EUMETSAT current activities on desert targets

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Summary of recent, current and planned activities

1. MSG-3 commissioning

2. Development of monitoring tools for internal SSCC variables

3. Re-assessment of the desert targets as currently set in SSCC:
   a. Temporal stability
   b. Spatial homogeneity
   c. Spectral behaviour

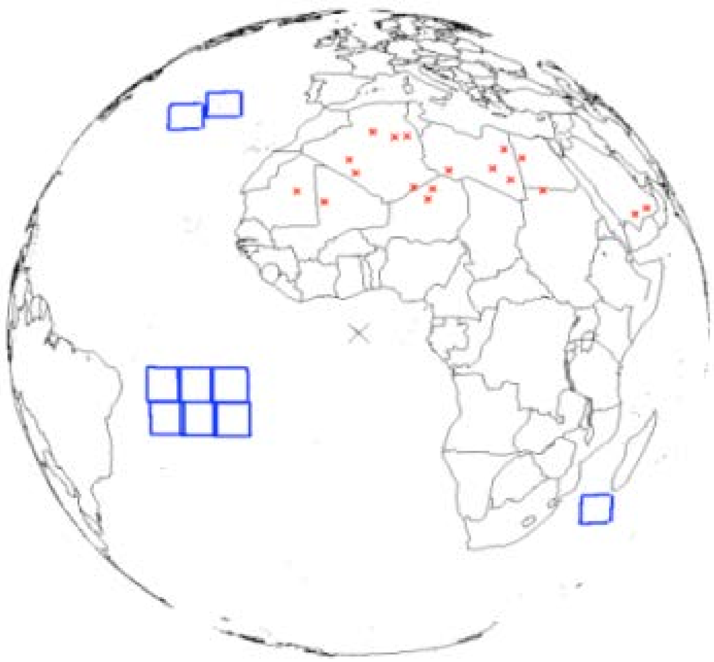
4. Long-term activities = improvement of SSCC to improve calibration quality for (past), current and future missions.

SSCC = SEVIRI Solar Channel Calibration system = current operational vicarious calibration system for MVIRI and SEVIRI warm channels

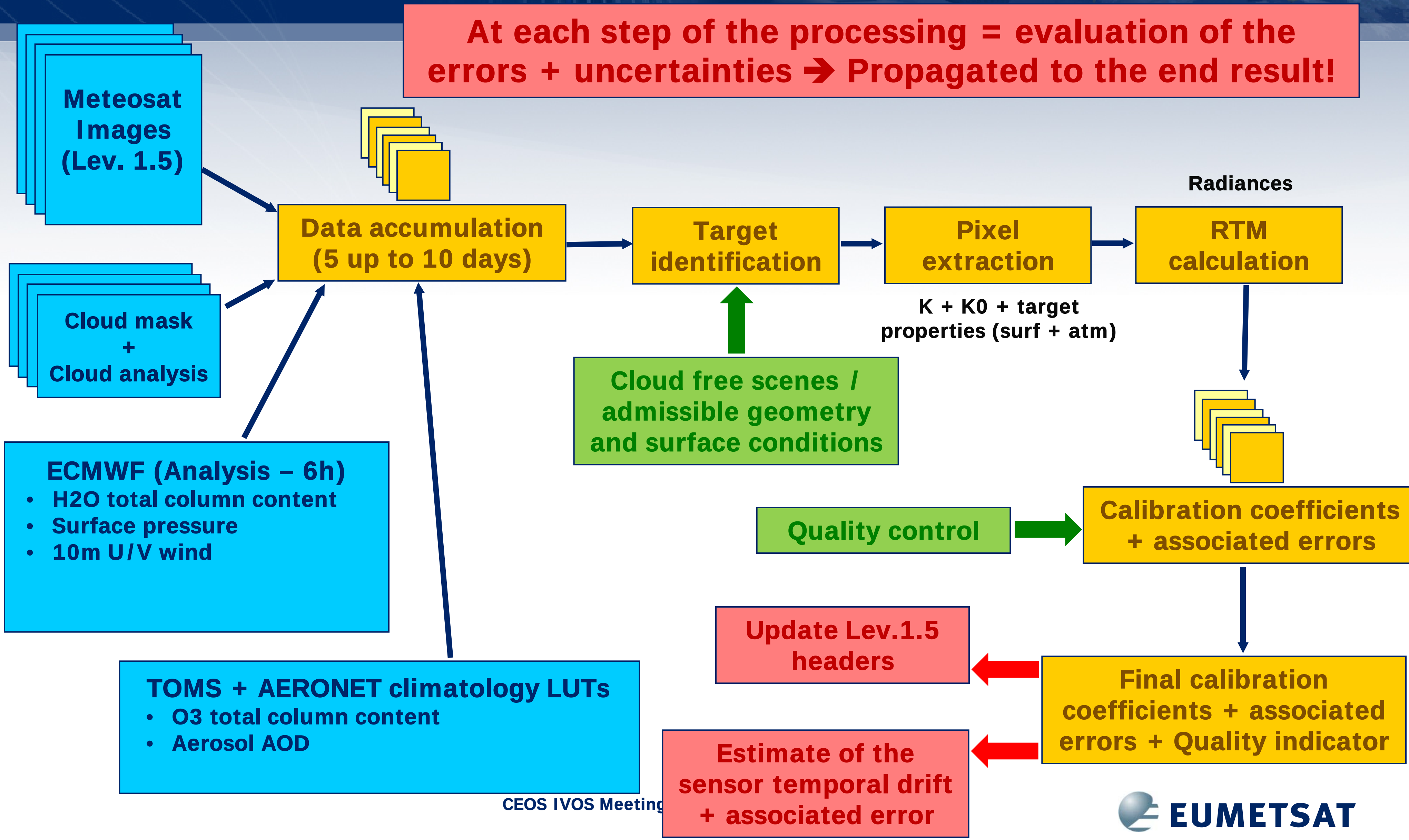
The SEVIRI Solar Channel Calibration system

- Developed and implemented in 2002/2003 by Y. Govaerts and M. Clerici
- System in place for SEVIRI (Met-8, Met-9 and Met 10) BUT ALSO for MVIRI (Met-2 till Met-7)
- Vicarious calibration:
  - Reference = RTM simulations of Top-Of-Atmosphere radiances
    Evaluated against well-calibrated polar-orbiting instruments (SeaWiFs, ATSR2, AATSR, VEGETATION, MERIS)
  - Comparison with TOA measured signal

- 2 target types used for comparison:
  1. Desert bright targets (18 targets)
  2. Dark sea targets (9 targets) (checking purposes)



The SEVIRI Solar Channel Calibration algorithm



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MSG3 commissioning

- MSG3 → Launched on 5th of July 2012
- Calibration of warm + cold channels started at the end of August:
    - Warm channels calibration = SSCC (vicarious calibration)
    - Cold channels = Blackbodies / inter-calibration with IASI (Metop-A)
- December = end of the commissioning CAL/VAL activities
- MSG3 became MET-10 in January 2013 (starts of OPE)
- 20/01/2013 = End of drift to 0.0 Lat/0.0 Lon
- 21/01/2013 MET-10 takes over from MET-09

MSG3 commissioning

- 14 calibration runs with SSCC (from end of August till mid-November)

	Retrievals mean value ($Wm^{-2}sr^{-1}\mu m^{-1}$ / DC)	Retrieval standard deviation ($Wm^{-2}sr^{-1}\mu m^{-1}$ / DC)
VIS0.6	0.5216	0.0029
VIS0.8	0.4227	0.0023
NIR1.6	0.0881	0.0004
HRV	0.6628	0.0028

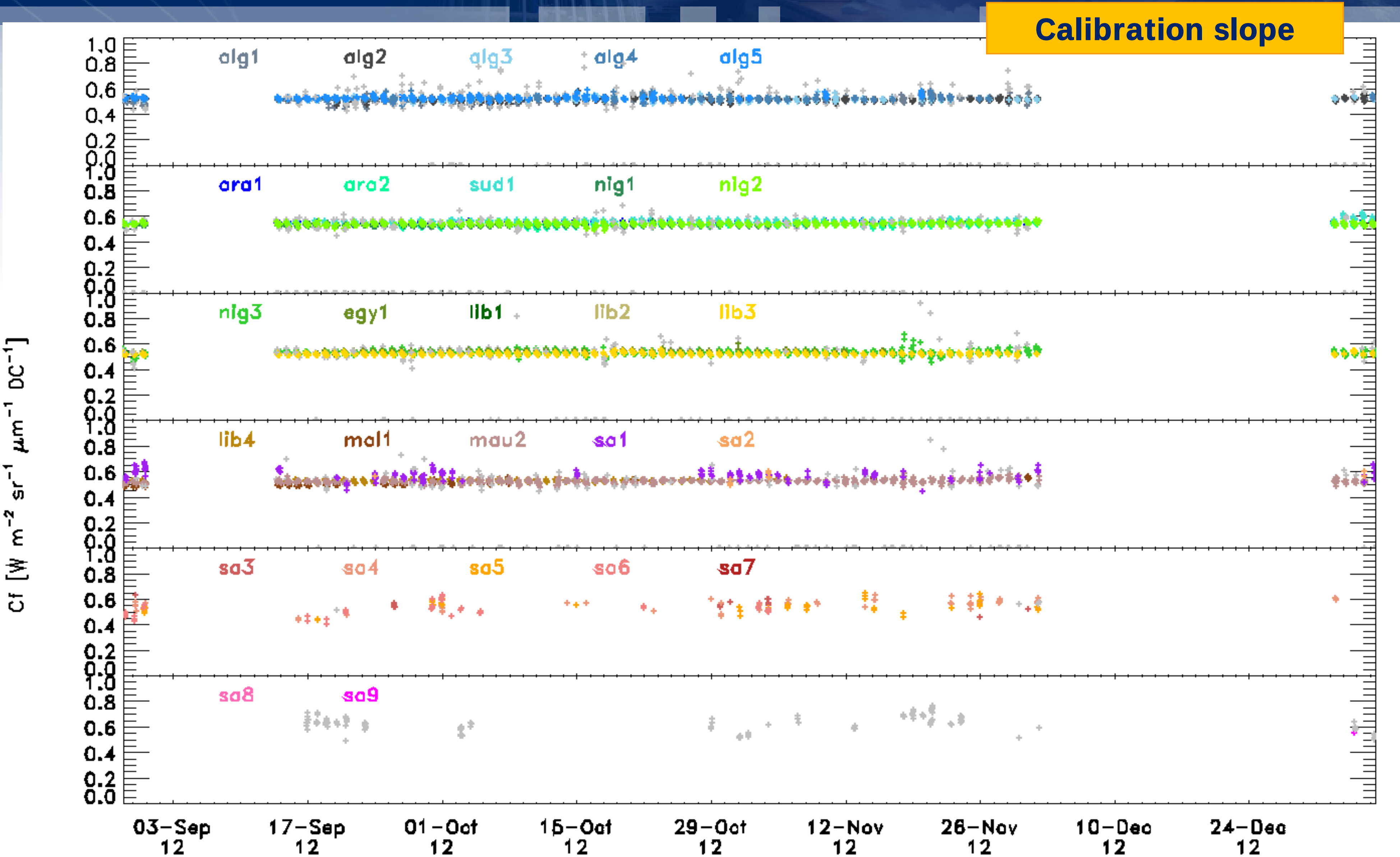
	$100 \times (Cf_{MPEF} - Cf_{Mean}) / Cf_{Mean}$
VIS0.6	-0.52
VIS0.8	1.05
NIR1.6	0.40
HRV	-0.19

Relative difference in percent between the mean calibration coefficient slope and the slope provided to MPEF

Systematic biases w.r.t. pre-launch values (except for NIR1.6)
Biases = constant in time during the test period:
➔SSCC results ~ 9% and 7% darker resp. for VIS0.6 and VIS0.8
➔SSCC results ~ 16-17% brighter

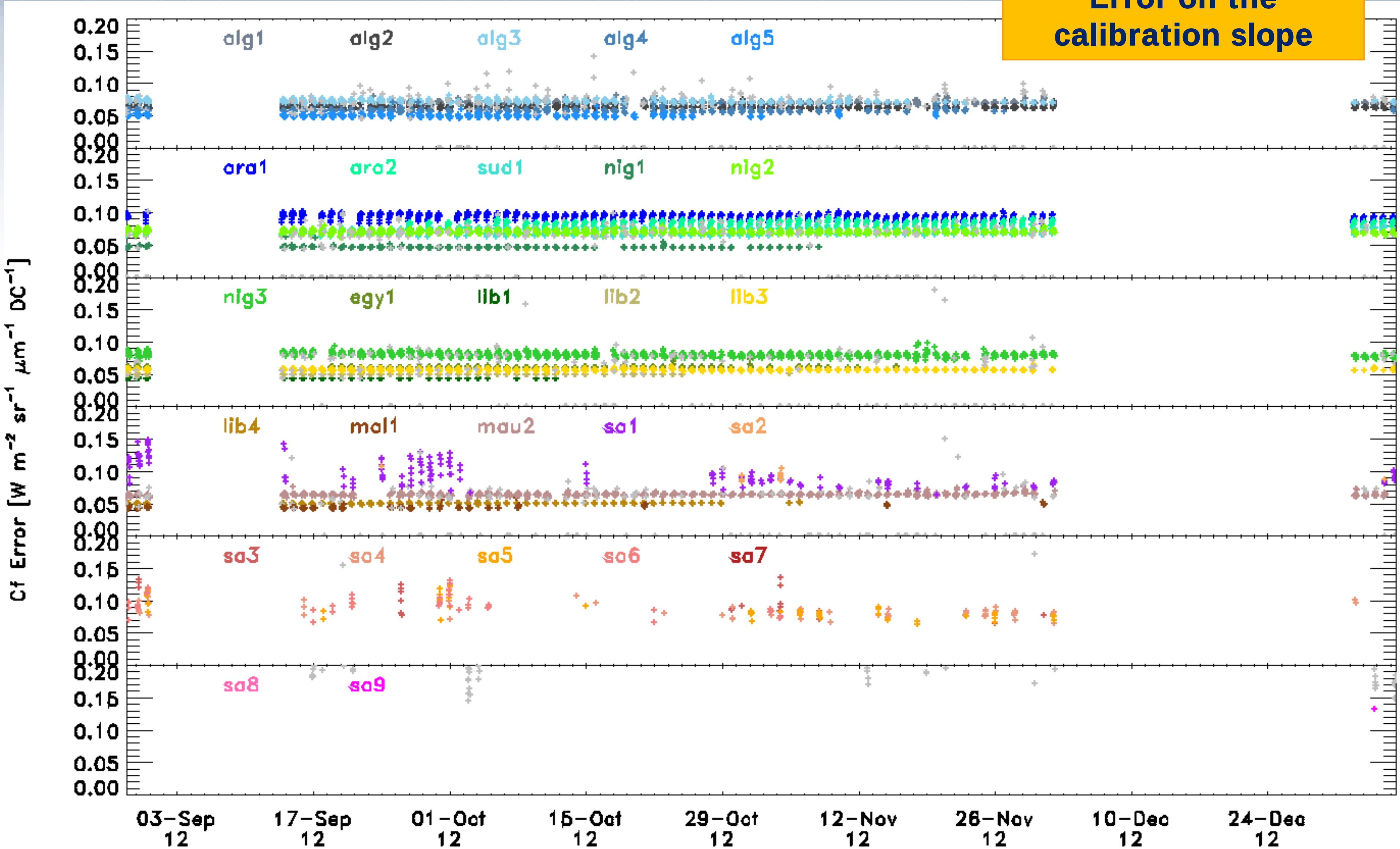
Reasons for such biases not known yet.
SSCC error estimates on the retrievals = between 4 and 5% for all channels during the entire test period.

MSG3 commissioning

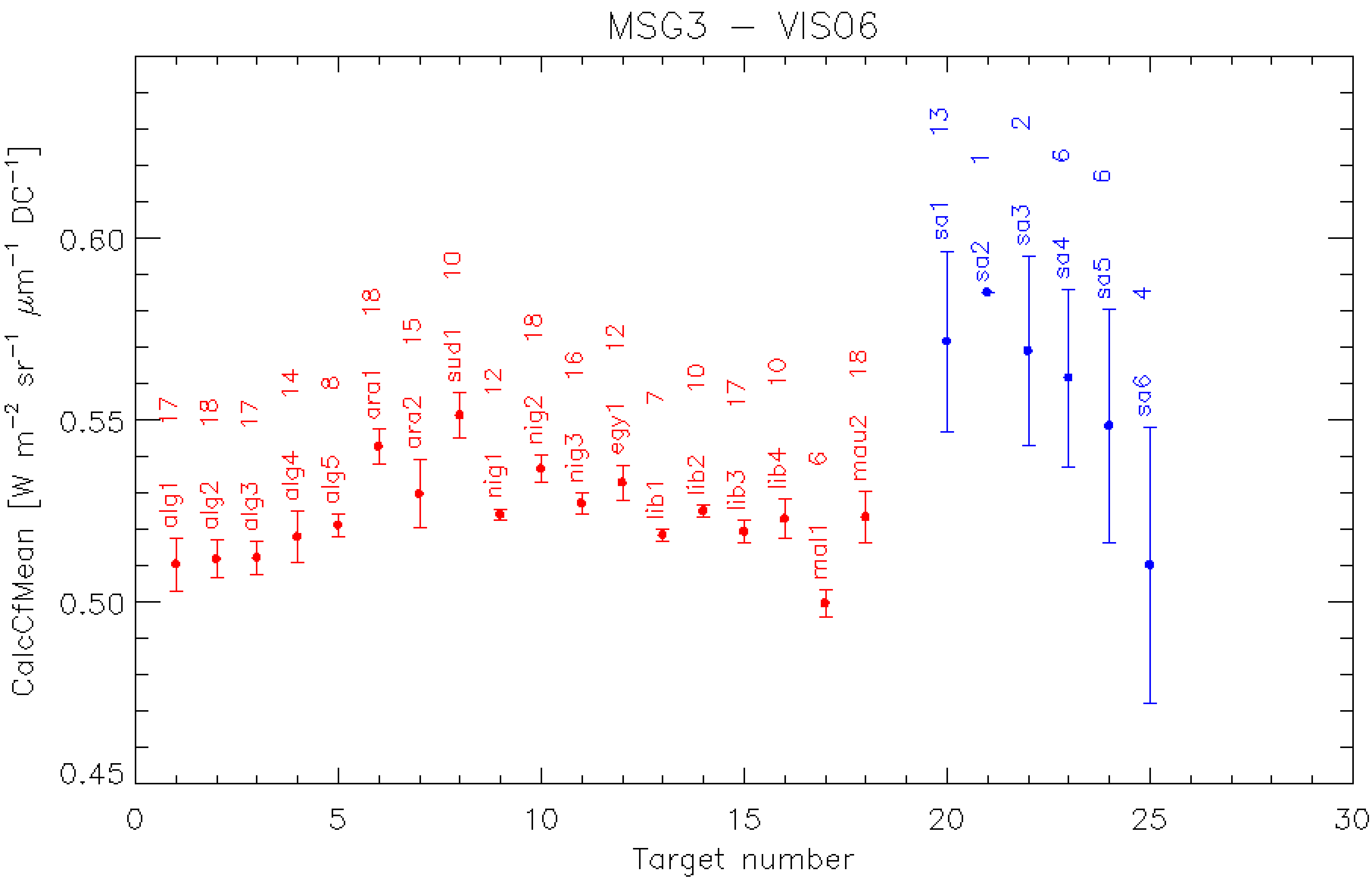


MSG3 commissioning

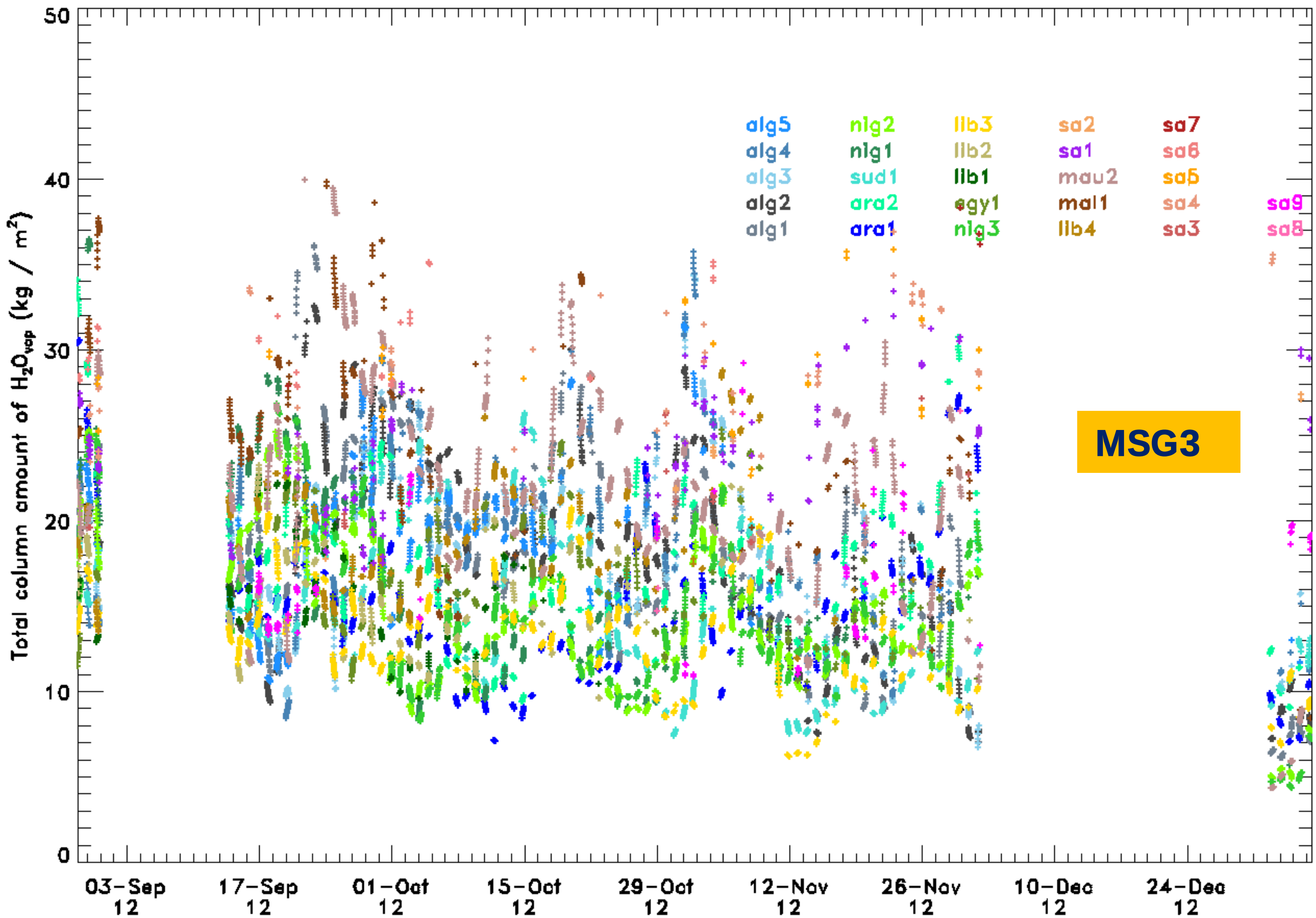
Error on the calibration slope



Example of retrieval homogeneity…



Development of monitoring tools for internal SSCC variables



Total column amount of water vapour

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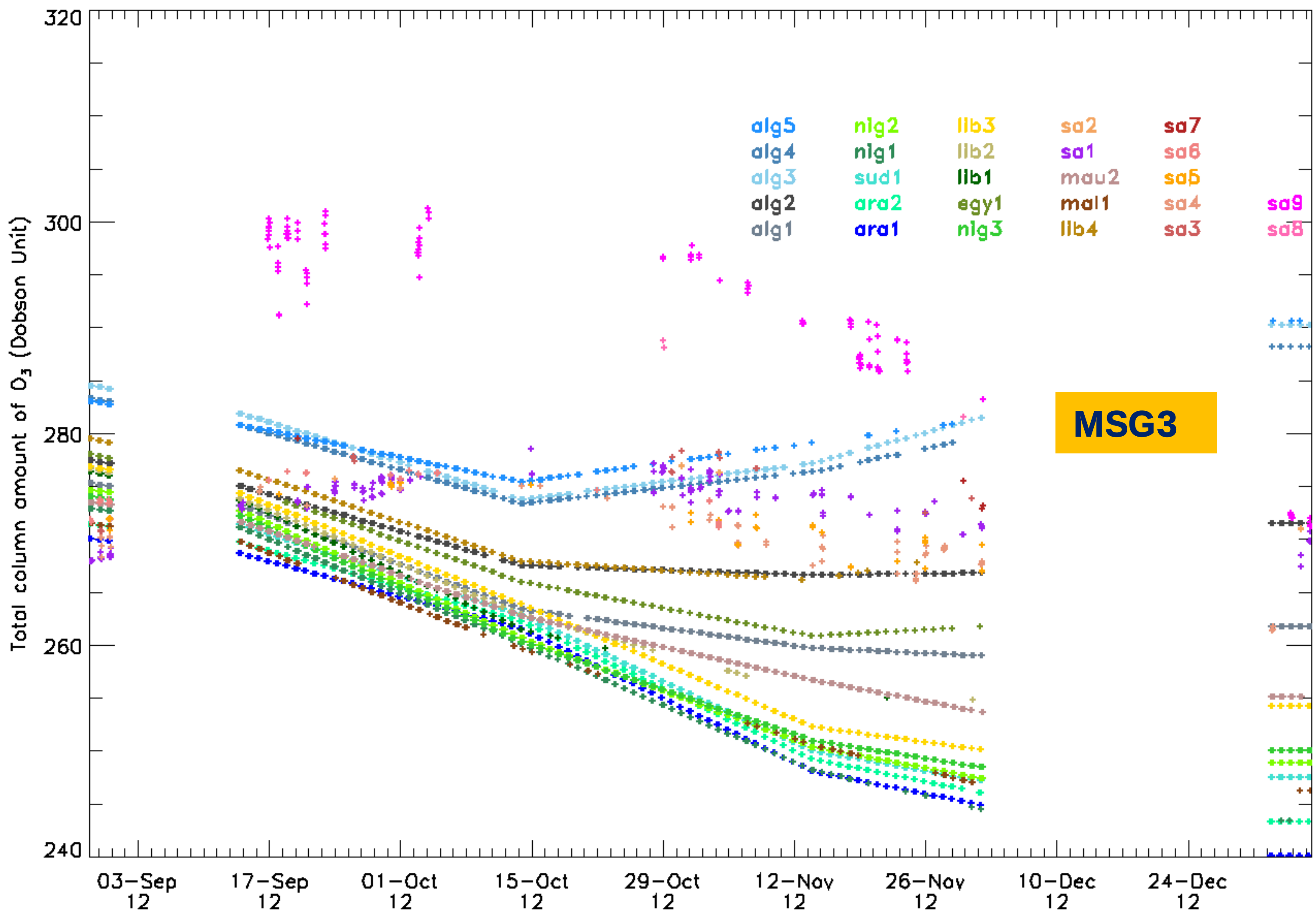
Development of monitoring tools for internal SSCC variables



Total column amount of ozone

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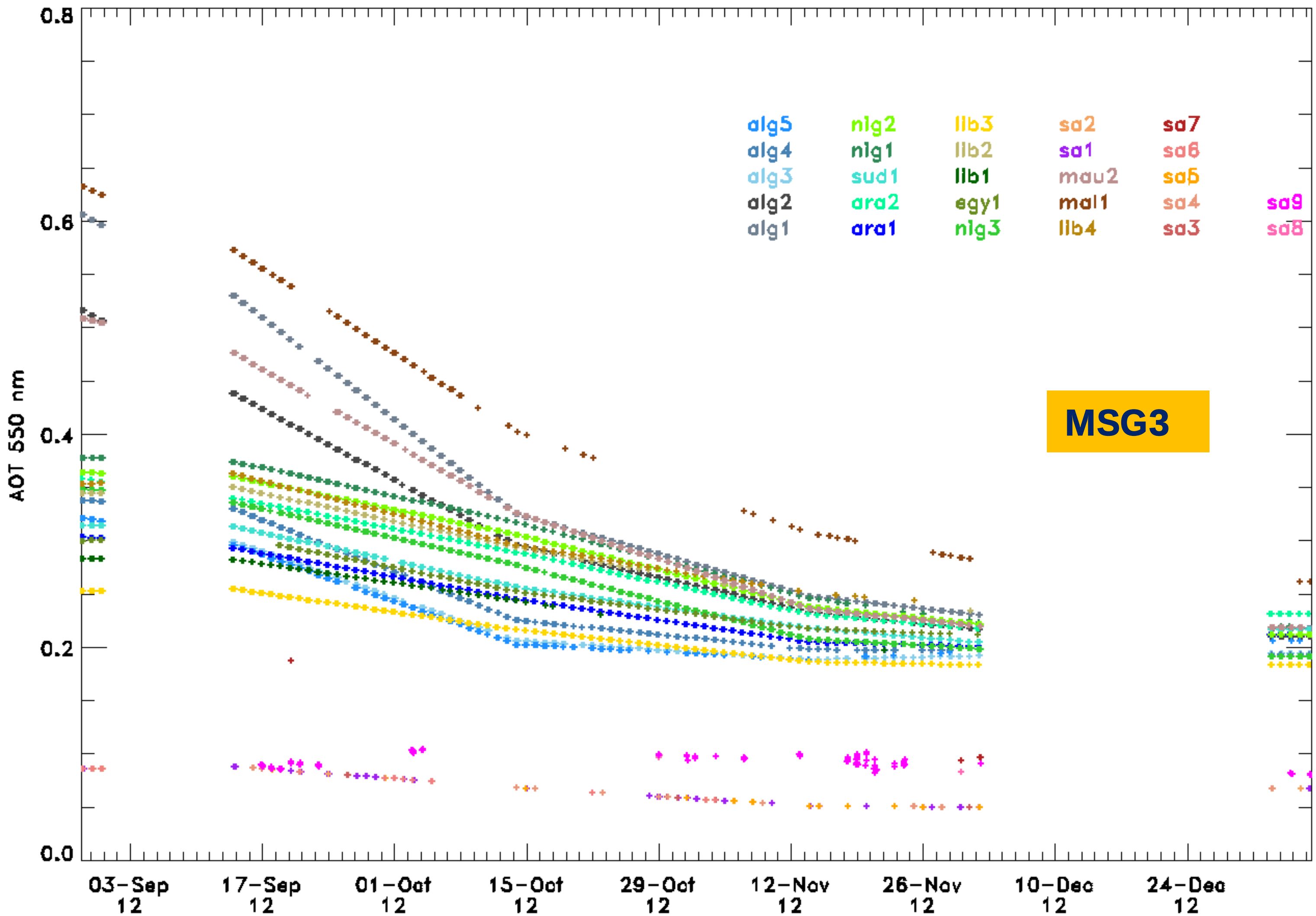
Development of monitoring tools for internal SSCC variables



Aerosol optical thickness at 550nm

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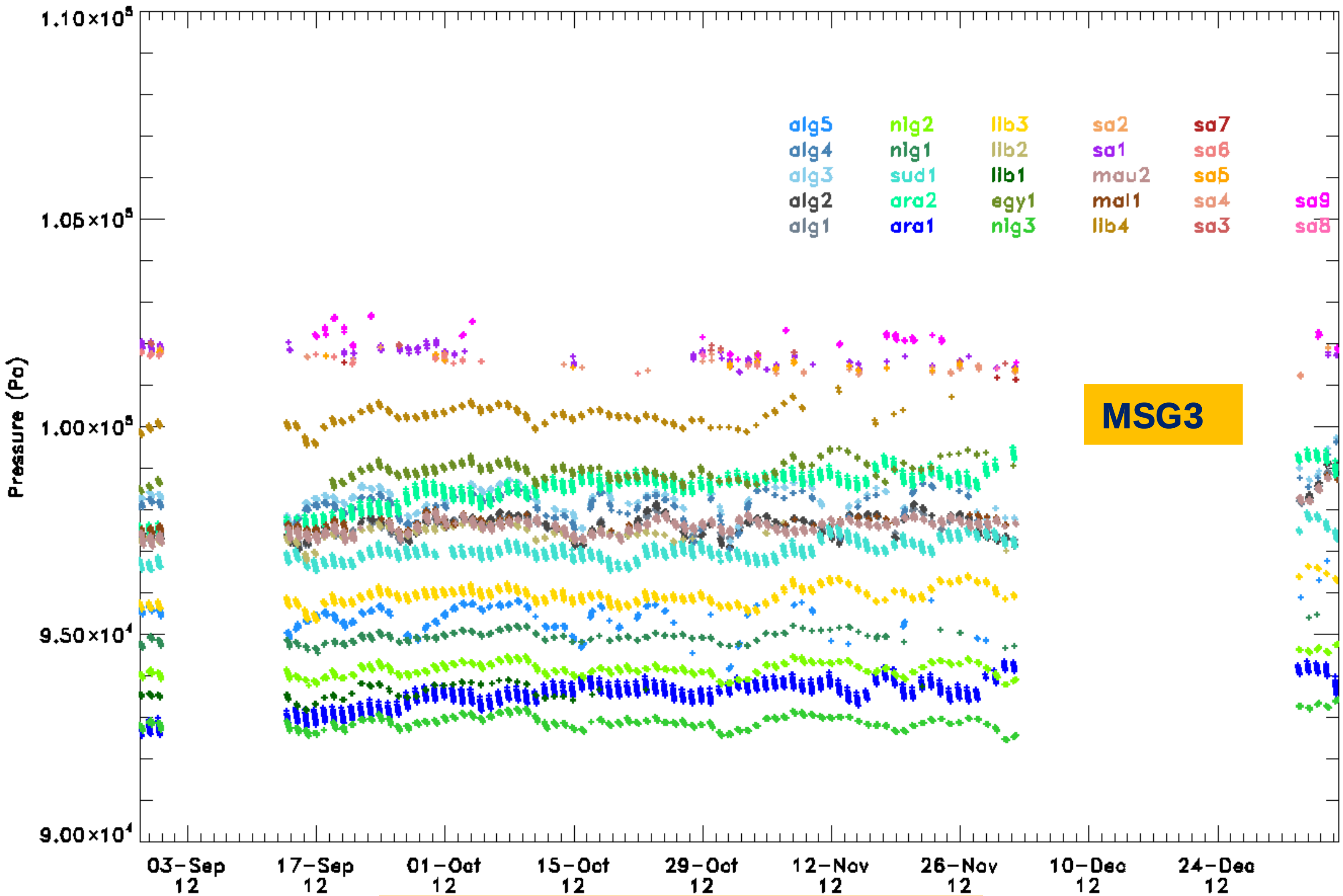
Development of monitoring tools for internal SSCC variables



Surface pressure

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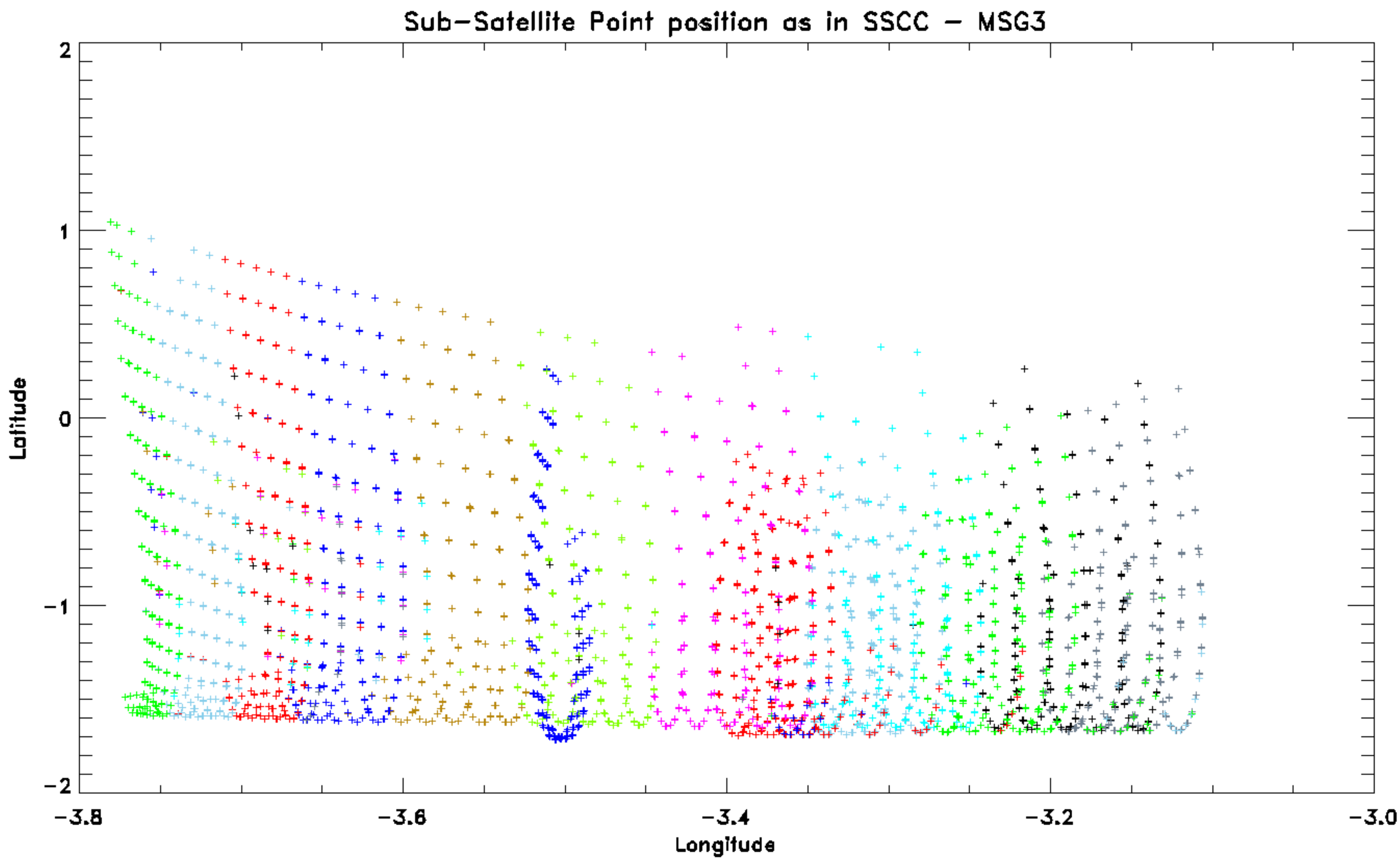
Development of monitoring tools for internal SSCC variables



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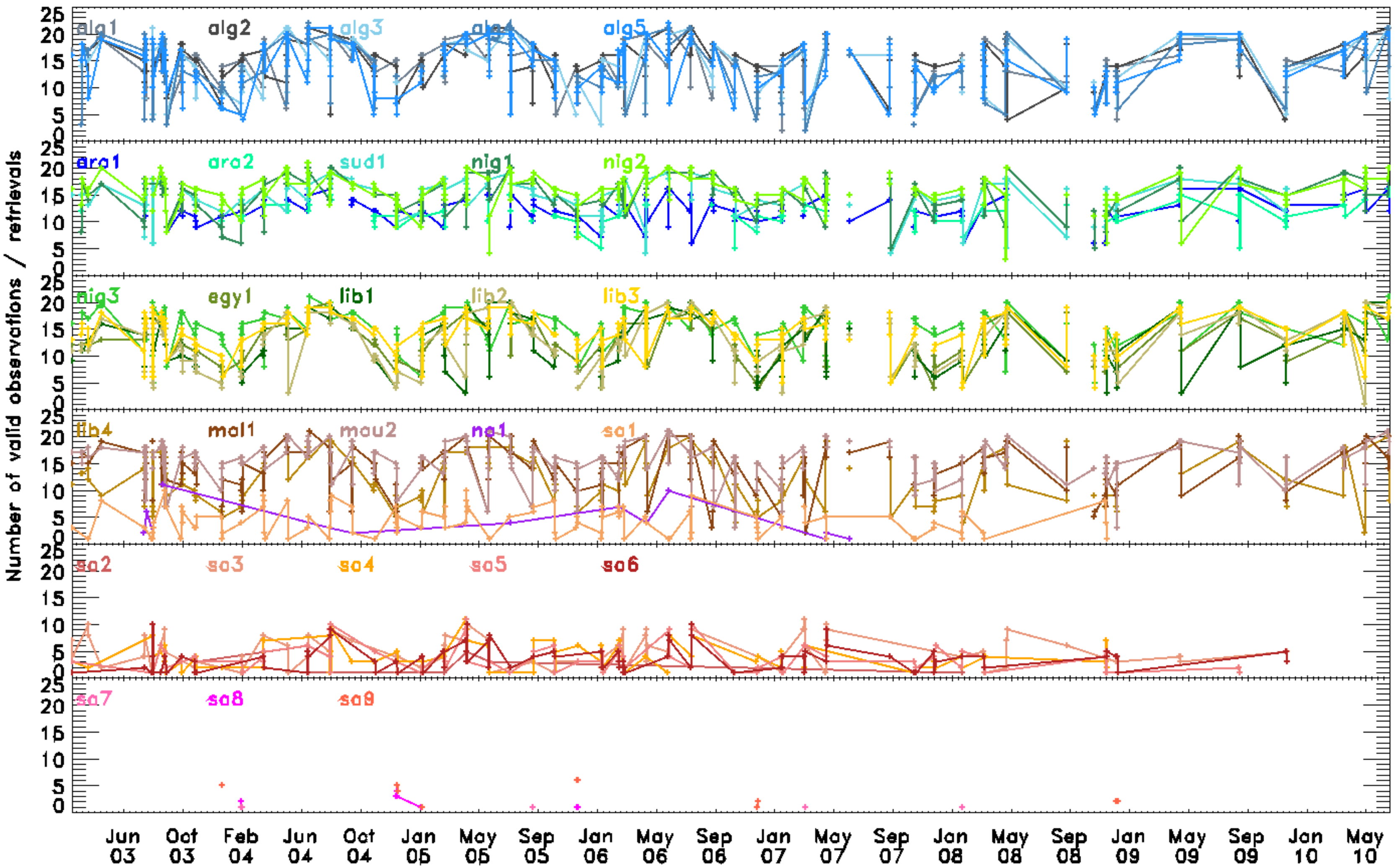

Number of valid observations per run and target

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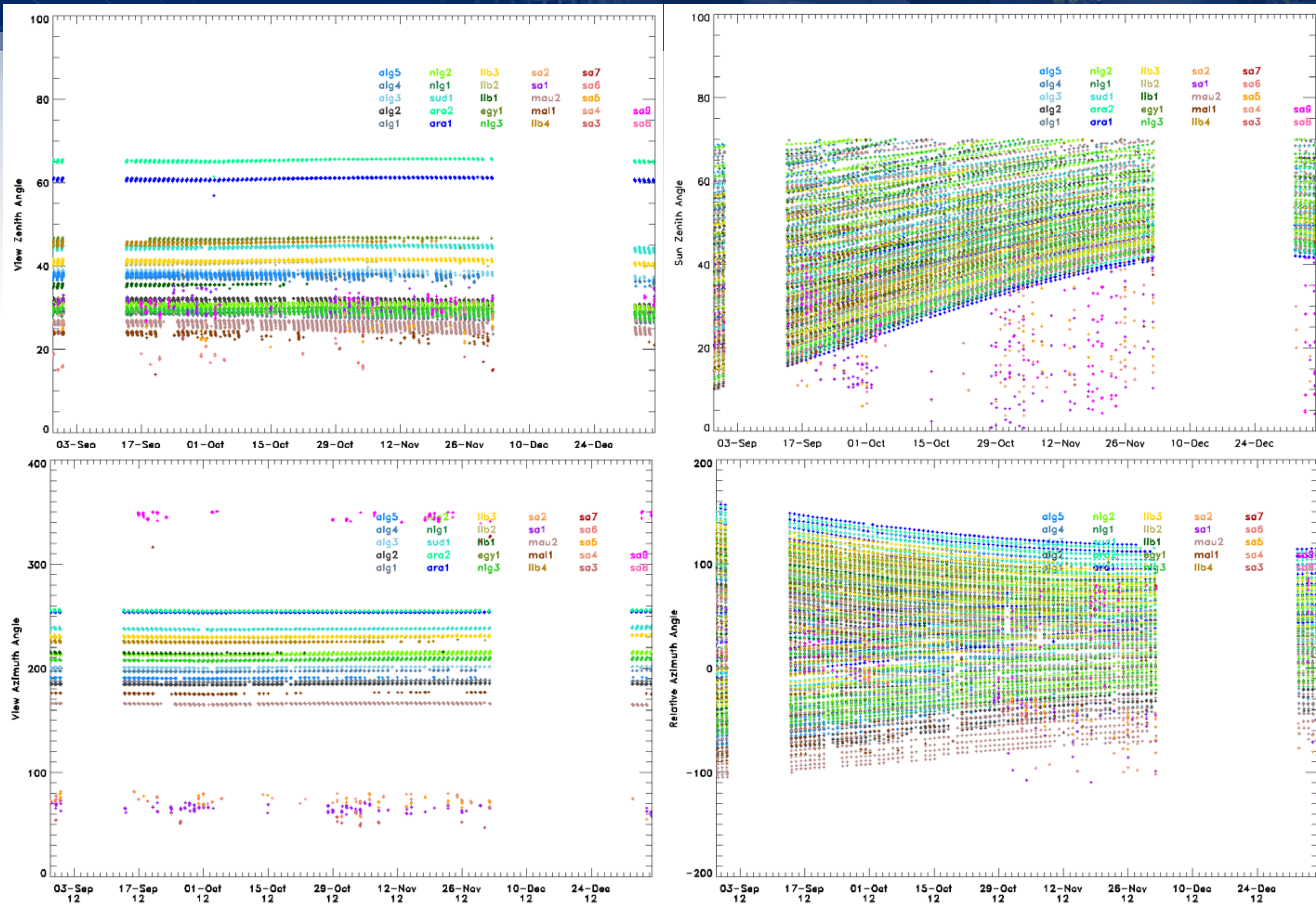
Development of monitoring tools for internal SSCC variables



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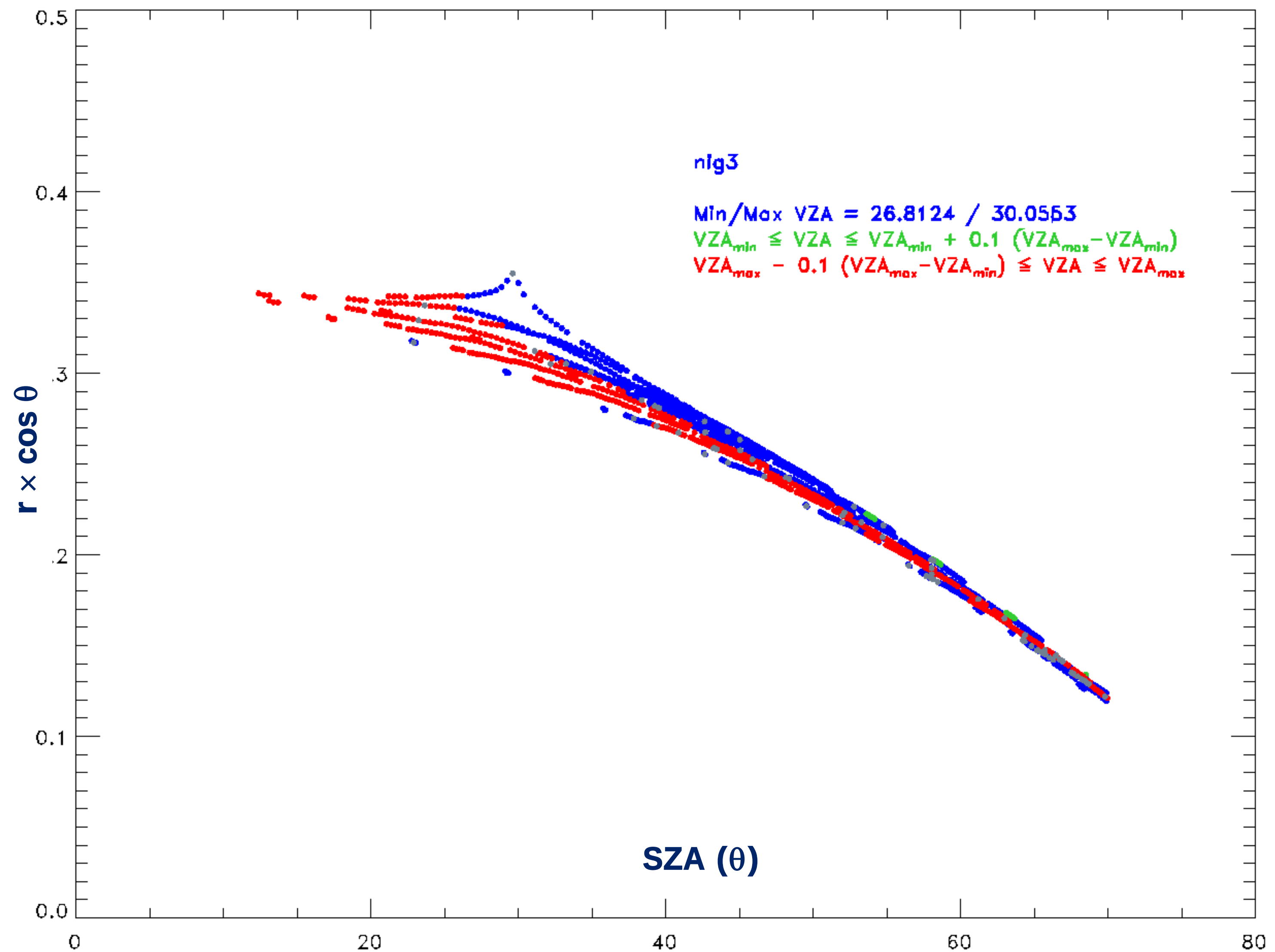

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Re-assessment of the desert targets

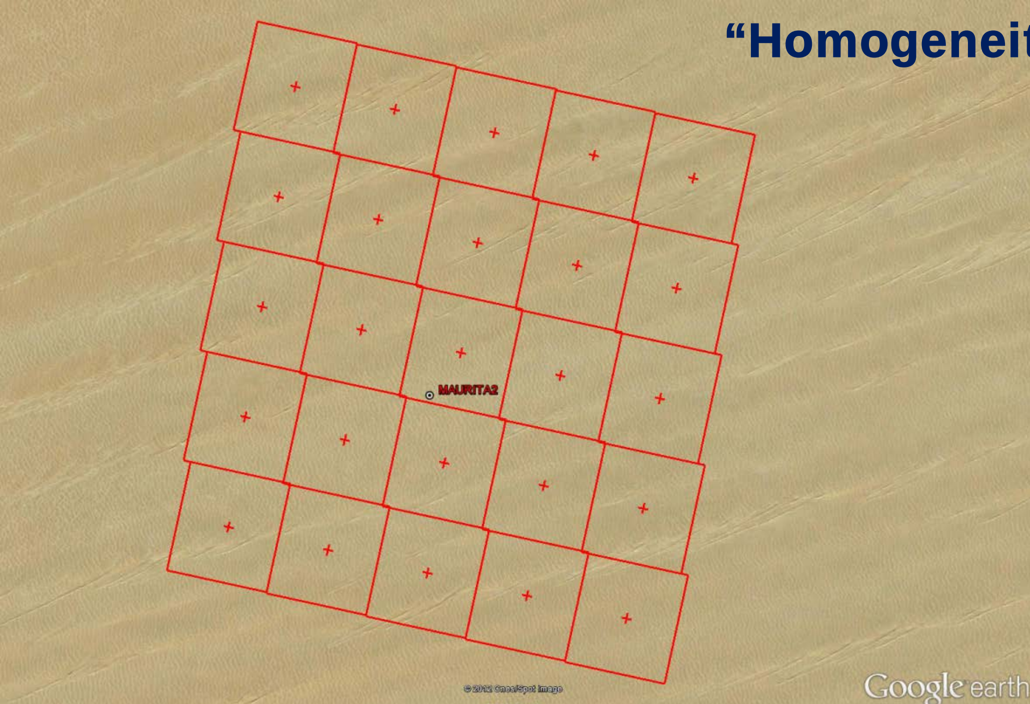
1. Scope of the re-assessment = to improve the current version of SSCC

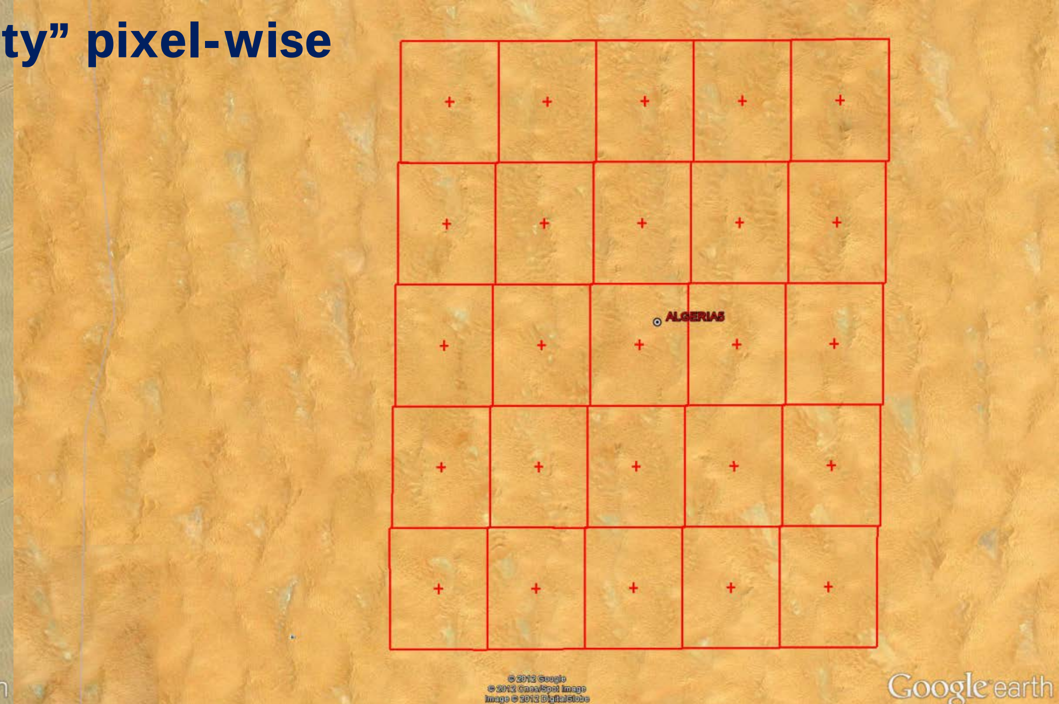
   ➔ ONLY ONE ASPECT OF THE PLANNED ACTIVITIES ON SSCC

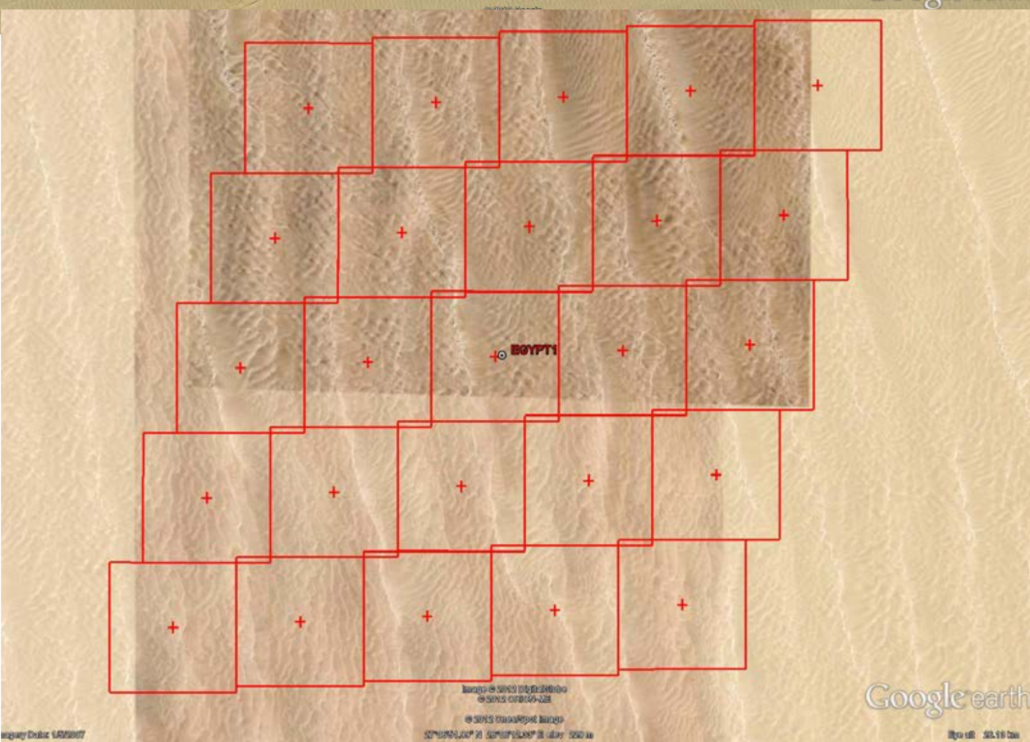
2. Re-assessment:
   - Analysis of the desert target temporal stability and spatial homogeneity.
   - Improvement of the Bidirectional Reflectance Factor for these targets.
   - Investigate the possibility to use more targets

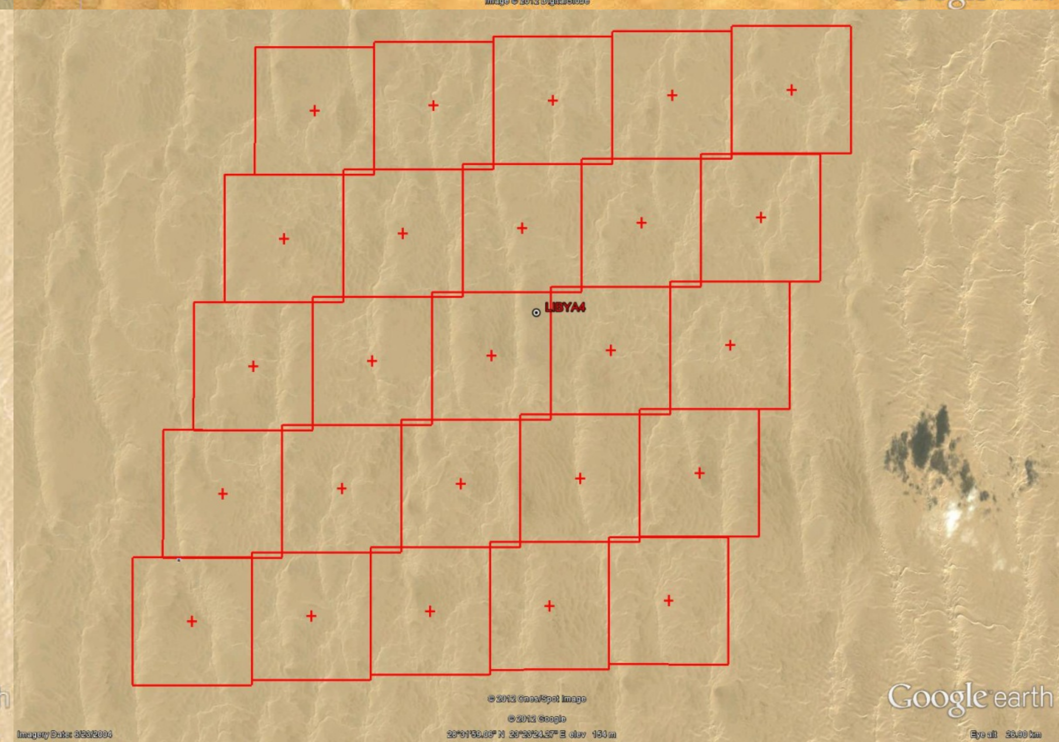
3. Possible use of the Meteosat First Generation Albedo product in the assessment of the desert target stability (30 years of data) + analysis of MODIS BRDF.

“Homogeneity” pixel-wise

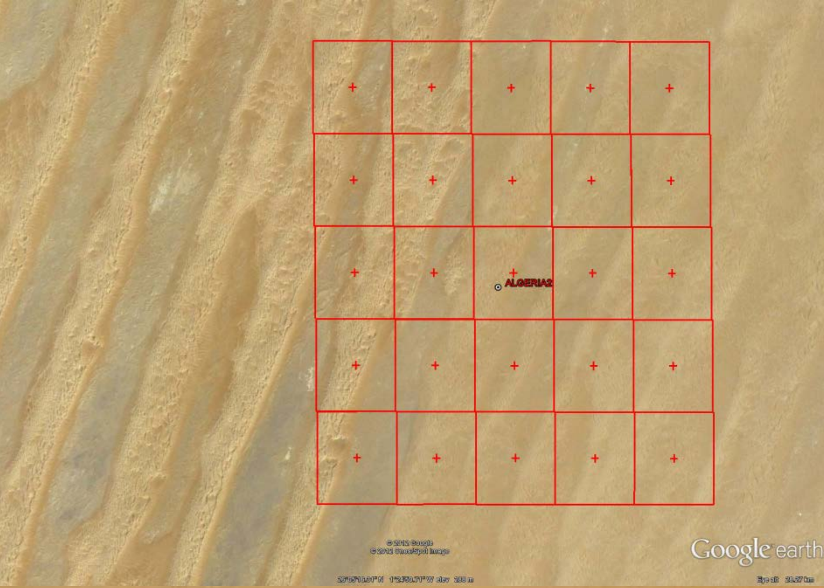


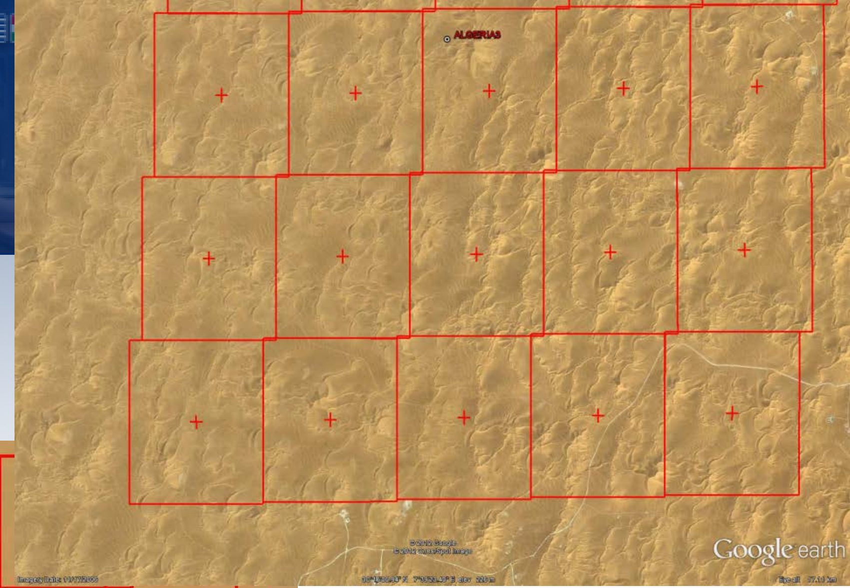


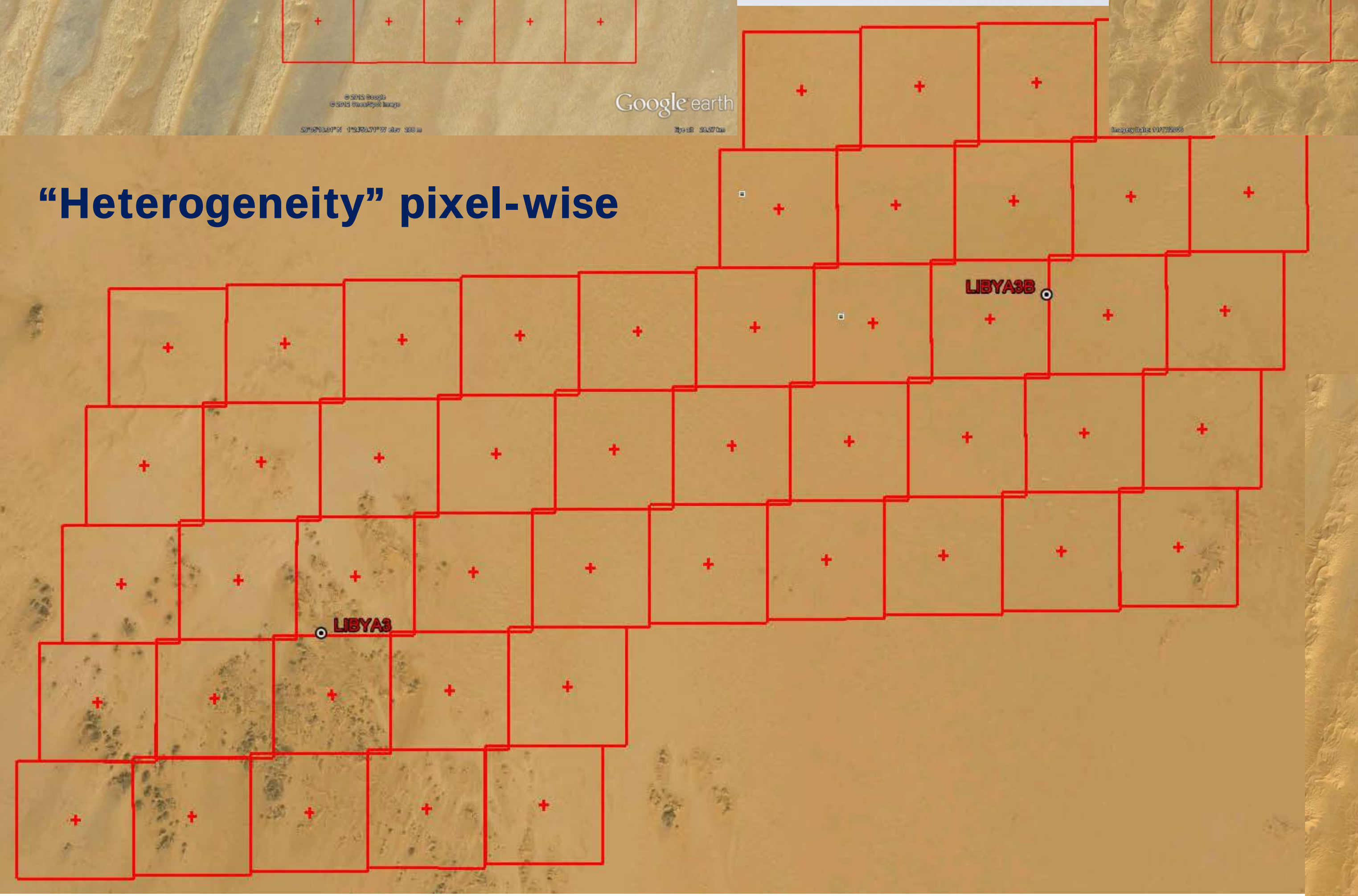


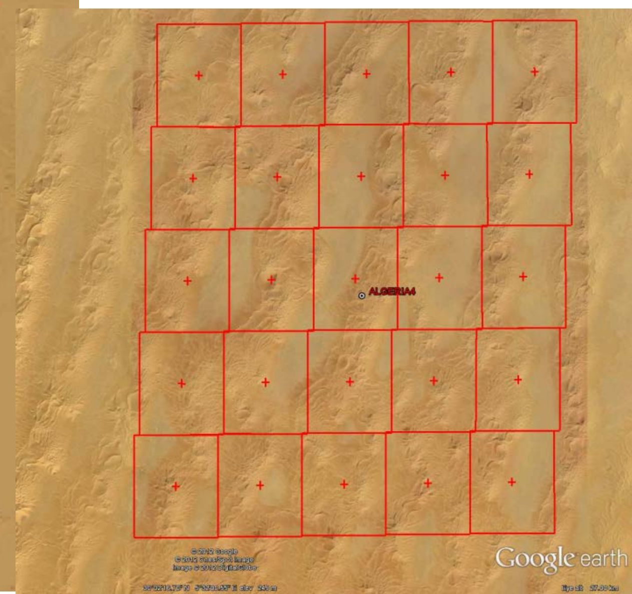


“Heterogeneity” pixel-wise

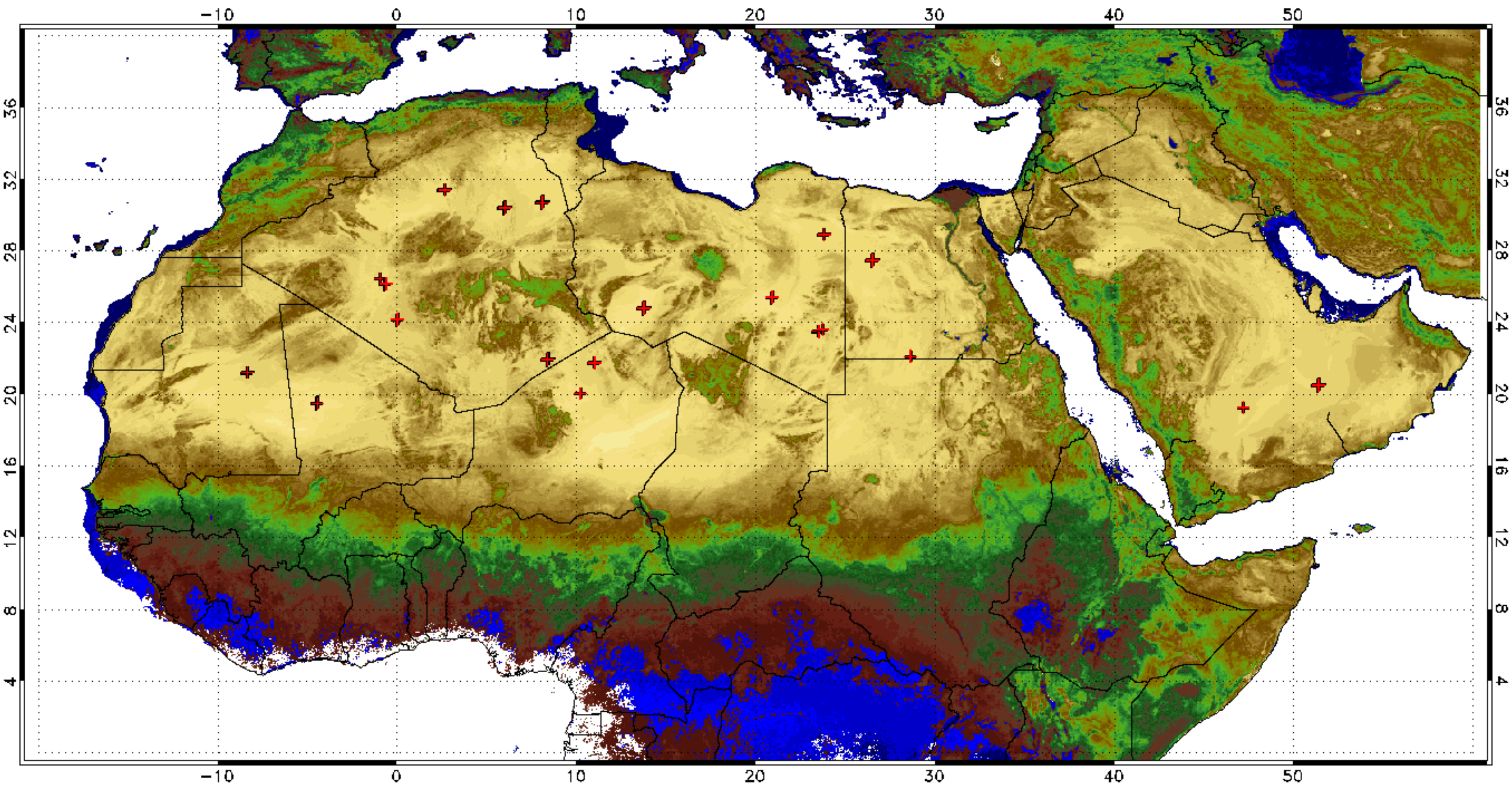


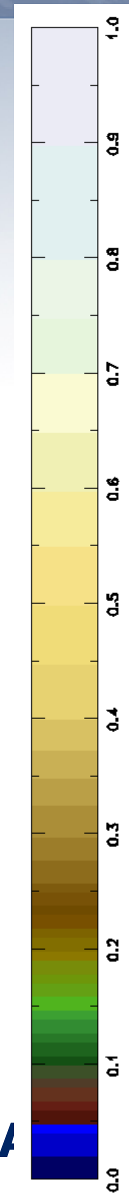






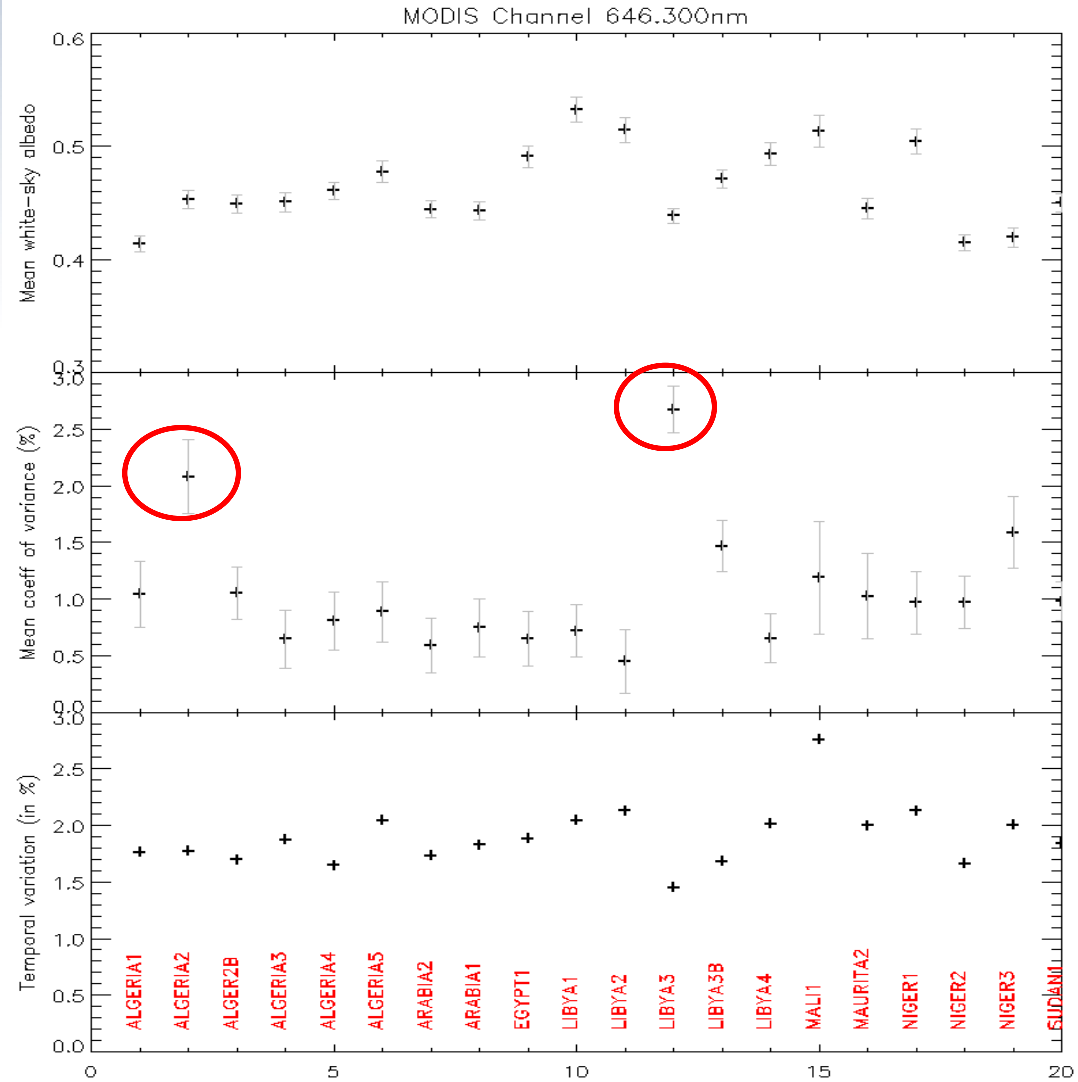
Desert target temporal stability and spatial homogeneity





Temporal average of the BRDF product derived from MODIS observations at 646nm between 2002 and 2008 (courtesy Prof. B.J. Sohn, Seoul National University). In red: SSCC desert targets.

Desert target temporal stability and spatial homogeneity



ALGERIA2 and LIBYA3 ➔ higher spatial heterogeneity than the other targets

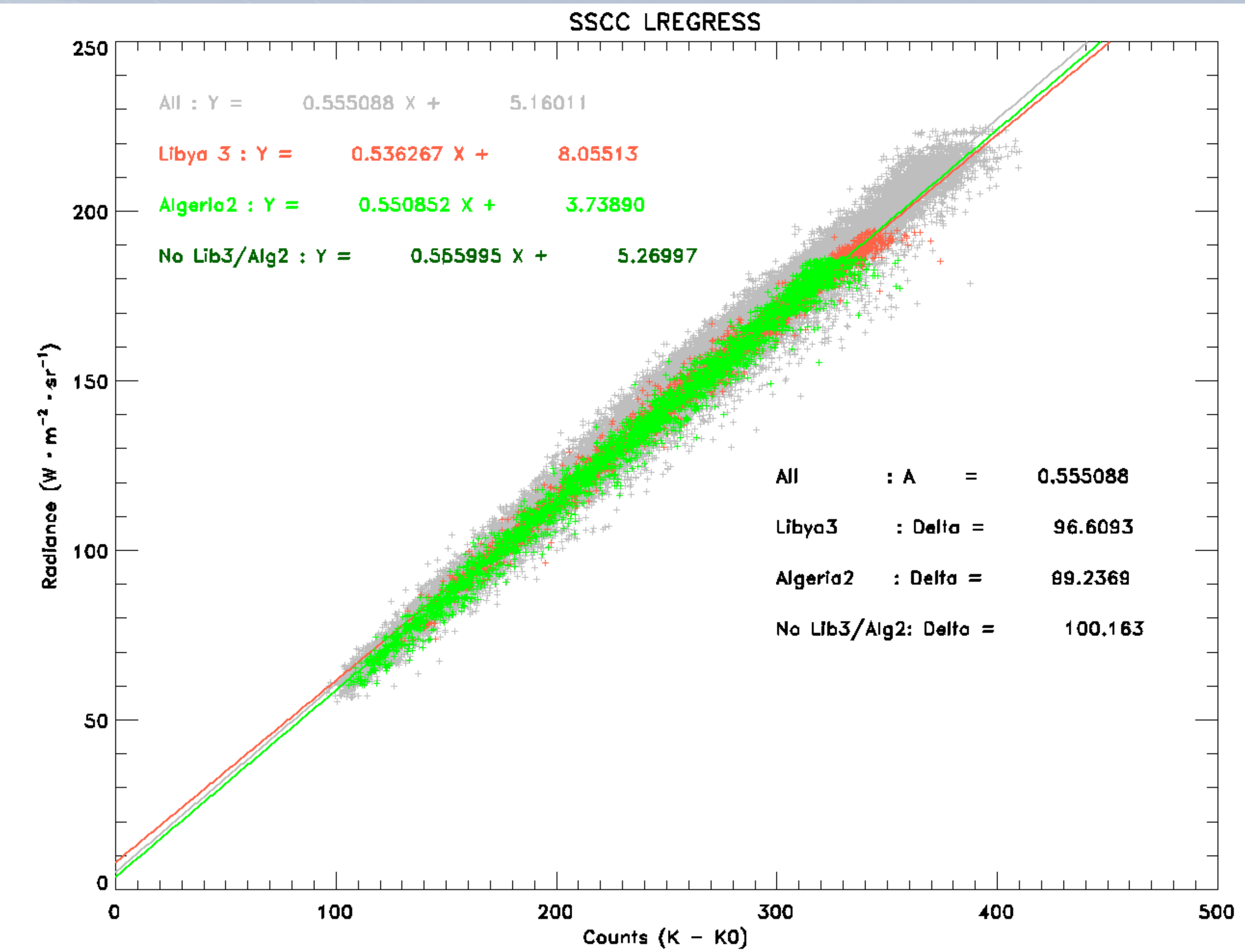
ALGER2B and LIBYA3B (not included in SSCC) ➔ Possible alternative targets

OUTCOME: possibly additional / other targets to be used by SSCC

➔ Cross analysis with other data sets

Data extracted from the temporal average of the BRDF product derived from MODIS observations at 646nm between 2002 and 2008 (courtesy Prof. B.J. Sohn, Seoul National University).

Re-assessment of the reference targets



Example of re-analysis of SSCC results: assessment of the weight of specific targets on the overall estimated calibration coefficients in the VIS06 band.

The linear regression uses the estimated errors on the modelled top-of-atmosphere radiances.

Long-term activities: improvement of the current SSCC system

- Improvement of the radiative transfer processes (in particular the multiple scattering + coupling with gaseous absorption).

- Assessment of the uncertainties of the radiative transfer model with respect to main variables assessed + assessment of the uncertainties of the complete calibration chain.

- Not only desert targets… Implementation of new methods in order to blend the final calibration product (re-visiting Rayleigh scattering methods, Deep Convectives clouds, Lunar calibration…).

Conclusion and future work...

In order to :

1. Meet the requirements on MTG/FCI: 5% accuracy (current requirement on MSG/SEVIRI: 10%!)
2. Improve SEVIRI current calibration system
3. Re-visit the Meteosat archive

➔ Need for reducing uncertainties and improving calibration accuracy

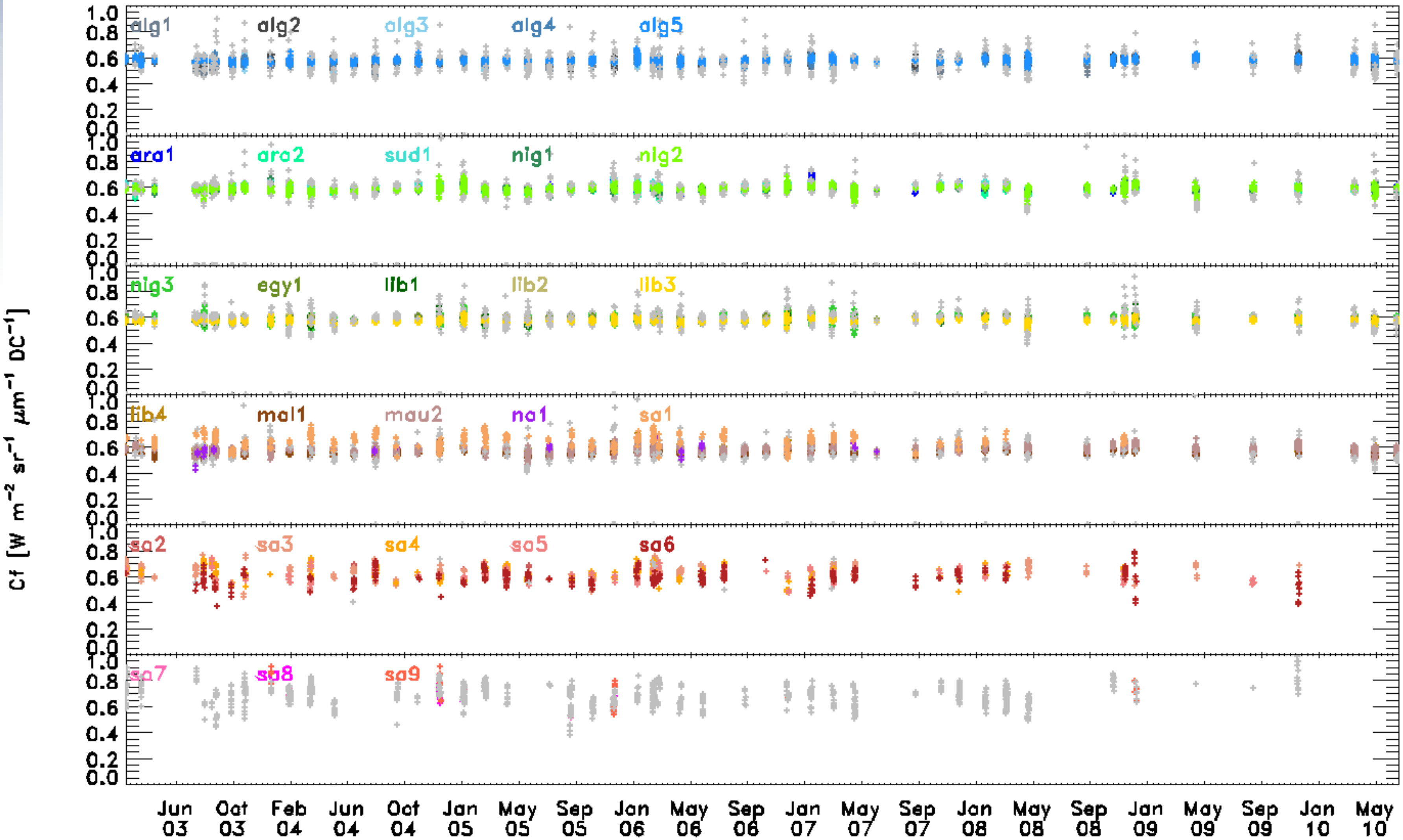
What is foreseen with SSCC (but not only)?

- Follow the latest development in terms of target characterization and modelling (closer interactions with CEOS IVOS + GSICS)
- Continue the assessment of the current system uncertainties
- Possibly use of MODIS / MISR / DIMITRI / SADE data in the current system
- Definition of more stable desert targets + characterization of the associated BRF
- Improvement of the RTM (multiple scattering + aerosols)
- Re-evaluation of the reference against reference instruments (MODIS, MISR, MERIS-like, ATSR-like, VEGETATION, PARASOL...)
- Implementation of additional methods such as DCC or homogeneous water clouds (in particular for FCI non-window channels)
- Address the challenge of new instruments and new designs such as FCI detector array
- Re-visit not-well characterized sensor response functions (Met2-6)

Thank you

Back-up slides for general purposes

Development of monitoring tools for internal SSCC variables



Target-aggregated calibration slopes

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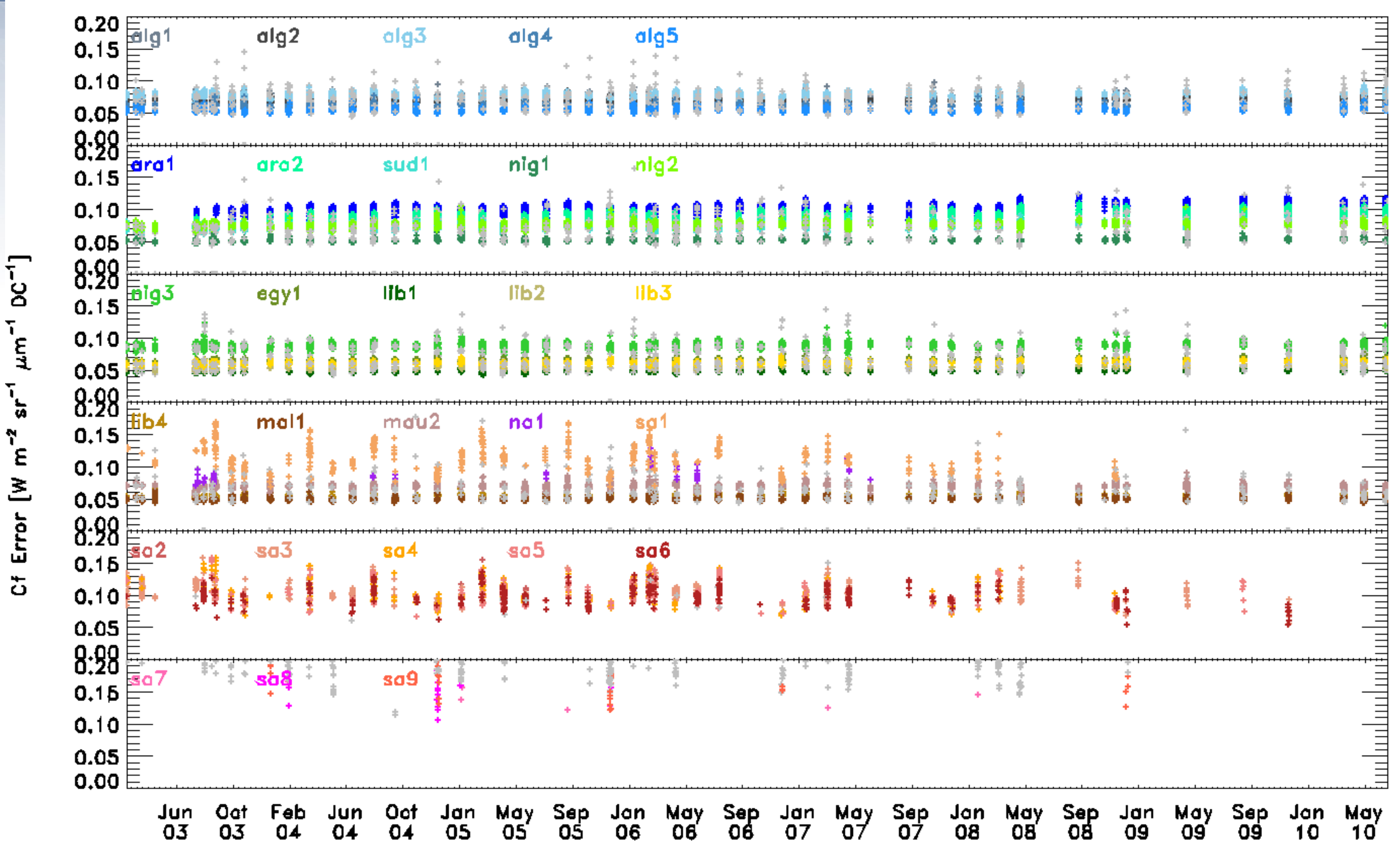
Development of monitoring tools for internal SSCC variables



Errors on the target-aggregated calibration slopes