

POSSIBLE DEFINITIONS OF ACSPO SST QUALITY LEVELS BASED ON THE STATISTICAL STRUCTURE OF REGRESSORS IN THE TRAINING DATASET OF MATCHUPS

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1. OBJECTIVE

Here, we propose the definitions of the Quality Levels (QL) for regression SST in the NOAA Advanced Clear-Sky Processor for Oceans (ACSPO), consistent with Sensor-Specific Error Statistics (SSES) implemented in ACSPO v.2.40 [1].

2. SSES IN ACSPO AND FISHER DISTANCE

The SSES are derived from the statistics of regressors within the training dataset of matchups (MDS), as functions of Fisher distance, ρ . The ρ characterizes how well a given vector of regressors is represented within a training MDS; the precision of regression SST wrt *in situ* SST is a quasi-monotonic function of ρ (Fig. 1). Correction of the **Baseline ACSPO SST (BSST)** for SSES biases produces **De-biased SST (DSST)**, which is more precise with respect to *in situ* SST due to partial suppressing the effects of cloud leakages and diurnal surface warming [1].

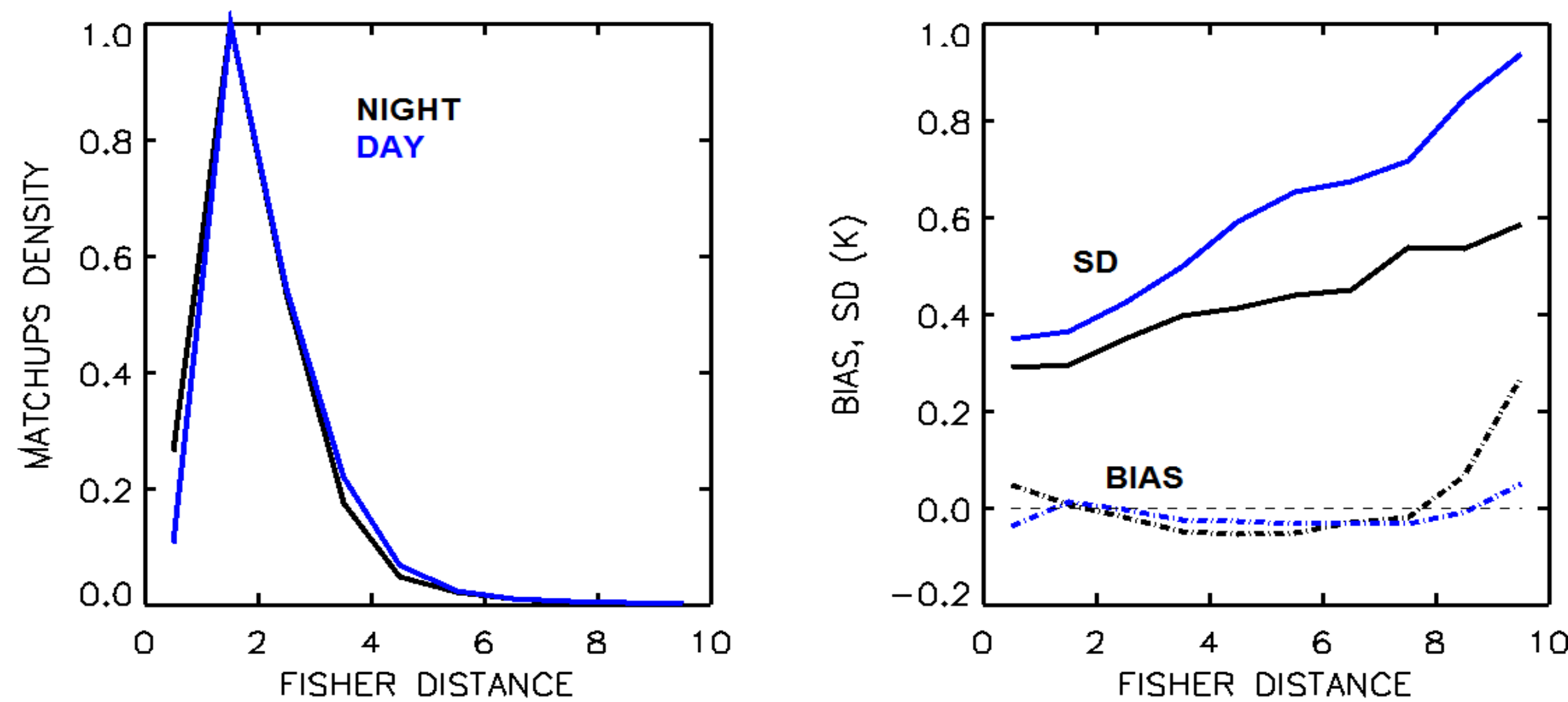


Fig. 1. (Left) The densities of matchups in the training MDS and (right) bias and SD of BSST wrt *in situ* SST as functions of Fisher distance, for S-NPP VIIRS. The distributions of matchups are similar for day and night. The biases are close to zero at the maxima of the matchups density, and the SDs wrt *in situ* SST are quasi-monotonic functions of Fisher distance.

3. THE DEFINITIONS OF QUALITY LEVELS

The proposed definitions of the QLs employ the Fisher distance parameter and the ACSPO Clear-Sky Mask (ACSM) [2]. The ACSM screens out the cloud effects from an input SST product. When applied to the BSST, the ACSM creates the “Baseline” SST domain. On the other hand, applying the ACSM to the DSST creates an “Extended” SST domain, in which the performance of the BSST degrades more significantly than the performance of the DSST. This “Extended” domain may be useful for those users, who are interested in assimilating the DSST in a larger domain.

Table 1. The proposed definitions of SST Quality Levels

Quality Level	Meaning	Definition
5	Best	Baseline domain, $\rho \leq 3$
4	Acceptable	Baseline domain, $\rho \leq 1$ or $3 < \rho \leq 5$
3	Poor	Baseline domain, $\rho > 5$
2	Extended domain	(Extended minus Baseline) domain
1	Invalid	Invalid
0	Missing data	Missing

Table 1 shows the proposed QL definitions. The QLs from 5 - 3 are assigned to pixels belonging to the “Baseline” SST domain, with progressively increasing Fisher distance, which makes the validation statistics to degrade from QL=5 to 3. The QL=2 is assigned to the pixels belonging to the “Extended” SST domain only.

REFERENCES

- Petrenko, B., Ignatov, A., Kihai, Y., and Dash, P., “Sensor-specific error statistics for SST in the Advanced Clear-Sky Processor for Oceans,” *Journal of Atmospheric and Oceanic Technology* **33**, 345–359 (2016), DOI: 10.1175/JTECH-D-15-0166.1.
- Petrenko, B., Ignatov, A., Kihai, Y., and Heindinger, A., “Clear-sky mask for the Advanced Clear-Sky Processor for Oceans,” *Journal of Atmospheric and Oceanic Technology*, **27**, 1609–1623 (2010), doi: 10.1175/2010JTECHA1413.1

4. EXAMPLE: QUALITY LEVELS FOR S-NPP VIIRS SST

Fig. 2 shows the distributions of deviations of BSST and DSST with QL=5 to 2 from the Canadian Meteorological Centre (CMC) L4 SST, for daytime VIIRS data on 18 June 2015. Table 2 shows the corresponding statistics of deviations of BSST and DSST from CMC. The validation statistics of BSST and DSST wrt CMC degrade from QL=5 to QL=3, as expected. The pixels with QL=2 add ~20% to the Baseline SST domain with the DSST statistics for this level still being much better than for the BSST.

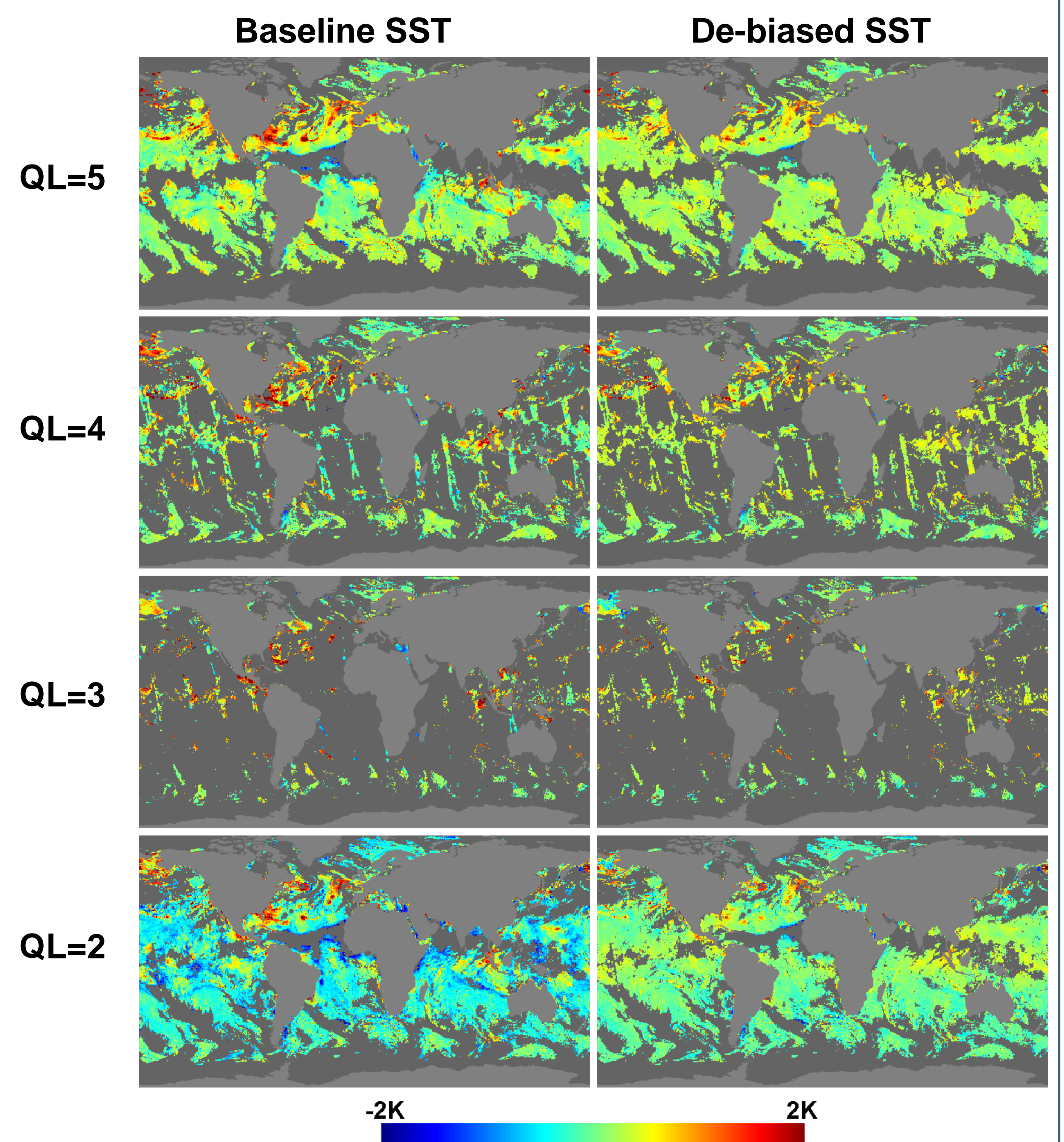


Fig.2. Daytime deviations of BSST and DSST from CMC for pixels with QL=5 to 2. S-NPP VIIRS, 18 June 2015. The corresponding validation statistics for the BSST and DSST are shown in Table 2

Table 2. Statistics of deviations of the Baseline and De-biased ACSPO SSTs from the CMC, for QL=5 to 2, corresponding to the VIIRS SST maps shown in Fig. 2.

Quality Level	Fraction of all ocean pixels	Baseline SST		De-biased SST	
		Bias	SD	Bias	SD
5	14.6%	0.35K	0.50 K	0.30 K	0.30 K
4	2.6%	0.49 K	0.72 K	0.42 K	0.52 K
3	0.8 %	0.53 K	0.75 K	0.07 K	0.81 K
2	2.6 %	-0.33 K	0.67 K	0.10 K	0.33 K

5. FURTHER DEVELOPMENT

Pending a better understanding of the ACSPO users’ needs, the described QL definitions may replace the current (relatively primitive) ACSPO QL definitions [1]