Common point filter

Model name	NumObs	R-CORR	RMS	NMB	RMSbc
AATSR_ADV.v1.42	87	0,884	0,06	21,10	0,06
AATSR_ORAC.v2.02	87	0,889	0,09	17,90	0,06
AATSR_SU_v4.0	87	0,781	0,08	-11,50	0,08
MISR_V31_1x1	5	0,984	0,06	3,64	0,07
MODIS5.1aqua	64	0,916	0,05	4,79	0,05
MODIS5.1terra	57	0,905	0,05	1,39	0,05

- AATSR: in general high correlation, low RMS
- ADV1.42 and ORAC 2.02 have highest R
- AATSR retrievals are weaker than reference datasets

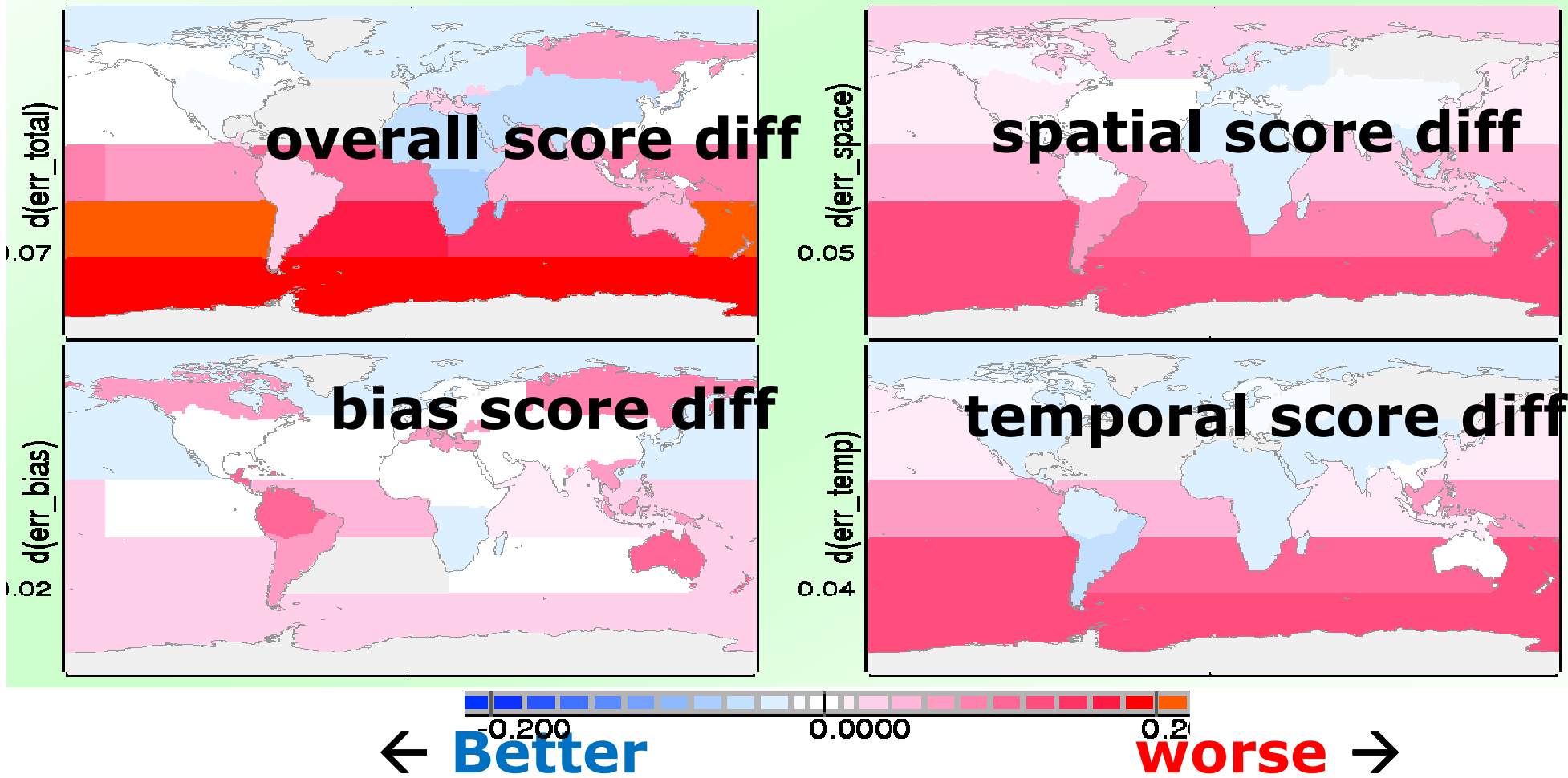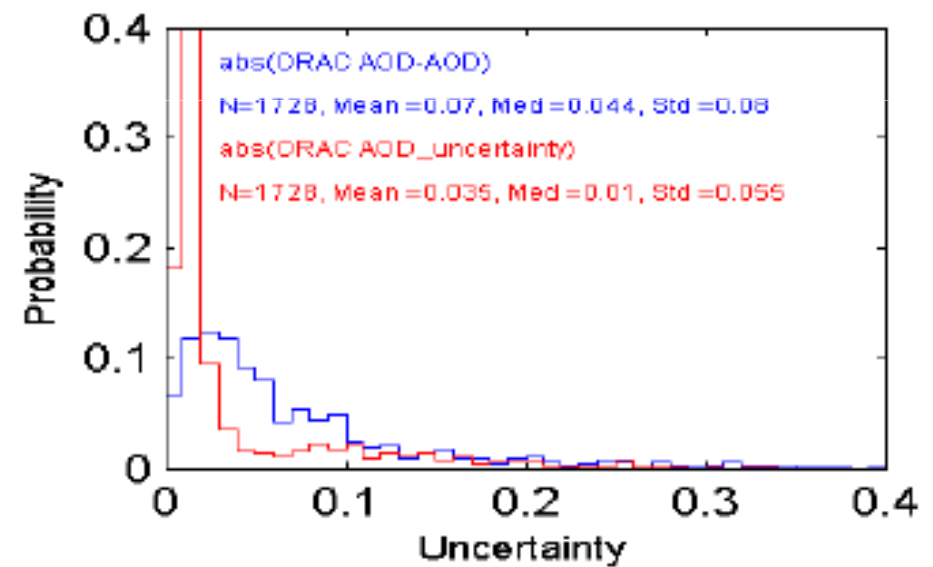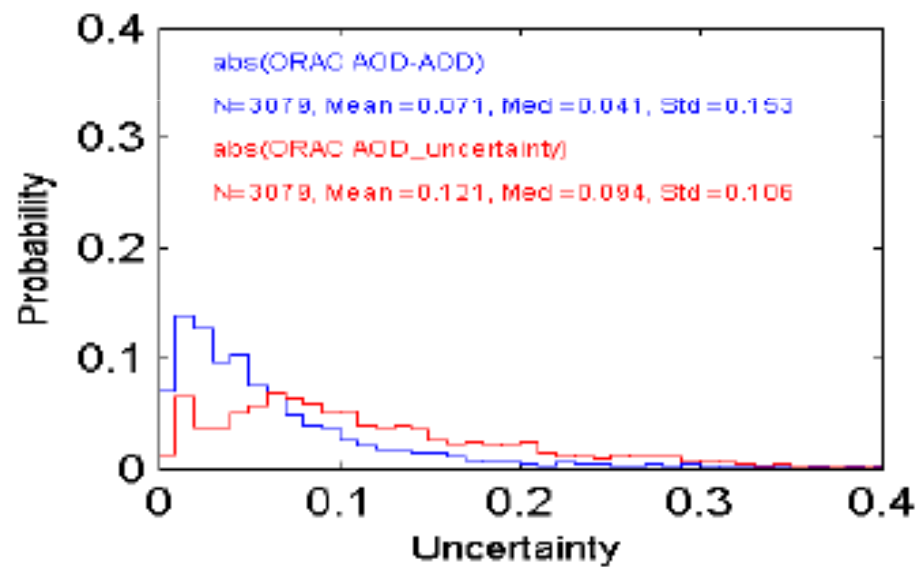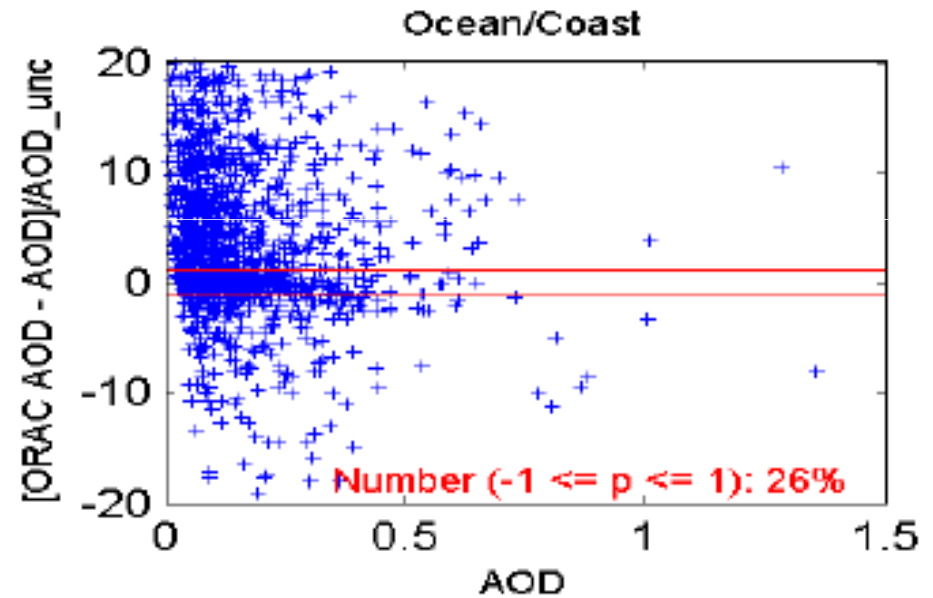- **Scores ATSR Swansey 4.0 versus Swansey 1.0 established against AERONET**

overall score diff

spatial score diff

bias score diff

temporal score diff
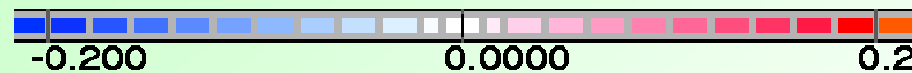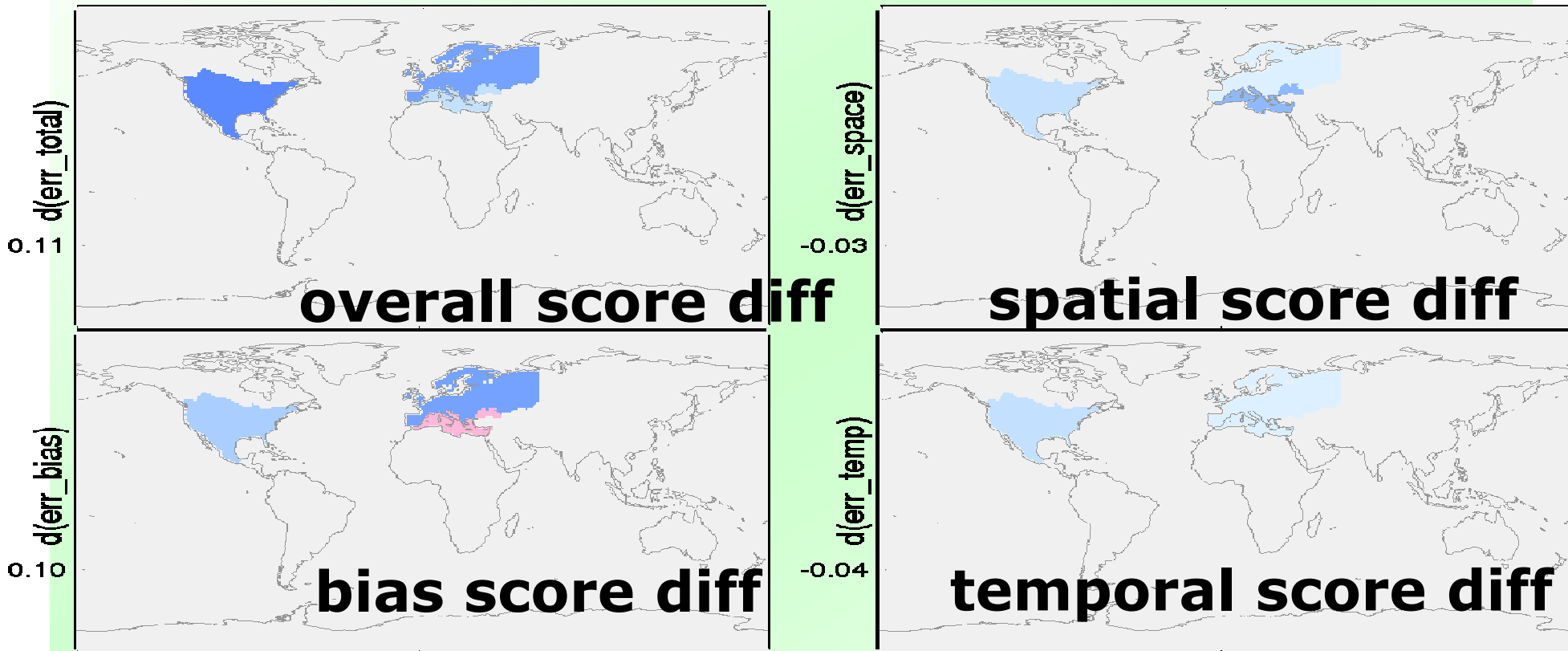
← **Better**   **worse** →

- **Scores ATSR Swansey 4.0 versus Swansey 1.0 established against MODIS daily data**

overall score diff

spatial score diff

bias score diff

temporal score diff

← **Better**   **worse** →

Analysis steps
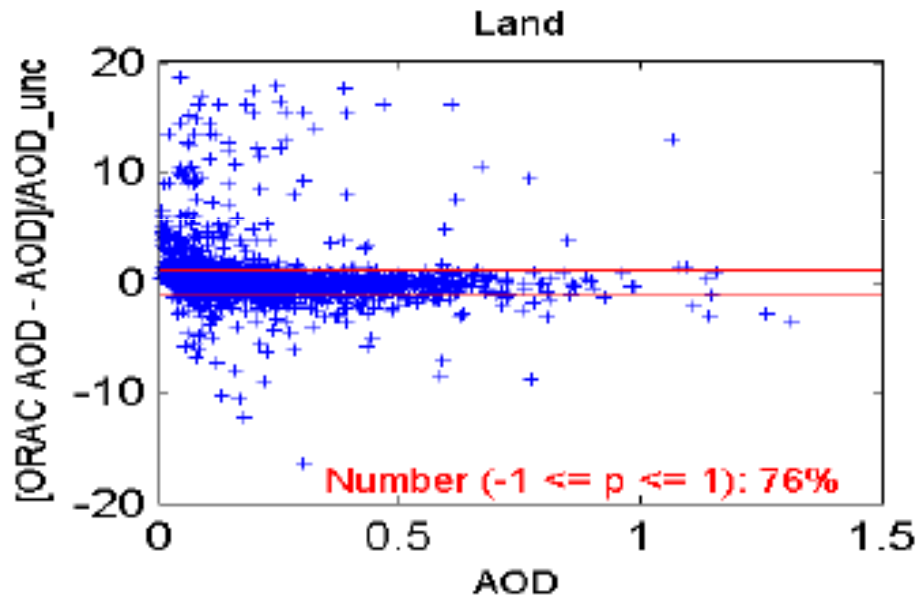
- Improve algorithms: Workshops + experiments (1 month)
  - Optical models, cloud masks, (surface)
  - Post-processing (cloud contamination, bright surface)
    Holzer-Popp, et al., AMTD 2013

- Select algorithms: Round robin exercise (4 months)
  - Best versions for all algorithms
    de Leeuw et al., RSE 2013 accepted

- Produce selected ECV products (entire 2008) -> today's results

- At all steps application of the same validation tools and statistics
  - Level 2 and level 3
  - Global + regional statistics
  - Scoring (spatial / temporal correlation)
  - Against AERONET / MAN + MODIS / MISR

Aerosol_cci products main advantages

- accuracy
  - Very high: PARASOL over ocean and 3 AATSR algorithms
- Coverage
  - ATSR-2 + AATSR enable time series 1995 – 2012
- Information content
  - Very high for PARASOL, good for AATSR
  - Absorption qualitative with absorbing index
  - Vertical with stratospheric product
- General
  - 3 year intesive team dialogue /efforts improved data
  - Significant improvement against baseline algorithms
  - Similar quality to MODIS / MISR over land
  - Pixel level uncertainties / quality indeces
  - Documentation at Aerosol_cci website
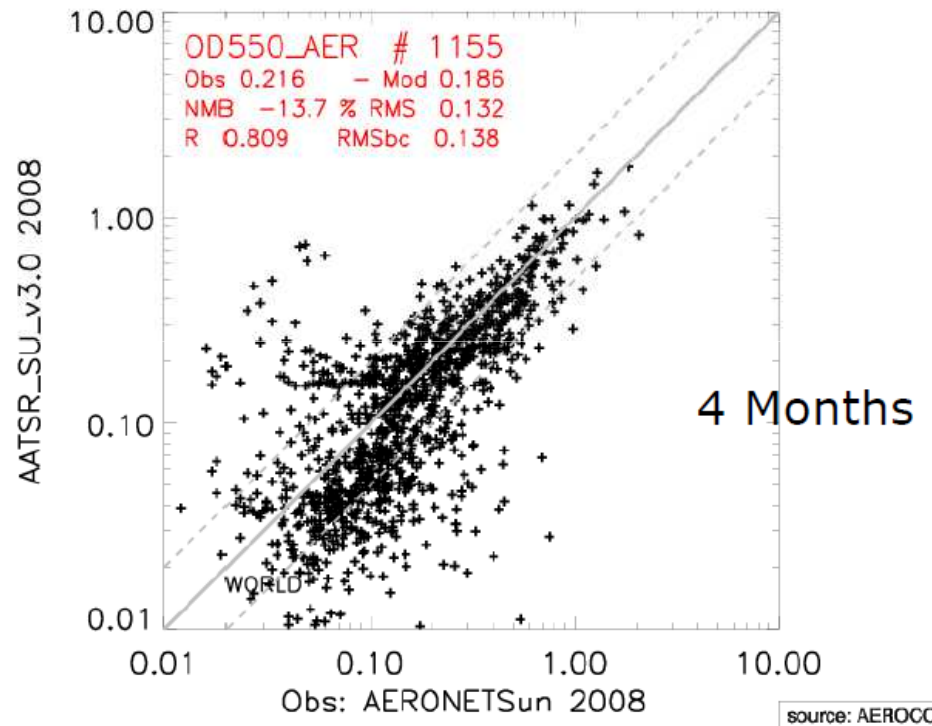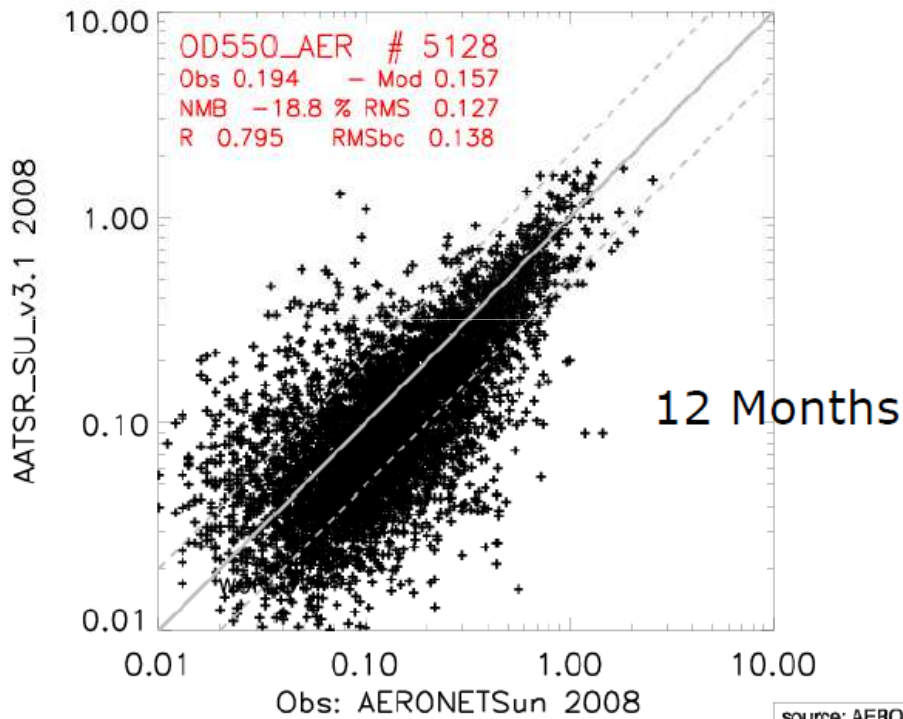
Why more than one AOD product?

- Different sensors
  - Information content differs
  - Depending on type / number of observations (multi-spectral, multi-angle, polarization)

- Different algorithms for one sensor (AATSR, MERIS)
  - Significant learning curve from comparisons and team
  - A possible measure of uncertainty
  - 3 AATSR algorithms reach similar high quality
  - Validation is limited in data sparse regions (ocean, Southern hemisphere)
  - No single algorithm performs best everywhere
  - Testing ensemble or combined products ongoing

Model name	NumObs	R-CORR	RMS	NMB	RMSbc
AATSR_SU_v3.0	1155	0,809	0,132	-13,7	0,138
AATSR_SU_v3.1	5128	0,795	0,127	-18,8	0,138

Documentation freely available at

http://www.esa-aerosol-cci.org/

Public open data access under preparation at

http://www.icare.univ-lille1.fr/archive/index.php?dir=CCI-Aerosols/

ATSR SU AOD product

Characteristics	Information
name	**SU algorithm v4.0** ENVISAT / AATSR + ERS-2 / ATSR-2
provider	Swansea University
contact	P.R.J.North@swansea.ac.uk
parameters	4 AOD, 3 mixing fractions, Angstrom coefficient
algorithm features	**Main principle: Dual view**
	Cloud mask: ESA standard
	Aerosol model: Aerosol_cci 4 common components
	Surface: BRDF model
	Other: -
main advantage	**17 year time series, high accuracy, good cloud filter**
limitations	**coverage (512 km swath), accuracy over ocean**
rmse/bias/correlation (land)	0.08 / -0.01 / 0.86 (daily 1° ADO550 vs. AERONET – 1394 pts.)
rmse/bias/correlation (sea)	0.08 / -0.02 / 0.78 (daily 1° AOD550 vs. AERONET – 87 pts.)
coverage	2008, global (except polar latitudes)
resolution	Daily, 10x10 km2
continuation	Sentinel-3 / SLSTR