



WACMOS - ET

Support to science element

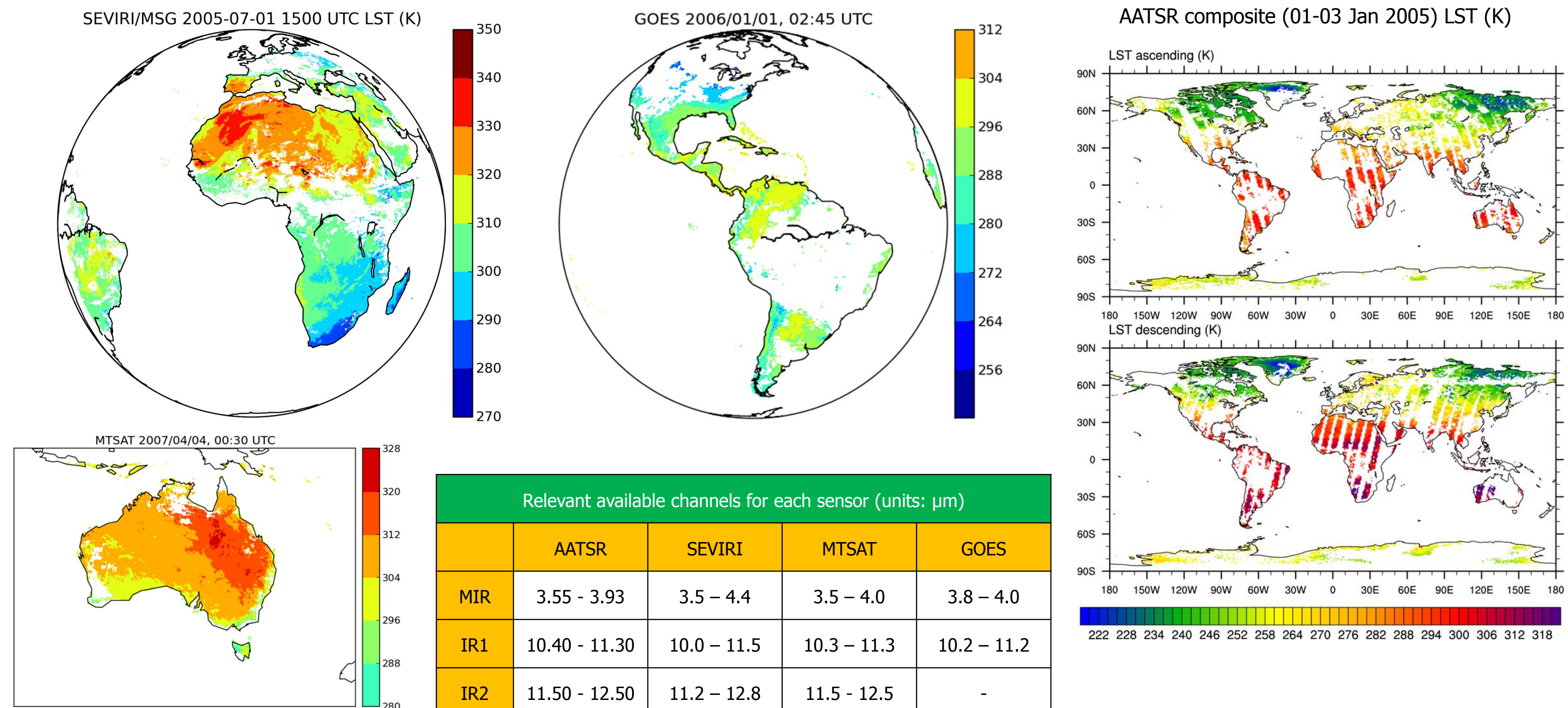
Earth Observation Water Cycle Multi-mission Observation Strategy (WACMOS)

WACMOS-ET: an ESA project to contribute towards the development of satellite-based **Terrestrial evaporation (ET)** products at global and regional scales.

Project Objectives:

- 1) To develop a **Reference Input DataSet (RIDS)** maximizing the use of European Earth Observation data
- 2) To derive and validate ET estimates from a group of **ET models** driven by the RIDS.

IPMA provided Land Surface Temperature (LST) estimates using AATSR (EnviSat), SEVIRI (MSG), MTSAT and GOES-E for 2005-2007 using algorithms and inputs as common as possible for all instruments, thus providing a **consistent, nearly global** dataset for **both GEO and LEO** platforms.



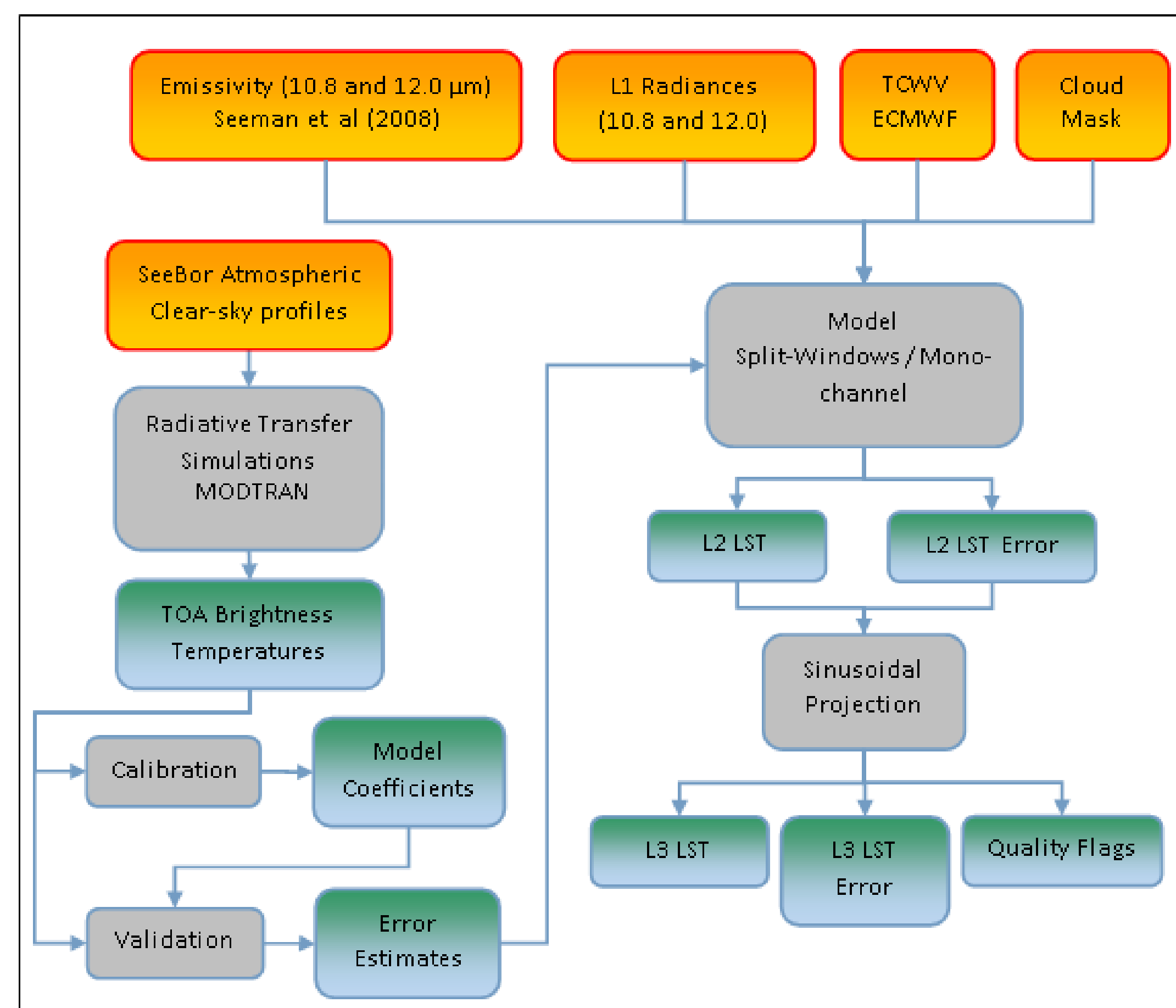
Generalized Split-Windows

$$LST = C + \left(A_1 + A_2 \frac{1 - \epsilon}{\epsilon} + A_3 \frac{\Delta \epsilon}{\epsilon^2} \right) \frac{T_{IR1} + T_{IR2}}{2} + \left(B_1 + B_2 \frac{1 - \epsilon}{\epsilon} + B_3 \frac{\Delta \epsilon}{\epsilon^2} \right) \frac{T_{IR1} - T_{IR2}}{2} + D(T_{IR1} - T_{IR2})(\sec \theta - 1)$$

Mono-Window

$$LST = A \frac{T_{IR1}}{\epsilon} + B \frac{1}{\epsilon} + C + D(\sec \theta - 1)$$

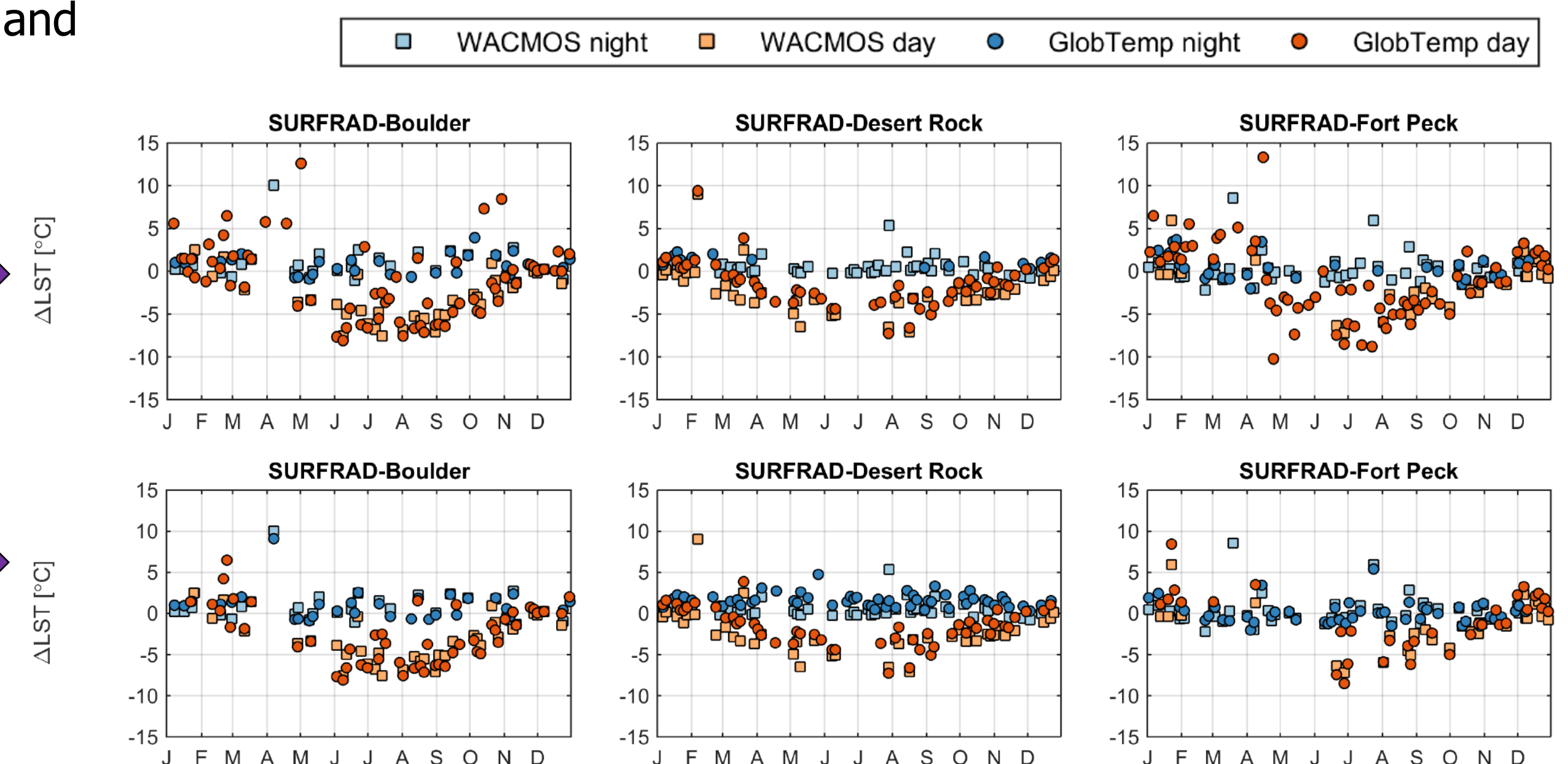
Processing chain and inputs



Differences of AATSR to in situ LST using WACMOS-ET and GlobTemp estimates

Different cloud mask (GlobTemp uses an improved cloud mask)

Same cloud mask (original AATSR, used on WACMOS-ET)



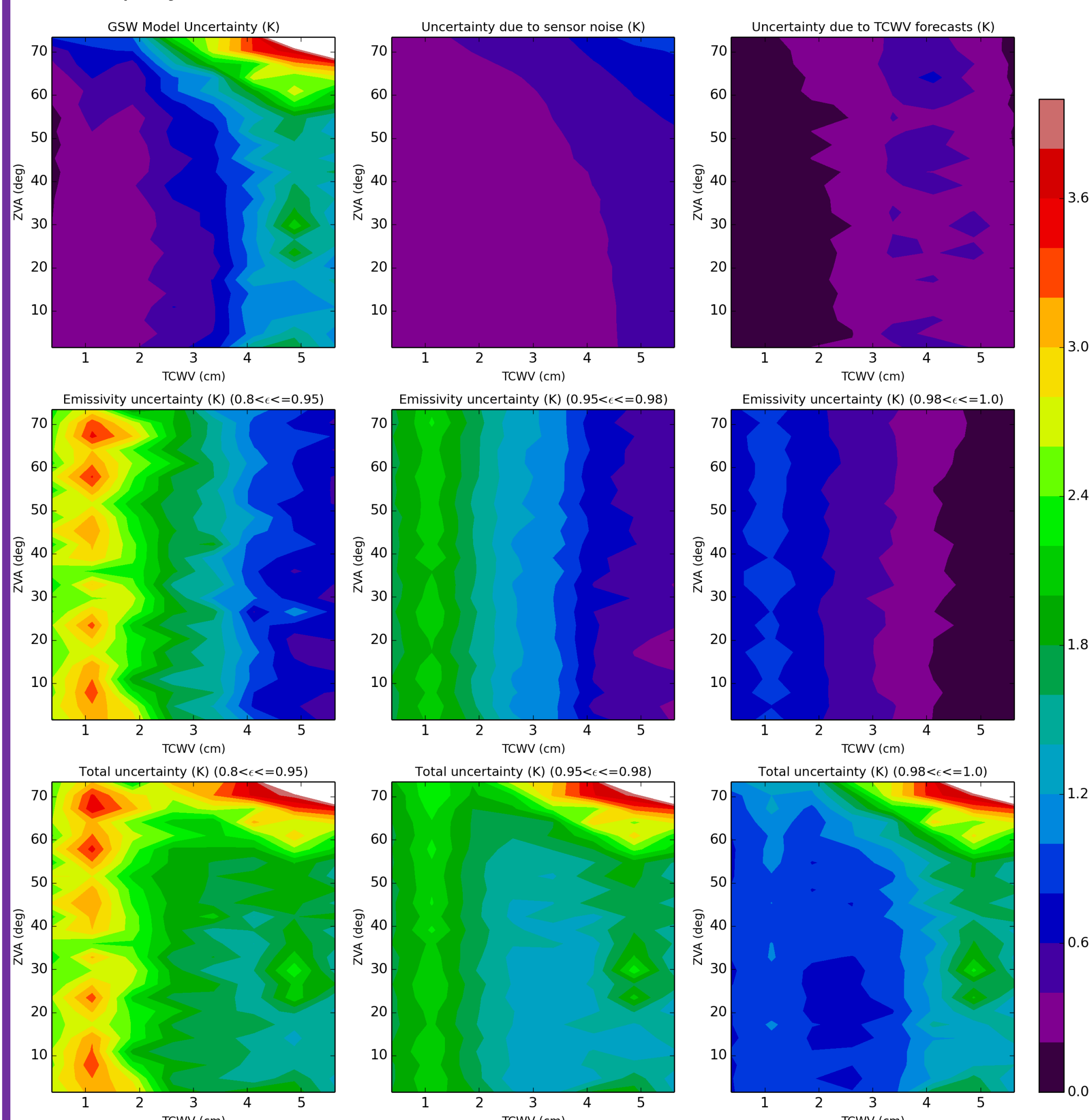
Overall summary statistics of all nighttime and daytime matchups for 2007 at all in situ sites. Note that the same cloudmask was used for both products (WACMOS-ET)

Product	Bias	StdDev	RMSE	MAD	Offset	Slope	R ²
WACMOS Night	0.06	2.26	2.25	0.81	0.34	0.97	0.97
GlobTemp Night	0.15	2.27	2.27	1.38	0.19	1.00	0.97
WACMOS Day	1.17	3.25	3.45	2.17	-0.76	1.08	0.96
GlobTemp Day	1.20	3.81	3.99	1.95	-1.52	1.11	0.96

Error propagation

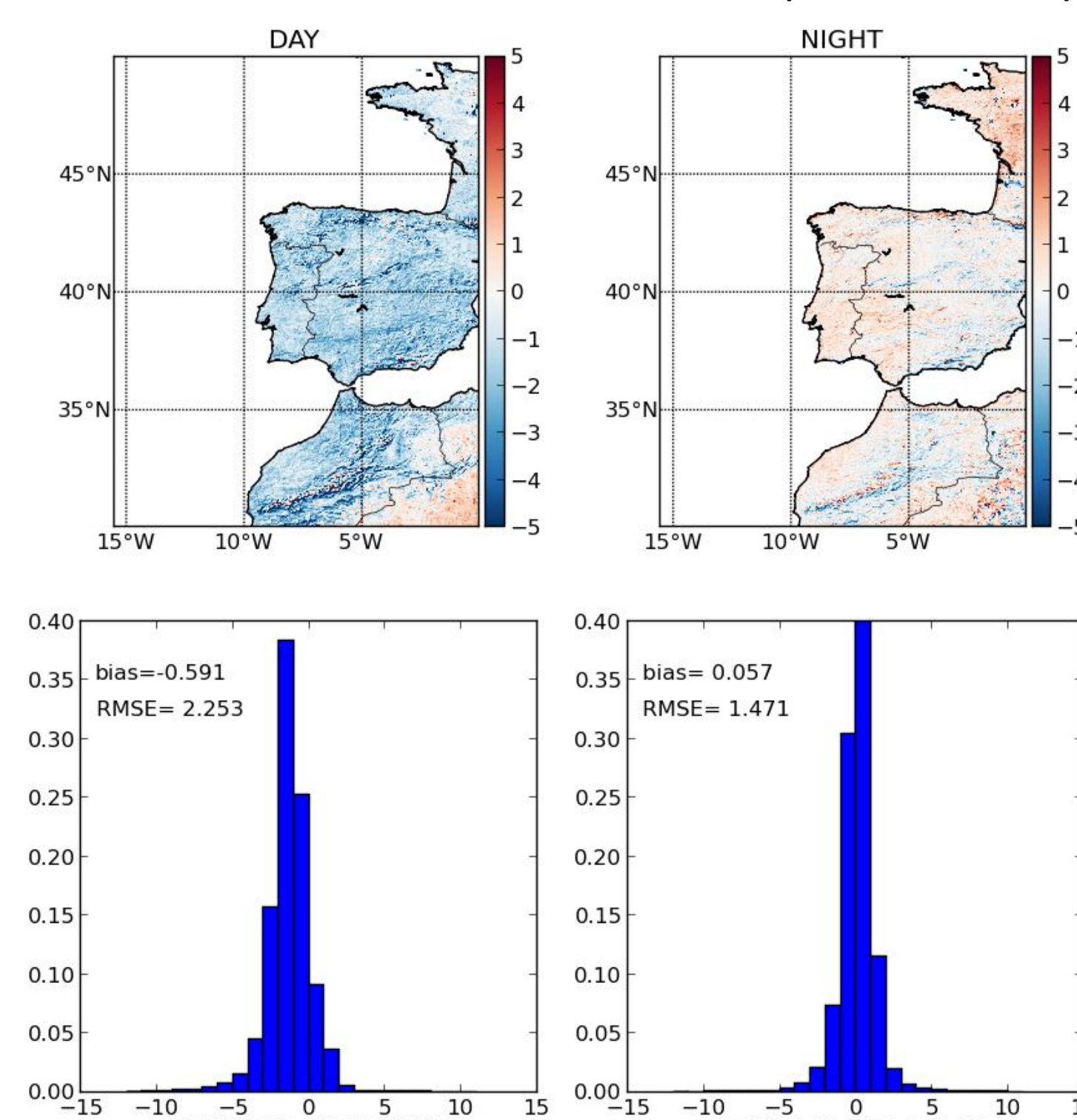
$$\sigma_{LST} = \sqrt{\sigma_{sensor}^2 + \sigma_{\epsilon}^2 + \sigma_{TCWV}^2 + \sigma_{model}^2}$$

Example for SEVIRI/MSG

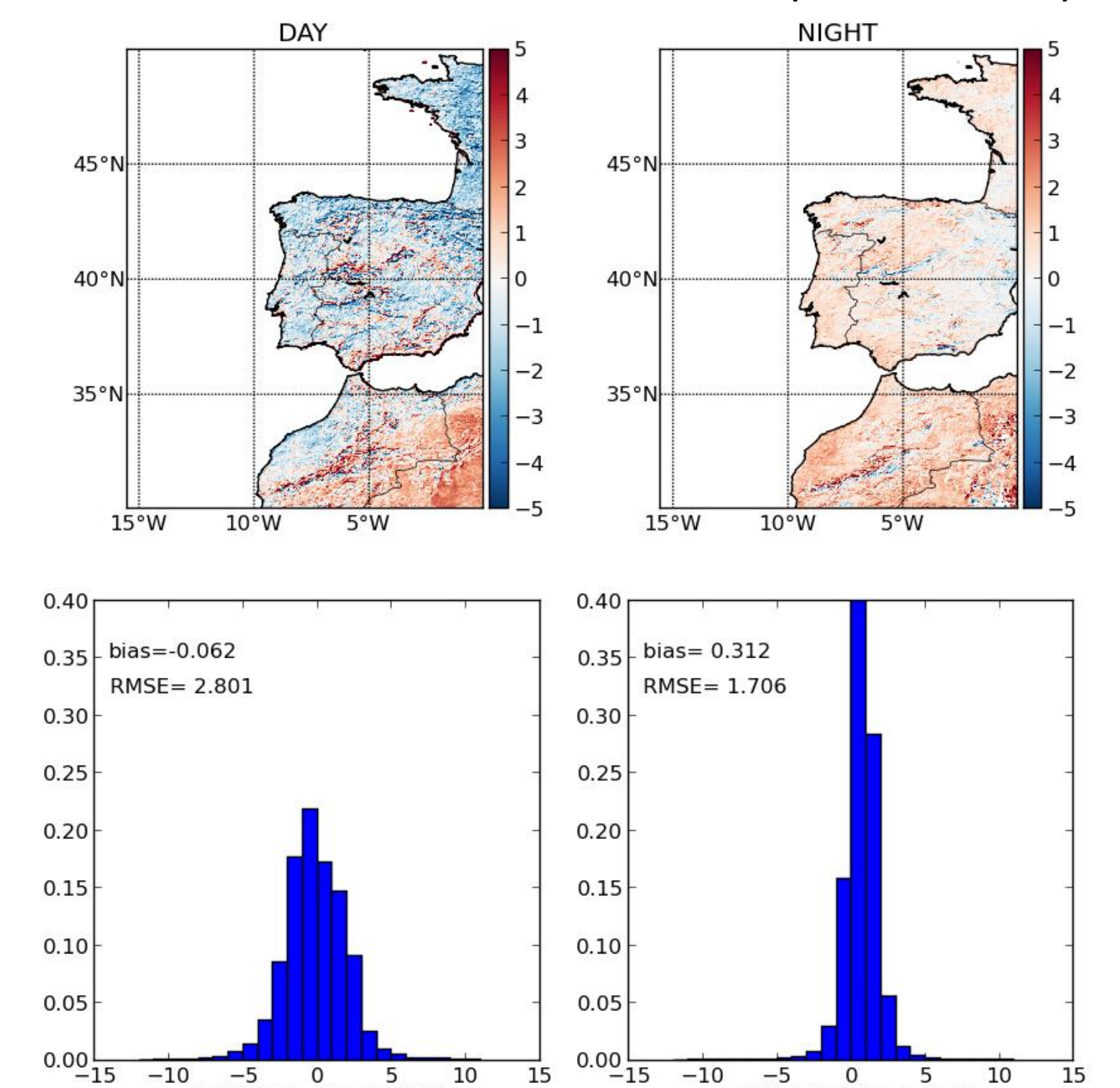


Sensor intercomparison

2005-2007 JAN mean difference (AATSR-MSG)



2005-2007 JUL mean difference (AATSR-MSG)



An advantage of the WACMOS-ET dataset is the possibility of intercomparison of LST data produced by different sensors using the same inputs and algorithms (except for GOES-E due to the unavailability of the IR2 channel). The intercomparison between remotely sensed LST and in situ data reveals large sensitivities to the cloud mask and to the emissivity database. It is recalled that the algorithms used in WACMOS-ET rely on that variable explicitly. However, since the larger uncertainties of emissivity come from semi-arid and desert areas, it is a suitable LST retrieval product for evapotranspiration estimations. The WACMOS-ET LST products show generally good agreement with in situ observations over a wide range of surface and atmospheric conditions.