Regional Land Fluxes TCDR within the EUMETSAT Climate Monitoring SAF: Evapotranspiration and Latent and Sensible Heat Fluxes.

William MOUTIER, Nicolas GHILAIN, Manon URBAIN, Nicolas CLERBAUX, Françoise GELLENS-MEULENBERGHS, Alirio ARBOLEDA, Miguel BARRIOS, Quentin BOURGEOIS, Anke DUGUAY-TETZLAFF, Reto STÖCKLI, Isabel TRIGO, Viju JOHNS, Alessio LATTANZIO, Jörg SCHULZ and Tom AKKERMANS.

Contact: *william.moutier@meteo.be*

Introduction

Land surface heat and water vapour fluxes are key elements in our climate system: they materialize the feedback the land gives in return to atmosphere. In order to better apprehend the changes of this feedback over the years, a long record of data is necessary. The exploitation of the observations from EUMETSAT METEOSAT suite of satellites could be valuable in that perspective as it provides a climate data record (CDR) for a period in time of about 30 years. For this purpose, the Climate Monitoring (CM) Satellite Application Facility (SAF) and the the Land Surface Analysis (LSA) SAF expertises are required.

The CM SAF has already issued climate data records based on METEOSAT satellites and the LSA SAF is issuing products for the near-real time applications based on the same platforms: most components of the land surface energy budget are issued, including the instantaneous and daily evapotranspiration rate [1]. From this collaboration, we present the method that will be used to provide in the future a CDR of surface heat fluxes based on METEOSAT satellites and some developments done to homogenize input data.

Methodology - *Adaptation from LSA SAF approach*

Inputs

METEOSAT
- AL- Surface ALbedo
- DSSF- Shortwave flux at surface
- DSLF- Longwave flux at surface
- LST- Land Surface Temperature

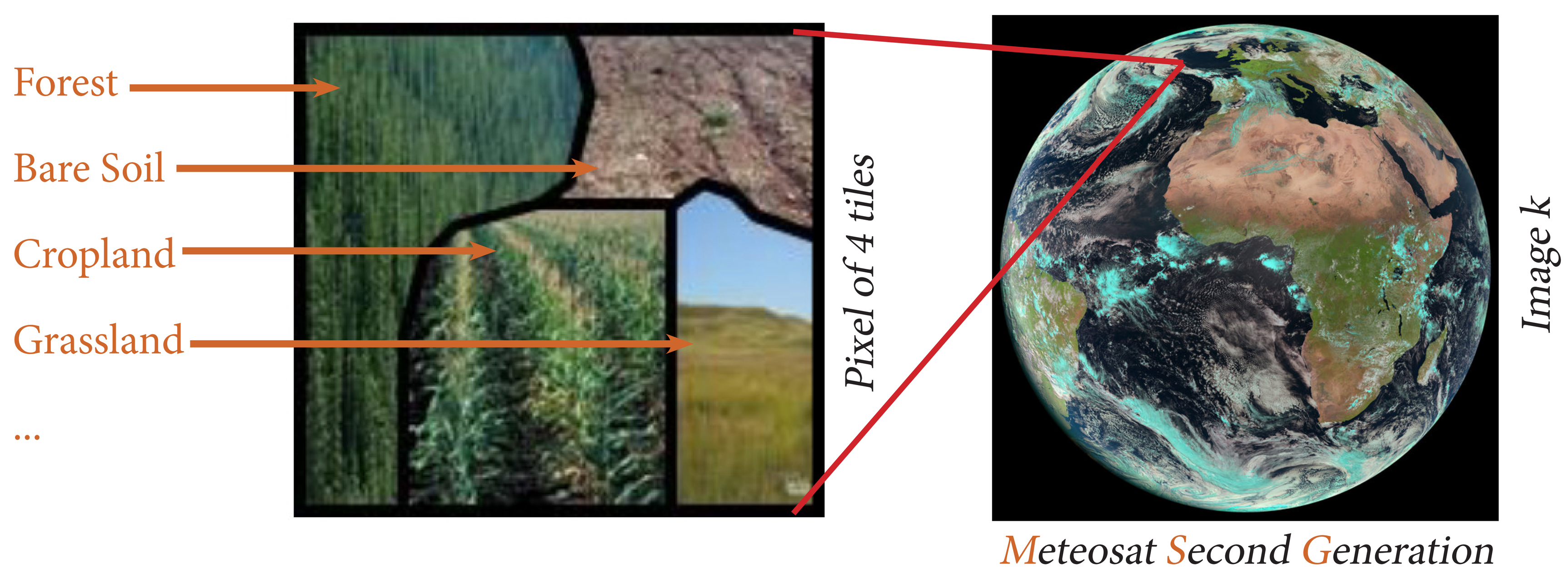
GLOBMAP
- LAI- Leaf Area Index

ESA CCI
- FVi- Fraction of tiles
- LCi- Land Cover of tiles
- SM- Soil Moisture

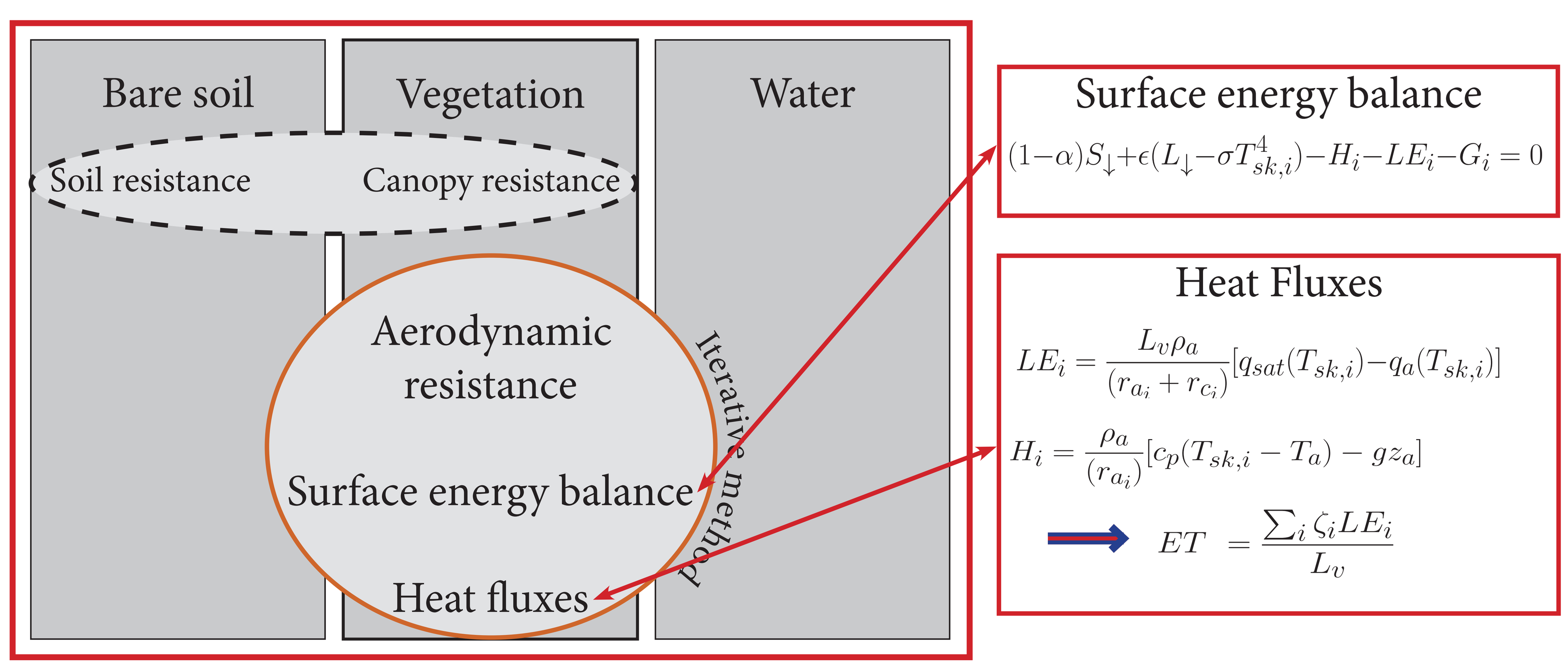
ECMWF ERA-5
- Ta- Air temperature
- Td- Dew point temperature
- Pa- Surface pressure
- V & U- Wind speed components
- ST- Soil Temperature
- SM- Soil Moisture

Model

Tile pixel approach

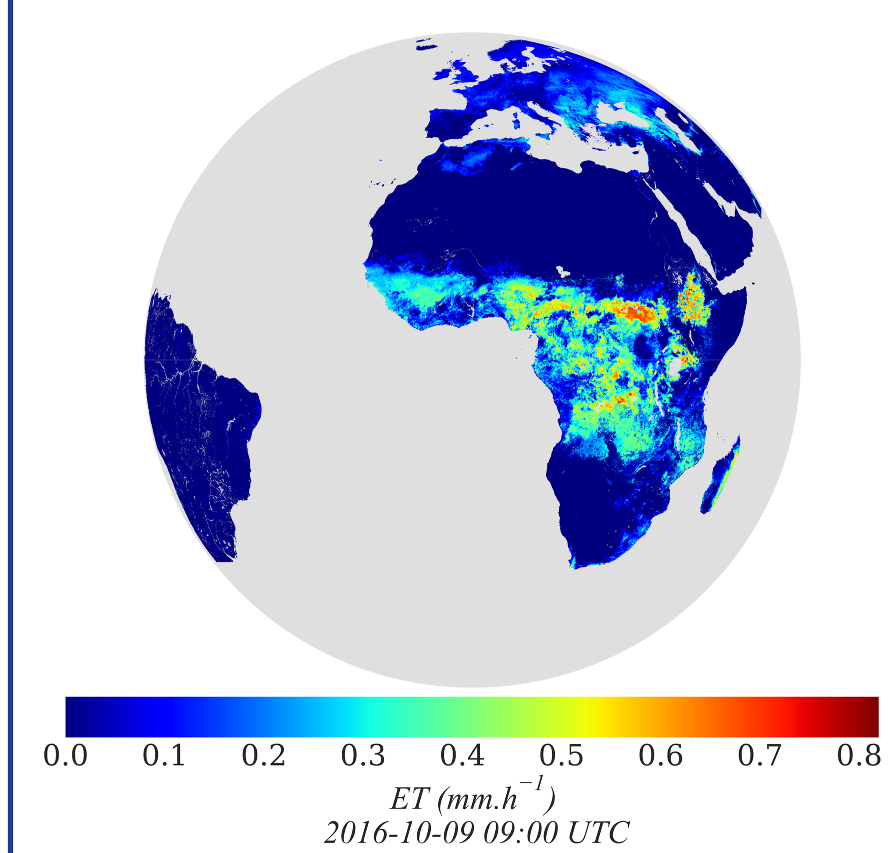


For each tile i of the pixel



Parameterizations adapted from ECMWF TESSEL model [1-2].

Outputs



- Sensible & Latent heat fluxes [W m^{-2}].
- Hourly and daily ET [mm.h^{-1} ; mm d^{-1}].
- ~ 5 km spatial resolution.

CDR from 1983 to 2020

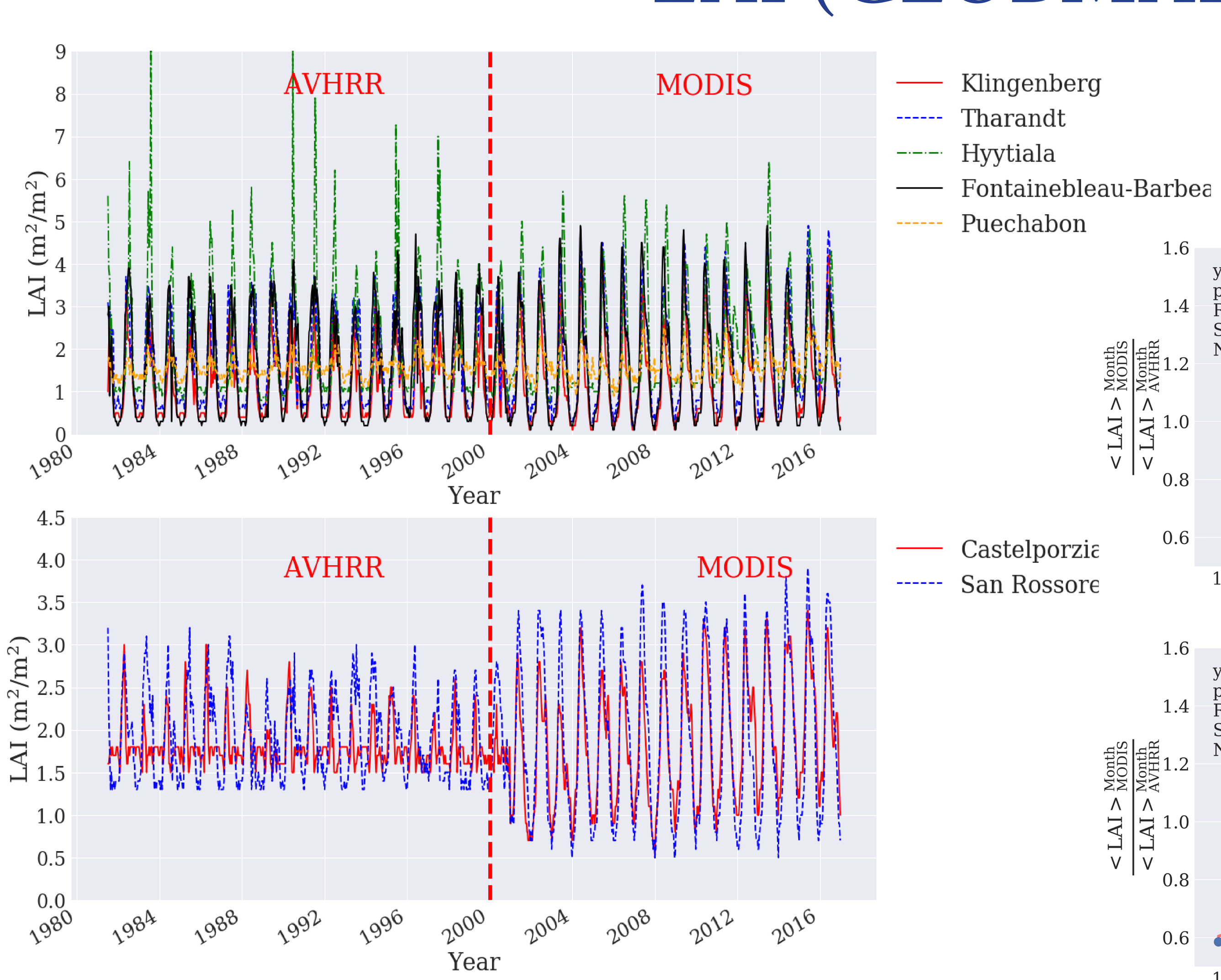
Quality assesment

Three evaluation approaches :

* In-situ validation (Fluxnet stations).
* Models inter-comparison (ECMWF and GLDAS).
* Consistencies check.

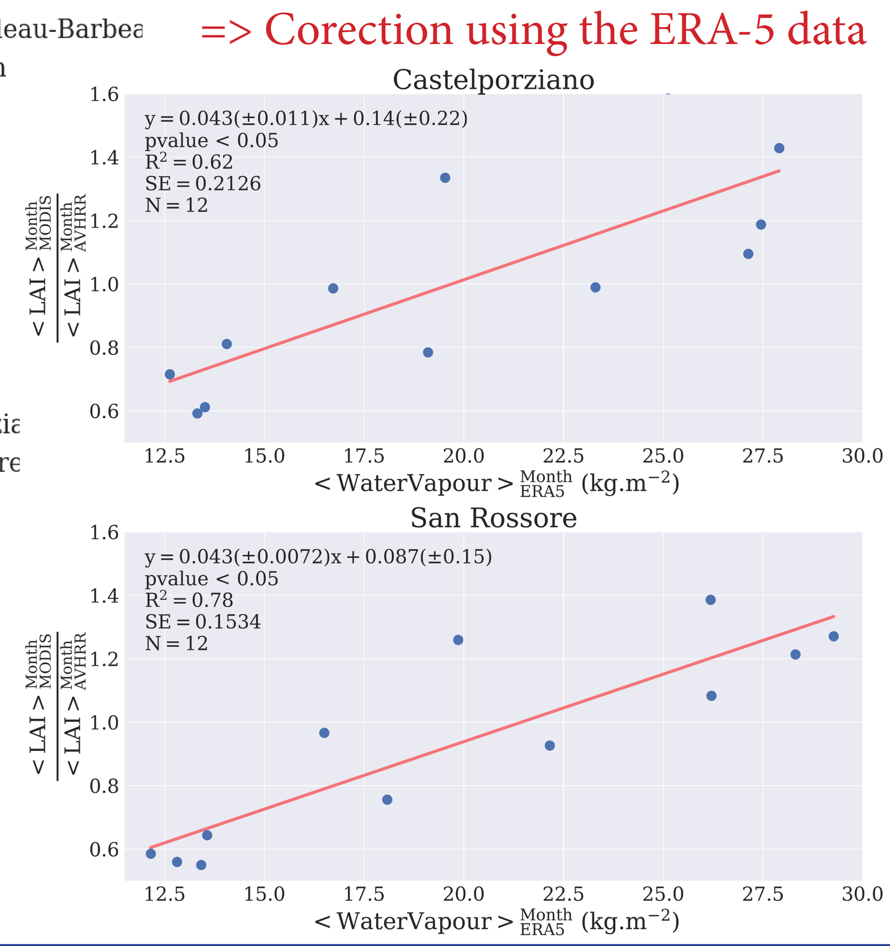
Progess in homogenizing input data for CDR

LAI (GLOBMAP)

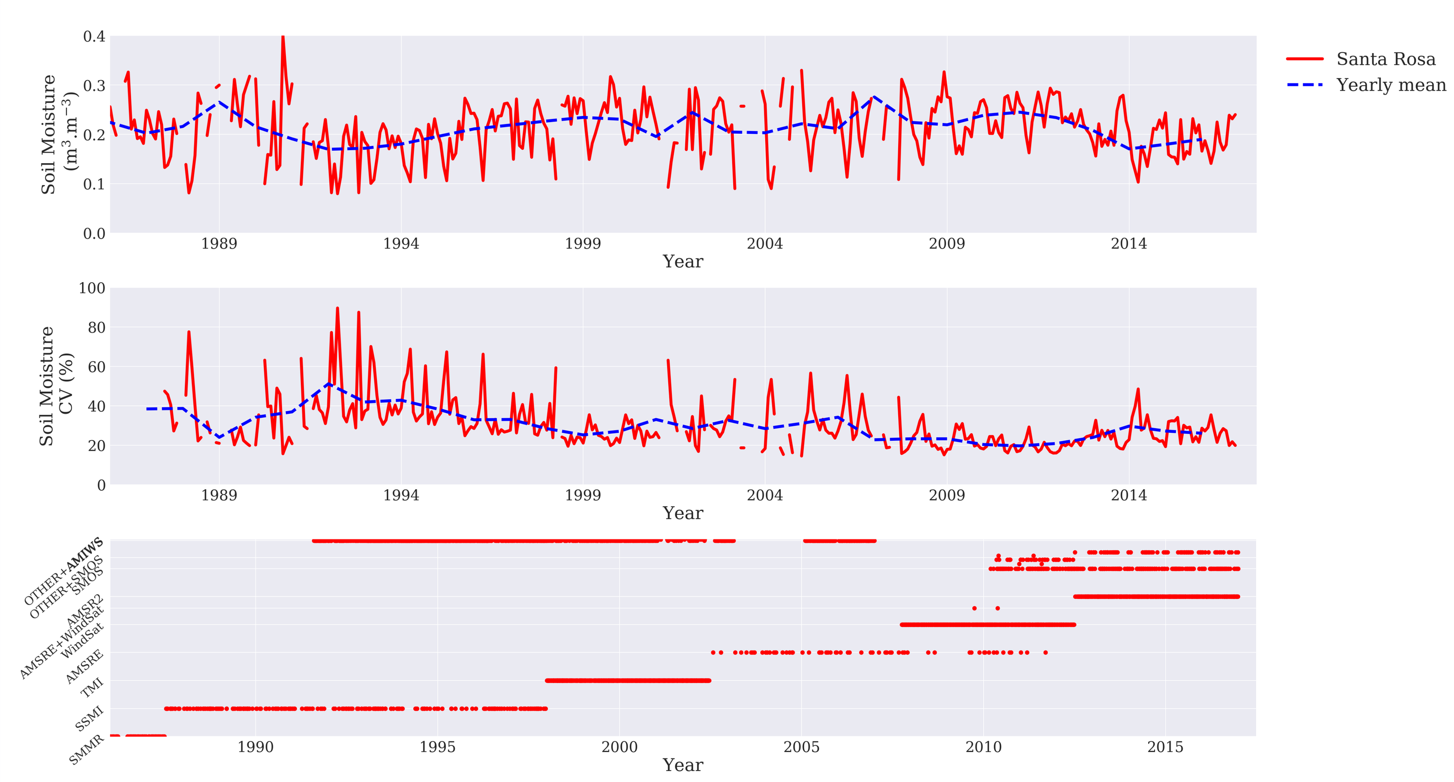


AVHRR sensor bands are more impacted by the the water vapor than the MODIS one [3-4].

=> Corection using the ERA-5 data



Soil Moisture (ESA CCI)



Combinaison of passive and active sensor data.

- Not a total consistency.
- Gaps in the time series.

=> Combinaison with data from a Land Surface Temperature approach [5].

References

[1] Ghilain, N., Arboleda, A., & Gellens-Meulenberghs, F. (2011). Evapotranspiration modelling at large scale using near-real time MSG SEVIRI derived data. Hydrology & Earth System Sciences, 15(3).

[2] Van den Hurk, B. J., Viterbo, P., Beljaars, A. C. M., & Betts, A. K. (2000). Offline validation of the ERA40 surface scheme (p. 43). European Centre for Medium-Range Weather Forecasts.

[3] Fensholt, R., Sandholt, I., & Rasmussen, M. S. (2004). Evaluation of MODIS LAI, fAPAR and the relation between fAPAR and NDVI in a semi-arid environment using in situ measurements. Remote sensing of Environment, 91(3-4), 490-507.

[4] Galvao, L. S., Vitorello, I., & Pizarro, M. A. (2000). An adequate band positioning to enhance NDVI contrasts among green vegetation, senescent biomass, and tropical soils. International Journal of Remote Sensing, 21(9), 1953-1960.

[5] Ghilain, N. (2016). Continental Scale Monitoring of Subdaily and Daily Evapotranspiration Enhanced by the Assimilation of Surface Soil Moisture Derived from Thermal Infrared Geostationary Data. In Satellite Soil Moisture Re trieval (pp. 309-332).

Acknowledgement: This research is funded by EUMETSAT (SAF/CM/DWD/CDOP3/CoA)-and PRODEX [4000123961] “Belgian contribution to the Satellite Application facility on Climate Monitoring (B-CMSAF)“.