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Copernicus: 4 Core Products Algorithm Studies

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Impact of the SLSTR geometry configuration versus (A)ATSR geometry configuration on retrieved time series

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- **Contents**
  - ❖ Study description
  - ❖ L2 simulation studies
  - ❖ ATSR and SLSTR monthly L3 AOD CDRs: Products harmonisation and filling gap between the products

- **The study concentrated on the aerosol product retrieved using the SY_2_AOD processor – the derived surface reflectance was also partly evaluated**

- **The main difference affecting the products between the (A)ATSR and SLSTR instruments is the mirroring of the oblique view from forward 55° to backward 55°**
  - ❖ Other contributing differences: swath, spatial resolution, added cirrus channel
  - ❖ Also, there are deficiencies in the calibration of the SLSTR channels utilized in the retrieval of some of the L2 products – new calibration correction issued 2021

- **Goal: Assess and report the impact of the mirrored oblique view on the selected L2 products (AOD 550 nm, Nadir surface reflectance 550 nm)**

- **Goal: Provide information to combine the (A)ATSR and SLSTR CDRs**

- **The main geometric difference potentially affecting the L2 retrieval results between the (A)ATSR and the SLSTR instruments is the change of the oblique view <u>from 55° forward to 55° backwards.</u>**

- **The forward scattering conditions of the (A)ATSR instrument in Northern Hemisphere are replaced by backward scattering conditions of the SLSTR instrument, and vice versa in Southern Hemisphere**
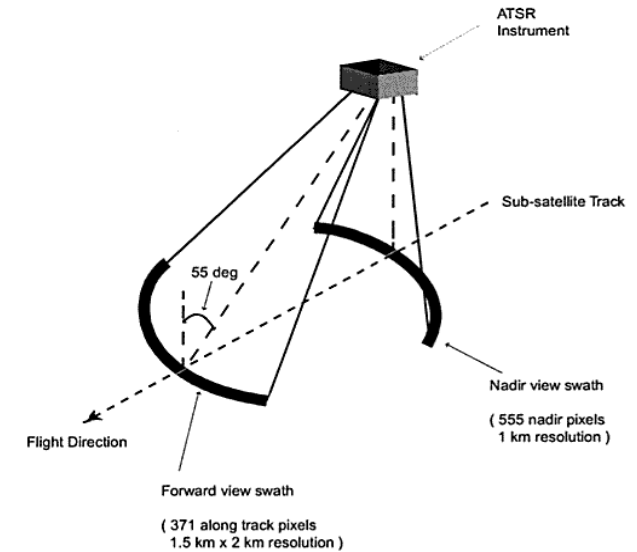
- **SLSTR L1B scenes were used to set the geometry and reference AOD**

- **AATSR-like geometry was computed by mirroring the SLSTR oblique relative azimuth angle by 180 degrees. Note: the processor is still the SLSTR SYN_2_AOD**

- **Two different approaches in the simulations**

- **Scene generation – The forward model of the SYN_2_AOD processor was used**

- **Pixel classification was used for the surface description**

- **Climatological aerosol information was used for the aerosols**

- **Enables to study the retrieval without/with added noise**

- **Scene generation – Full BRDF surface model with radiative transfer calculations**

- **Monthly global, 0.1-degree full BRDF database ADAM was utilized to set the surface reflectance**

- **A rural aerosol model. AOD from climatology**

- **Mimics the conditions in the actual retrieval**
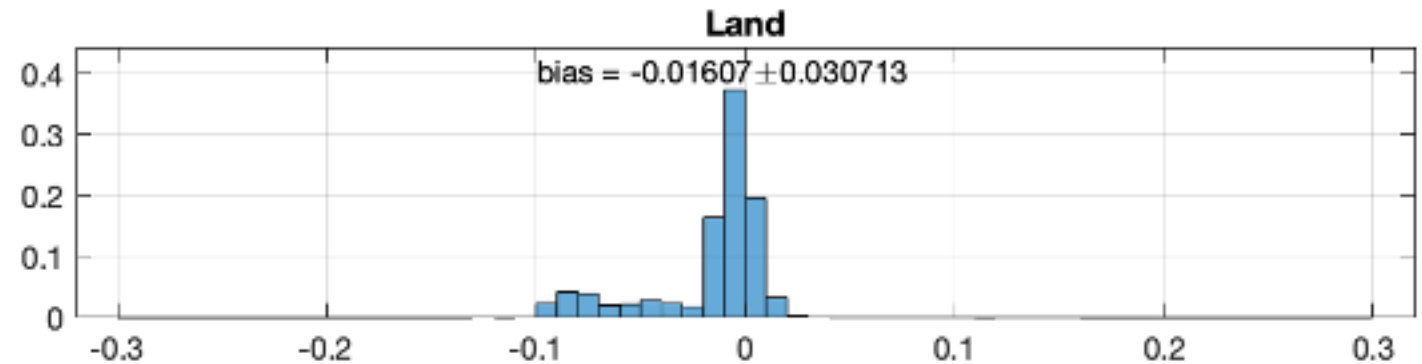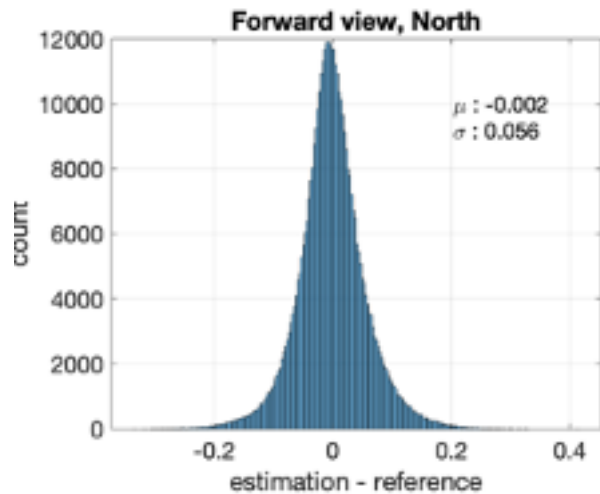
- **AOD evaluation – Examples** over land

- **SYN_2_AOD forward model**
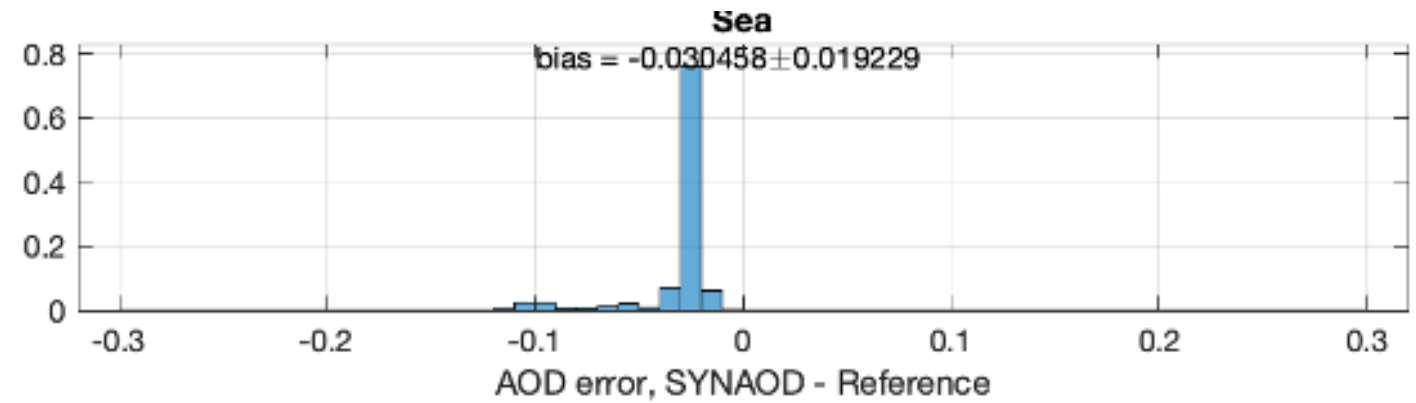
- **Full BRDF simulations**
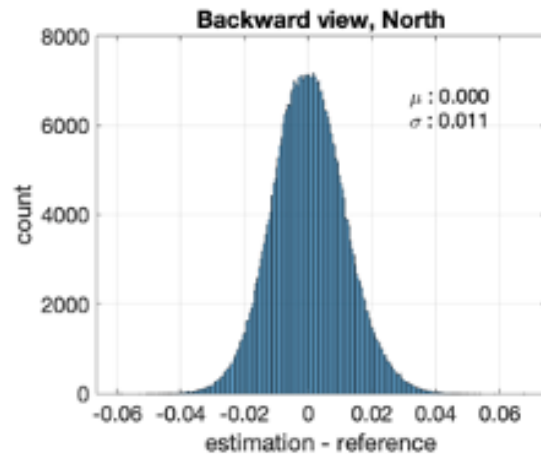
L2 Simulation Studies
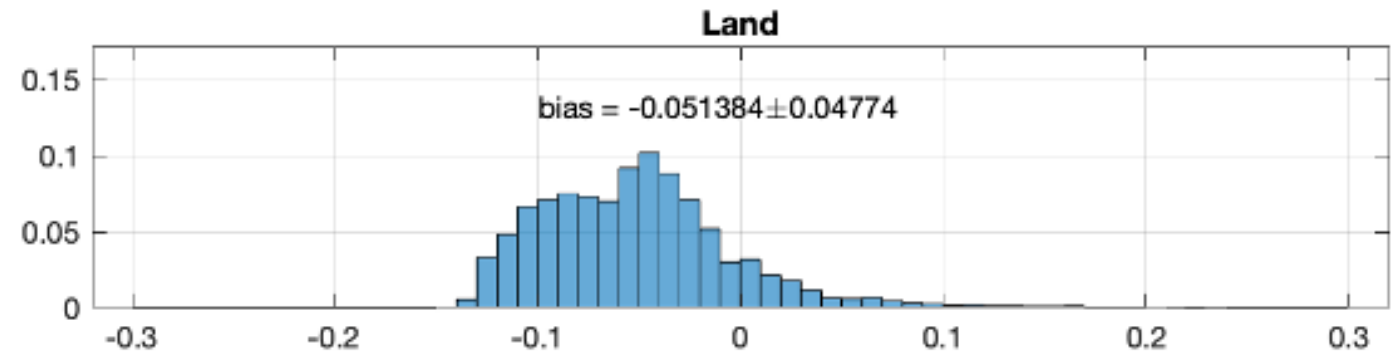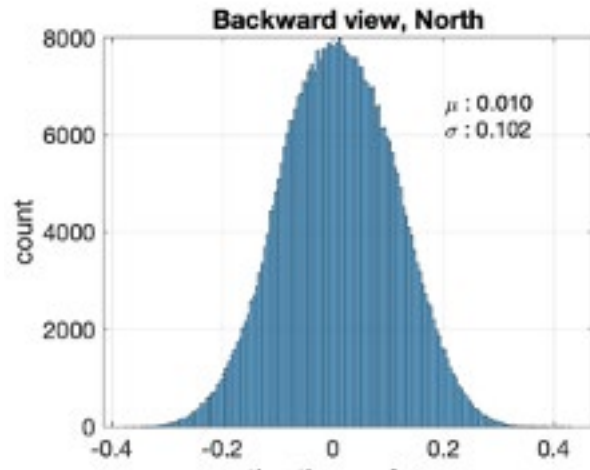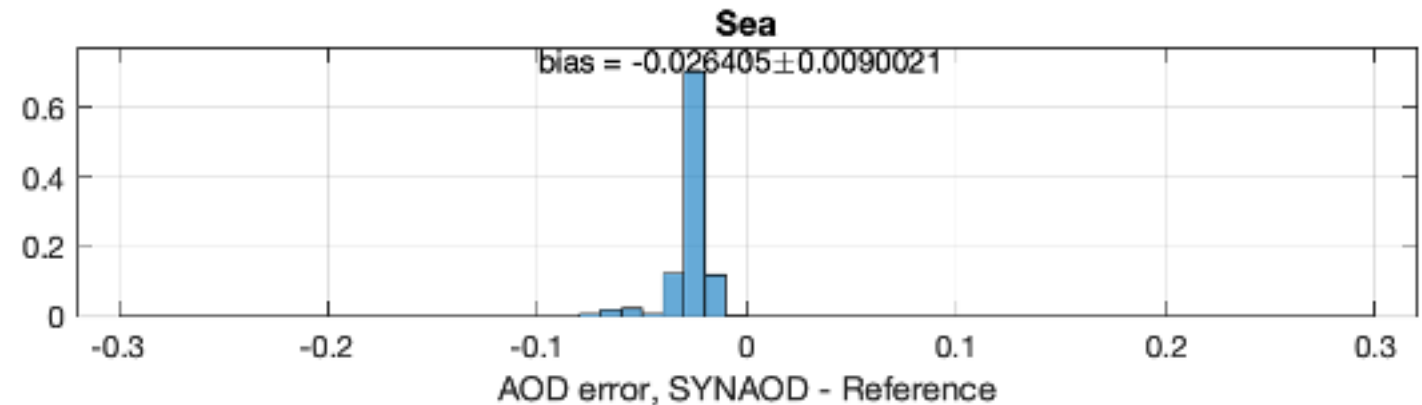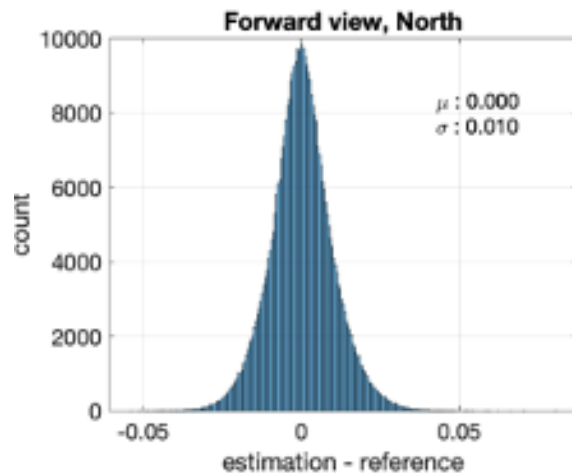
■ **AOD evaluation – Examples over ocean**

■ **SYN_2_AOD forward model**   ■ **Full BRDF simulations**

SLSTR

AATSR

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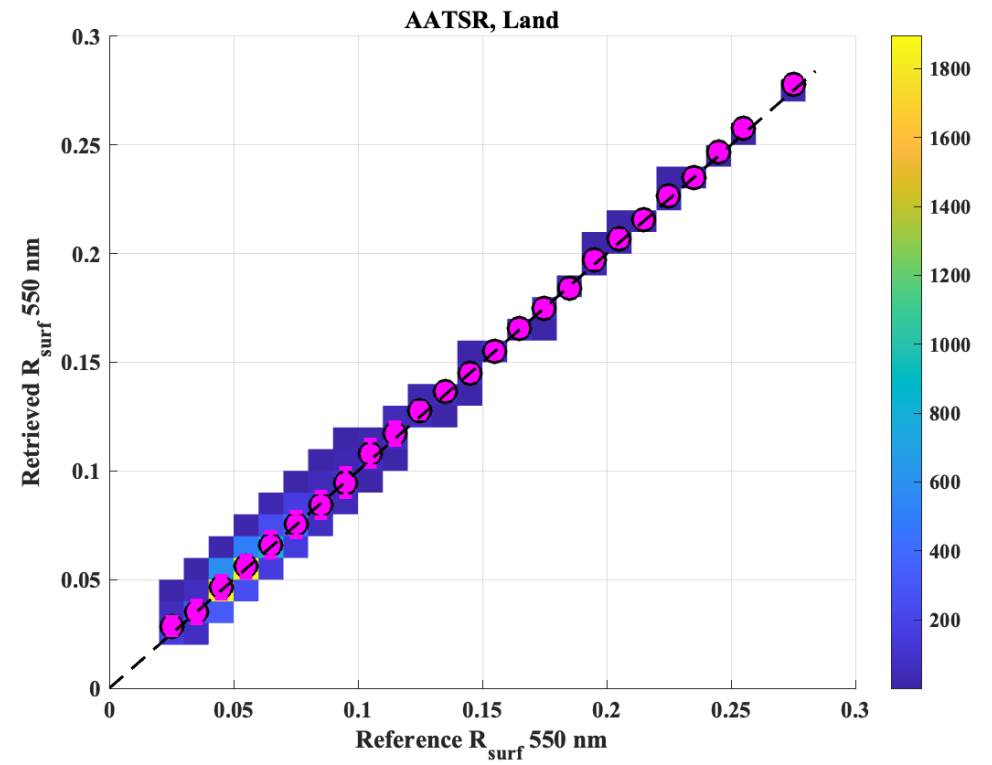METEOROLOGISKA INSTITUTET
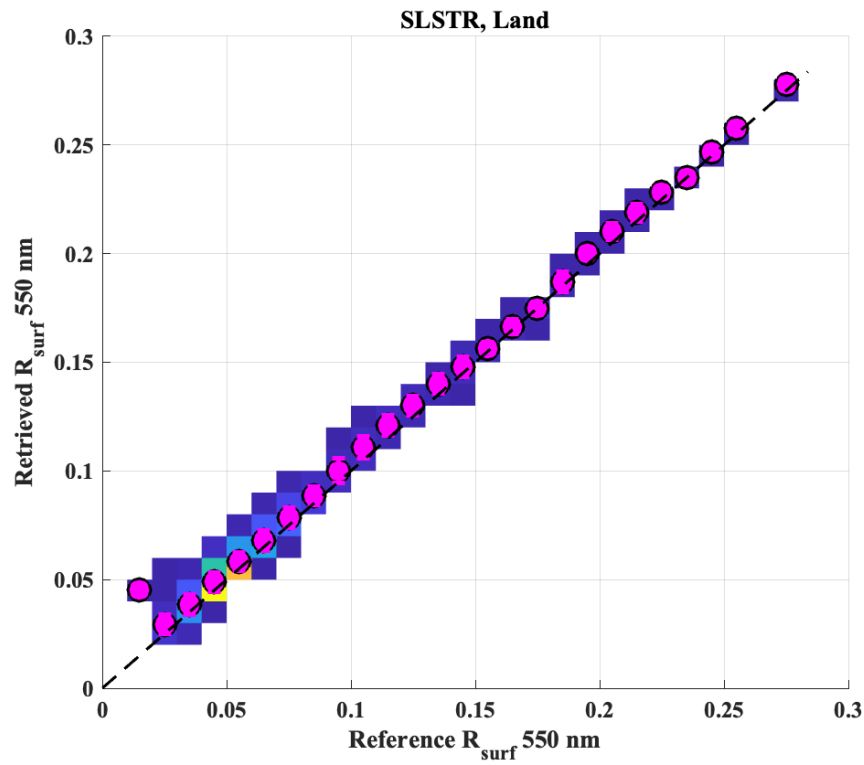FINNISH METEOROLOGICAL INSTITUTE**

▪ **Nadir land surface evaluation example**

▪ **Full BRDF simulations**

SLSTR

AATSR

- **The (A)ATSR and SLSTR AOD datasets were validated extensively to observe and report the bias between the retrievals in Northern/Southern hemispheres, and in a selected regions**

- **Recommendations how to combine the datasets were given**
  - ❖ Bias correction between the (A)ATSR and SLSTR datasets to harmonize them
  - ❖ Filling the gap when there was no dual-view instrument (2012 – 2016) with an auxiliary dataset (MODIS)

- **NOTE: for brevity here are mostly shown the NH/SH figures**

- **BIAS – L3 monthly (A)ATSR and SLSTR AOD datasets with auxiliary reference**
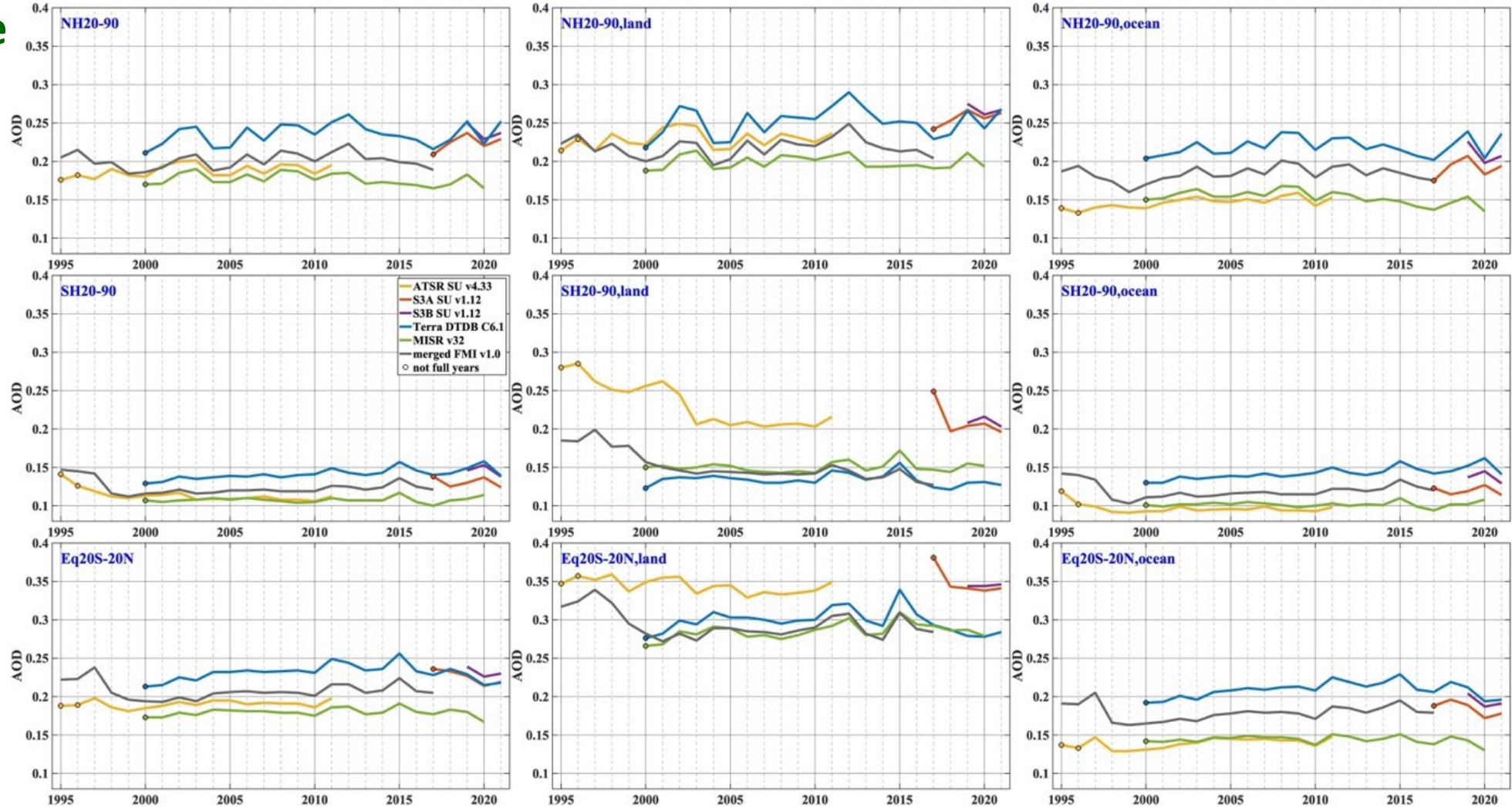
▪ **BIAS – There is no overlap of the (A)ATSR and SLSTR: determining the offset with MODIS Terra**
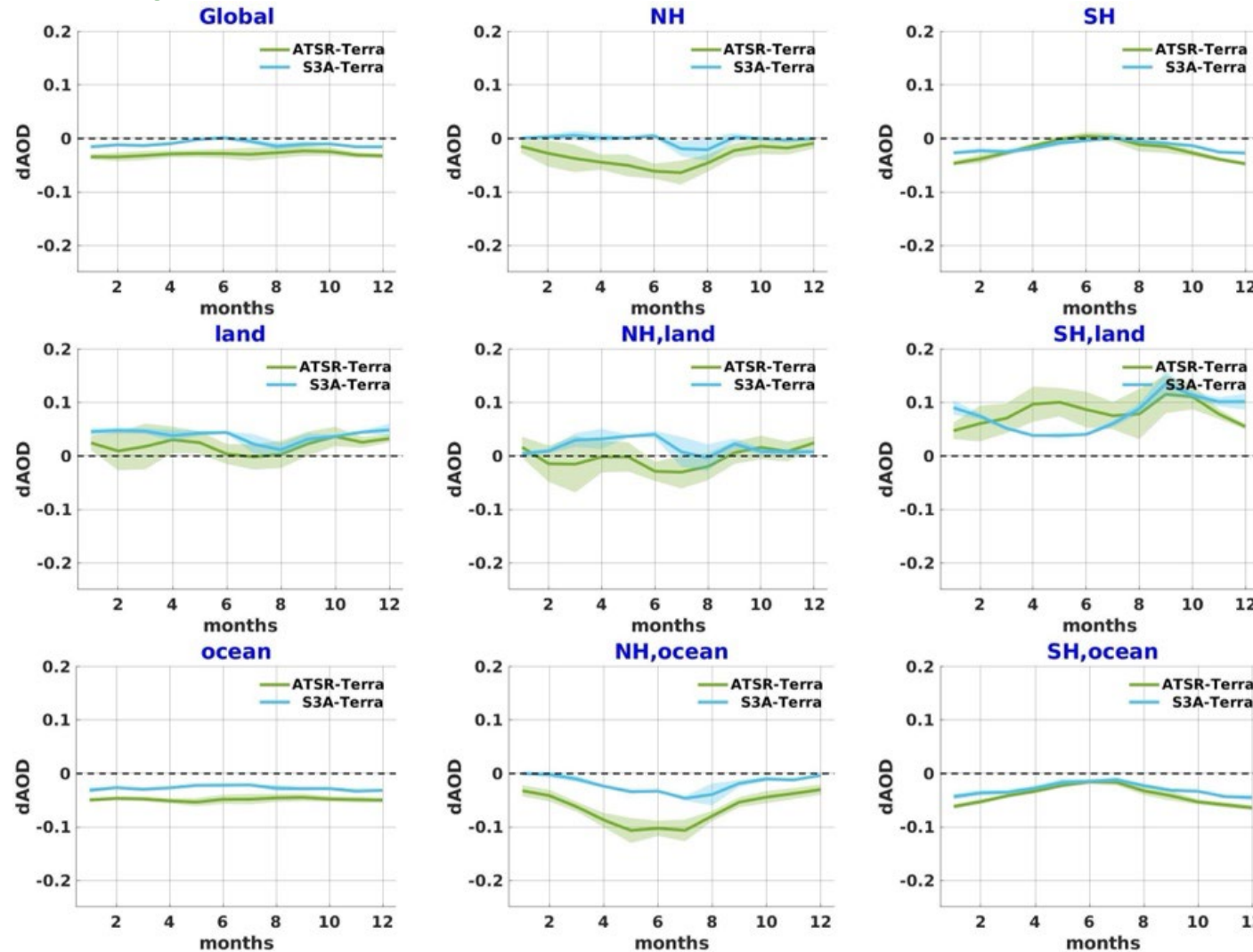

Here S3A shown – S3B almost identical

Different offset correction methods were tested, and recommendations given

- ❖ (A)ATSR dataset was modified to match the SLSTR datasets
- ❖ A gap-filling MODIS Terra dataset was modified to match the dual-view datasets
- ❖ End product – a continuous monthly L3 AOD dataset (COPA v1.1) covering years from 1995 to 2021
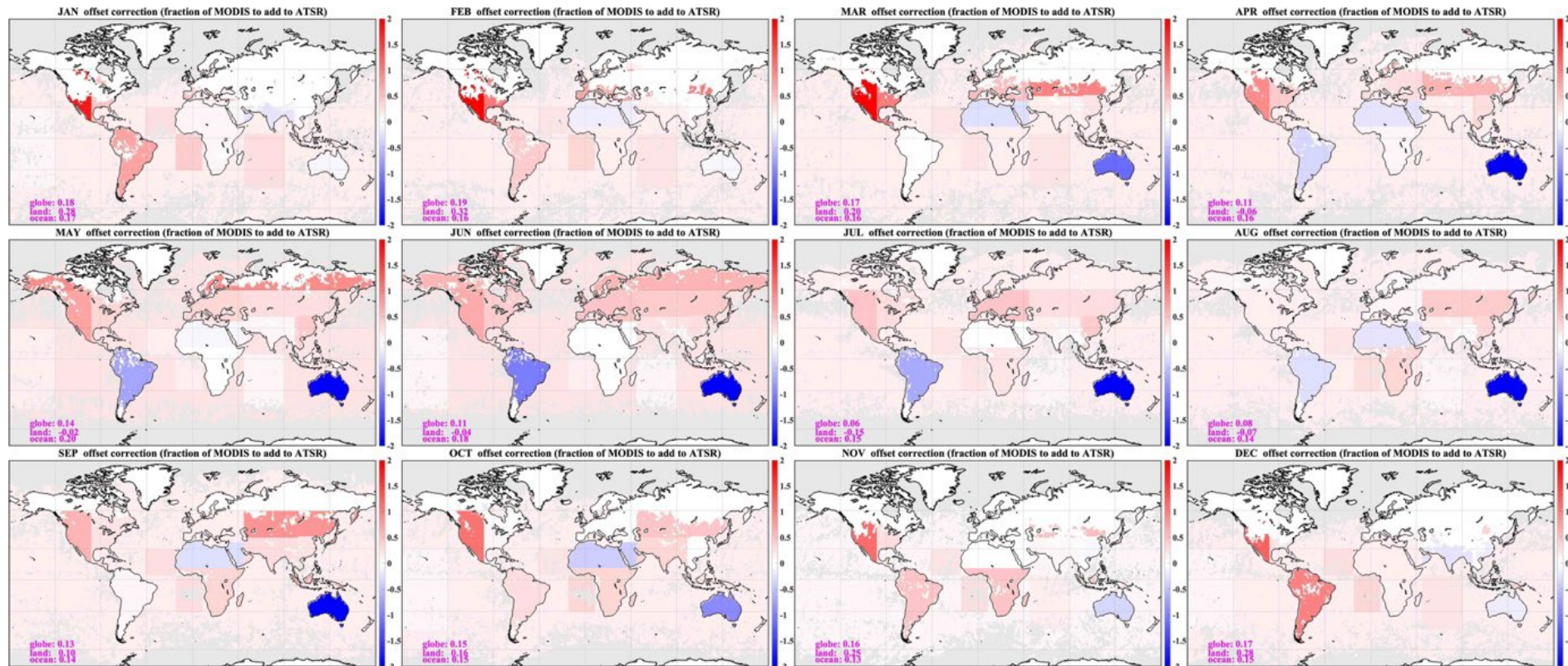
Relative to Terra, monthly regional offsets between ATSR and S3A

- **The time series of the COPA v1.1 AOD dataset – Example: Europe**
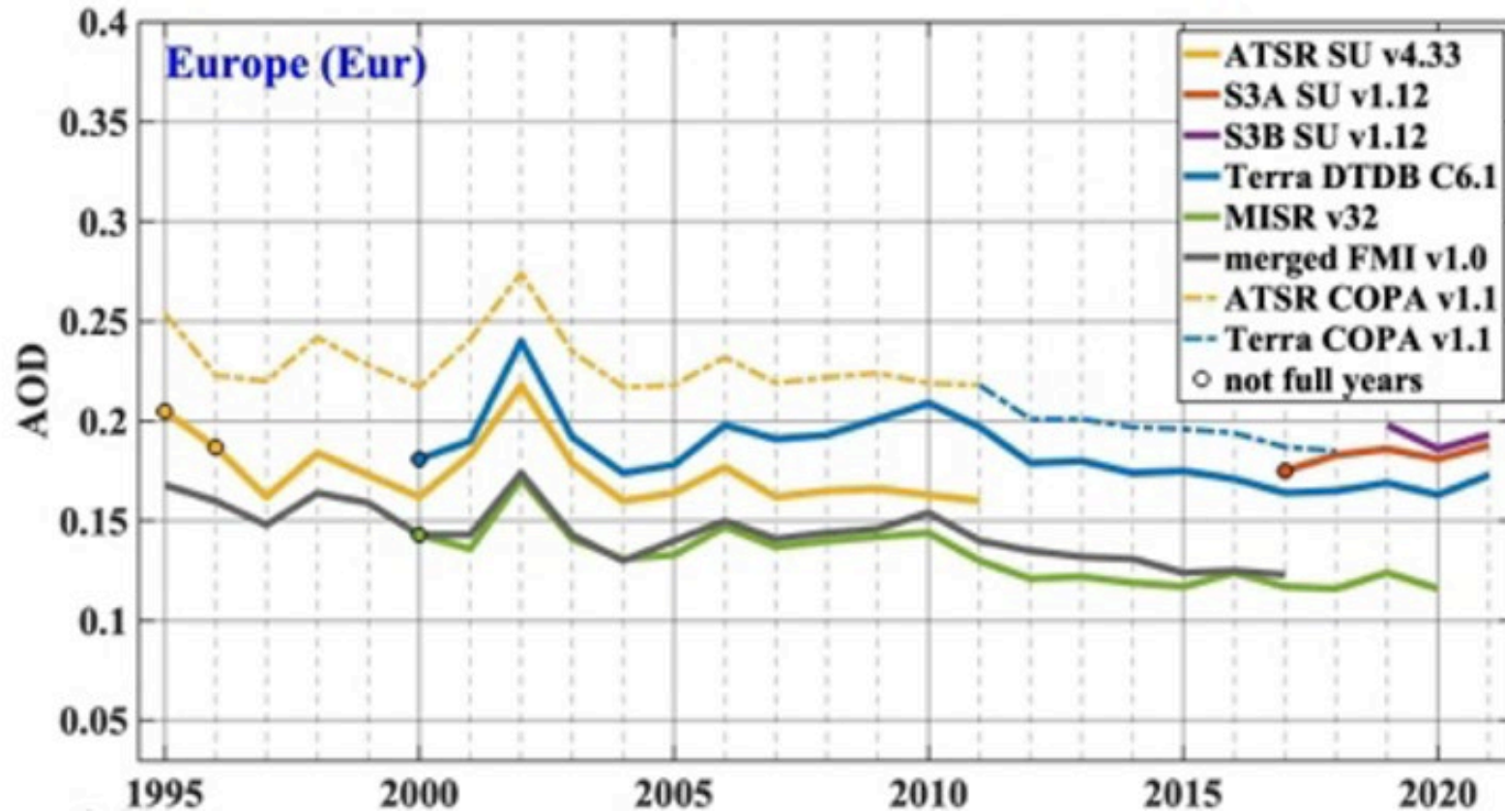
- **The impact of the difference of the retrieval geometry between the dual-viewing (A)ATSR and SLSTR was studied**

- **L2 – Simulated TOA reflectance**
  - ❖ An AOD bias between the geometries was observed over land, to lesser extent over ocean
  - ❖ The retrieved nadir surface reflectance appears to be robust against the geometry differences in the full BRDF simulations

- **L3 monthly**
  - ❖ Global, hemispherical, and regional bias was recorded between the instrument geometries
  - ❖ Methods were determined to harmonize the (A)ATSR and SLSTR datasets
  - ❖ Method to fill the gap between the AATSR and SLSTR datasets was developed