Matching Pursuit and rain flag

CLS: JC. Poisson, P. Thibaut
IFREMER: J. Tournadre

Reminder

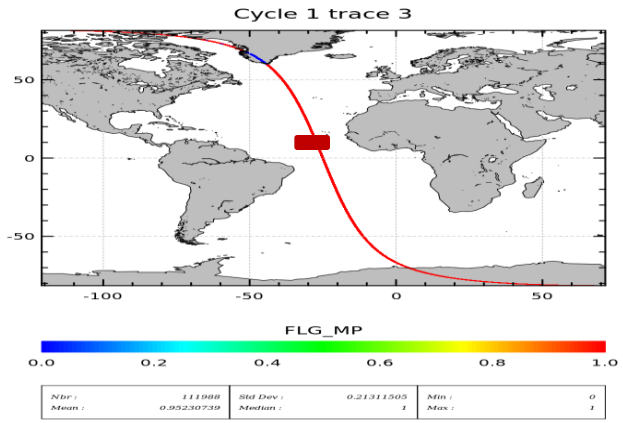
- AltiKa is a mono frequency altimeter, operating in Ka-band which is strongly affected by the presence of liquid water.

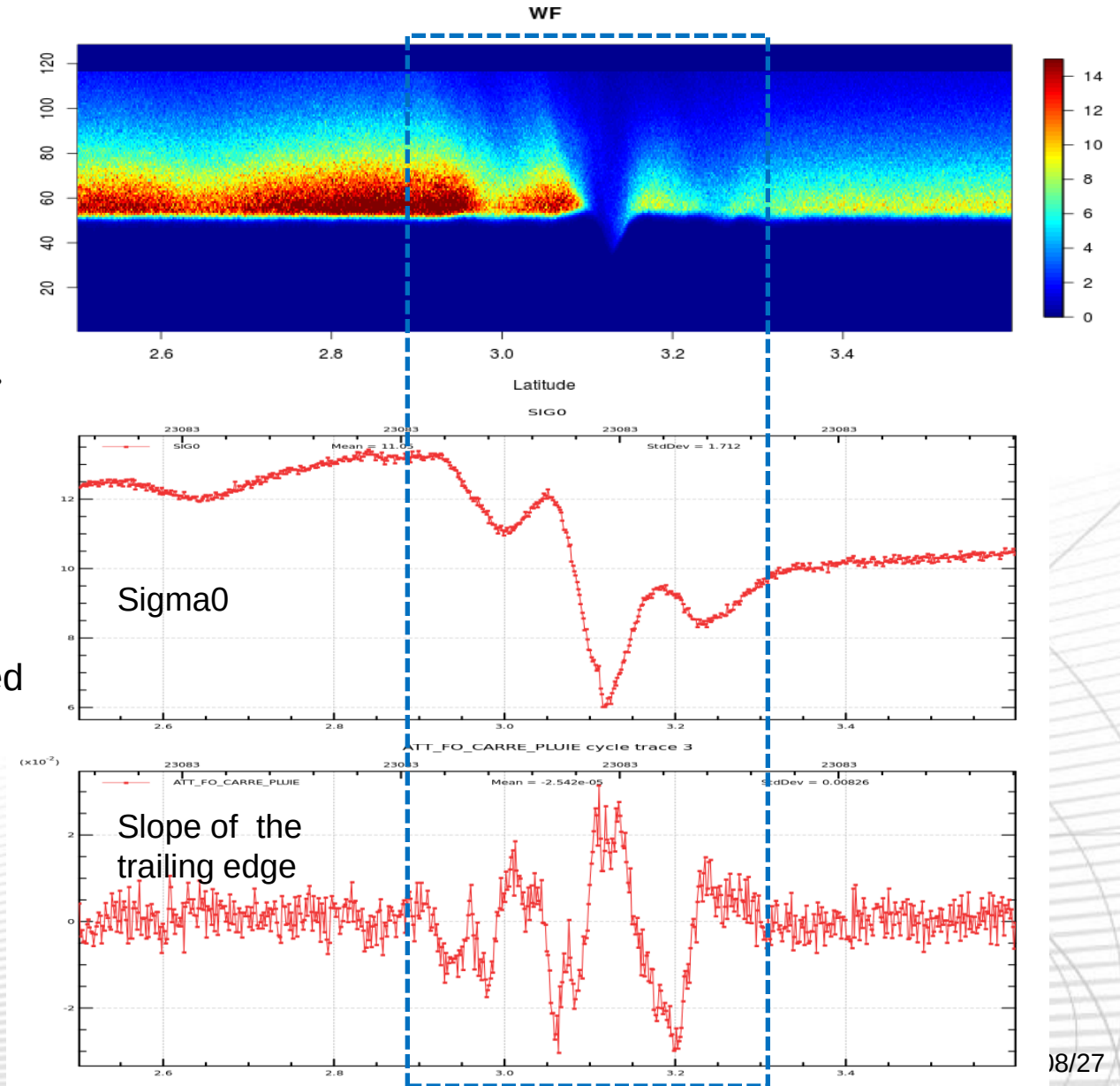
- J. Tournadre has previously shown the possibility of using the short scale variability of the trailing edge slope to detect areas affected by liquid water (rain or cloud).

- On Jason-1, J. Tournadre has developed a Matching Pursuit algorithm applied to the estimates of the slope of the logarithm of the trailing edge. This detection was able to locate the regions where waveforms are disturbed.
  ➔ The matching pursuit algorithm not only detects rain cells but all waveforms that deviate from the Brown model. (also blooms Sigma0, Sea-Ice …). The output flag has to be combined with another information to detect rain cells (with liquid water content for example).

- The analysis performed on Jason-1 has shown that the mispointing estimated by a MLE-4 retracker is not the most appropriate input for the matching pursuit.
  ➔ A linear regression of the logarithm of the trailing edge is computed in the AltiKa ground segment.

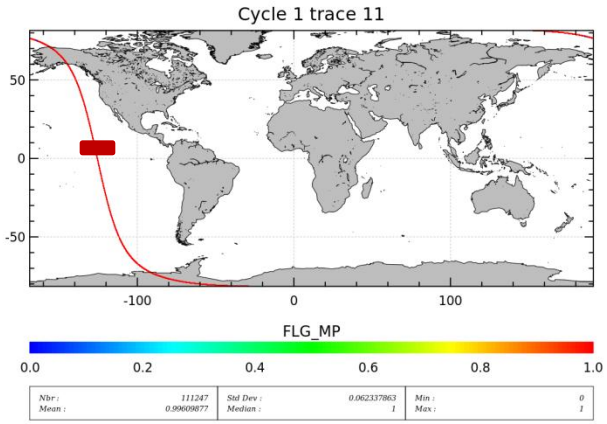
Waveforms affected by rain

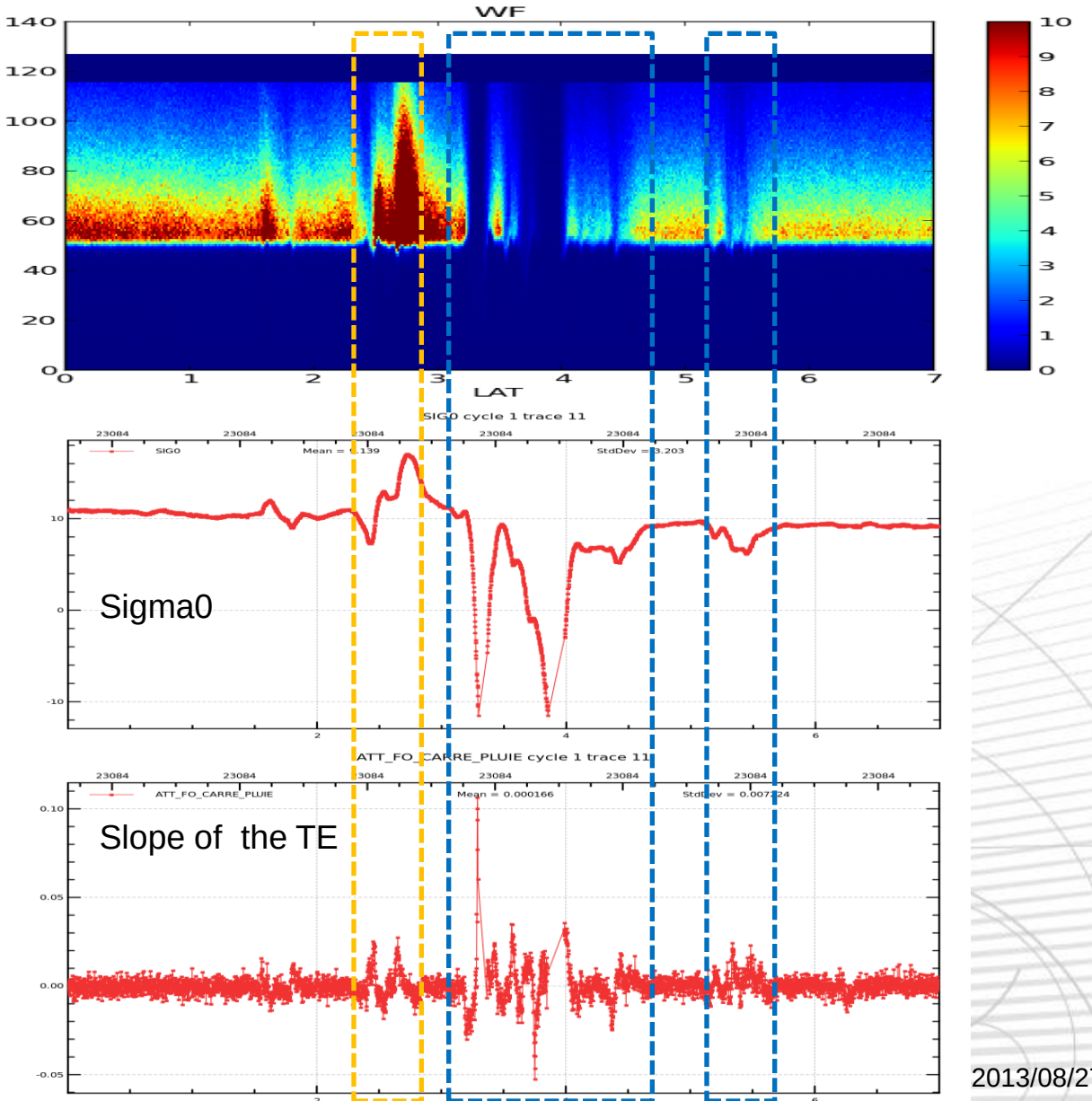




The slope of the trailing edge of the AltiKa waveforms can be used to detect non Brownian waveforms.

Waveforms affected by rain/bloom

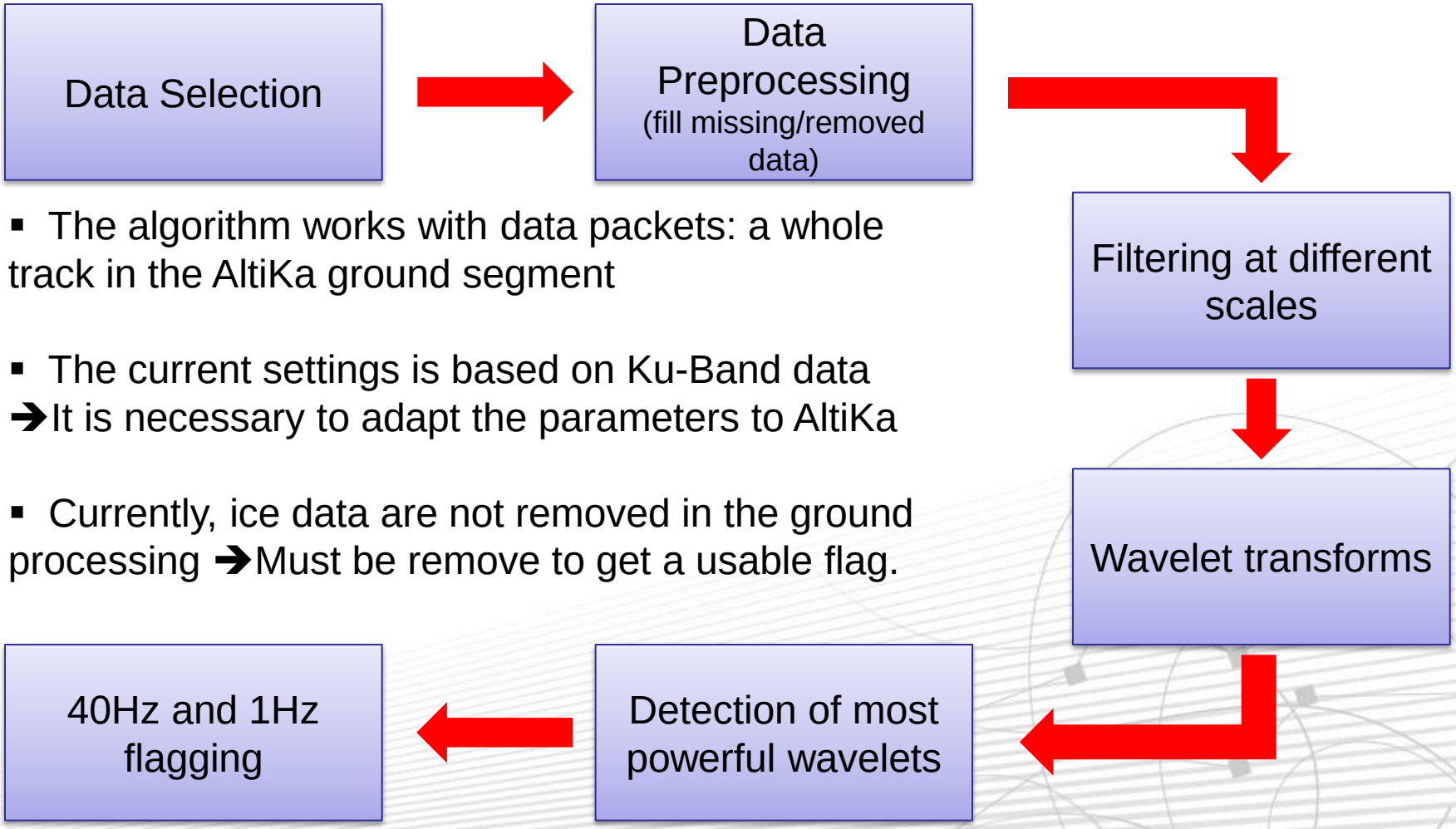




The slope of the trailing edge of the AltiKa waveforms can be used to detect non Brownian waveforms.

But it is not enough to deduce the presence of rain or cloud.

The Matching Pursuit algorithm



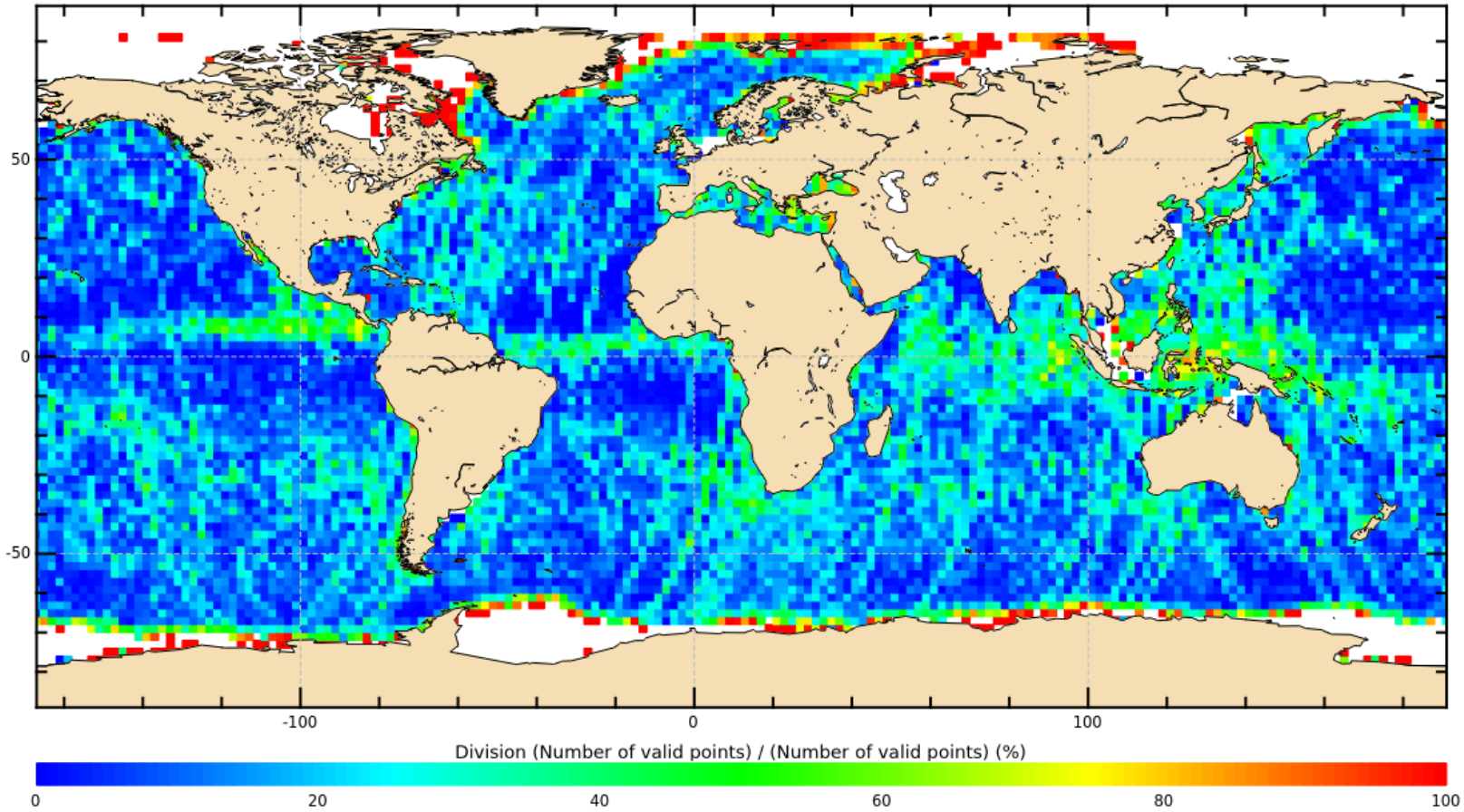
- The algorithm works with data packets: a whole track in the AltiKa ground segment

- The current settings is based on Ku-Band data
➔It is necessary to adapt the parameters to AltiKa

- Currently, ice data are not removed in the ground processing ➔Must be remove to get a usable flag.

Default settings

% of flagged data by grid boxes

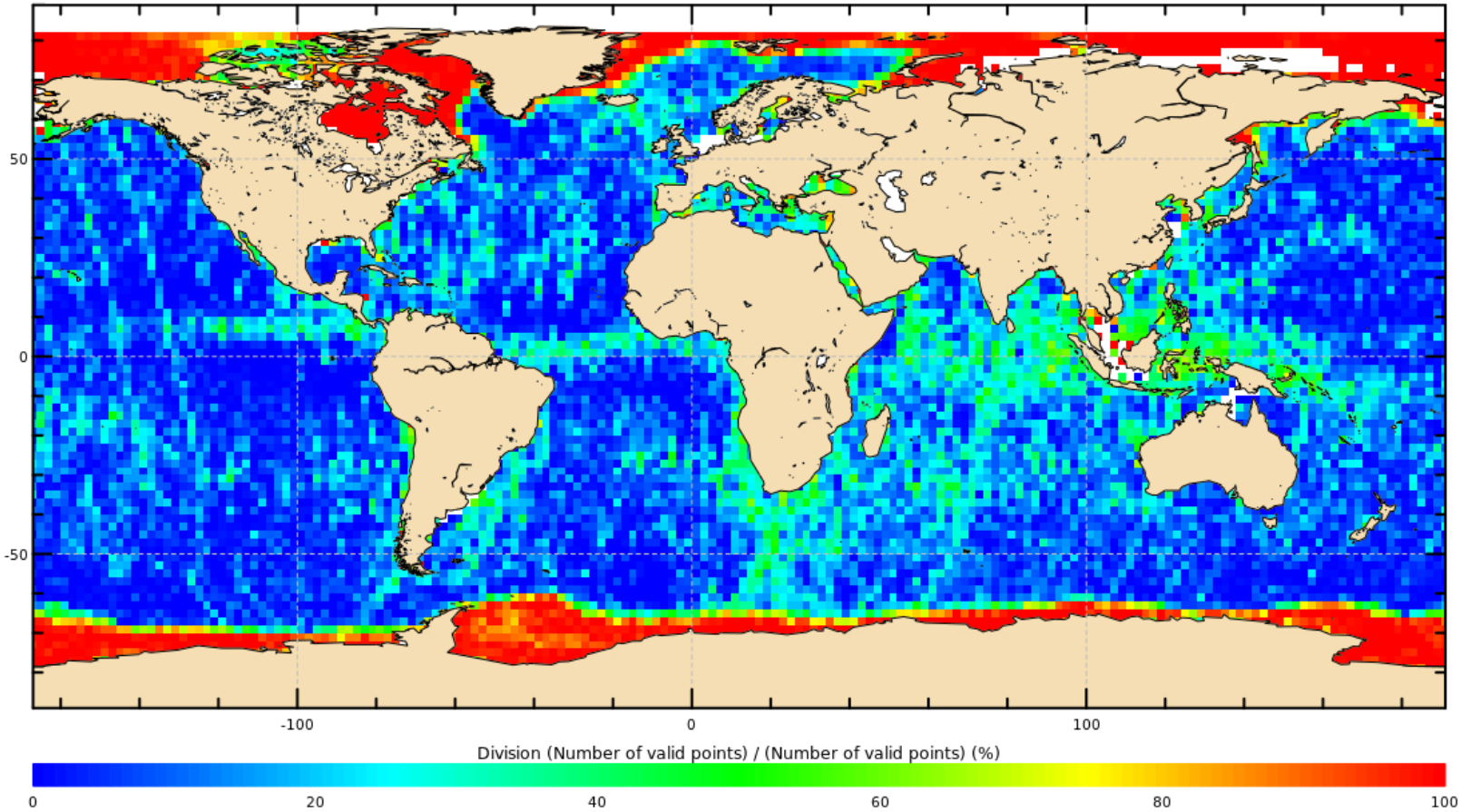


Results from the ground segment algorithm with data selection (no ice unlike the ground segment)

➔ ~ 15% of flagged measurements (abs(LAT) < 55°). But a track phenomenon is visible.

Settings improvements

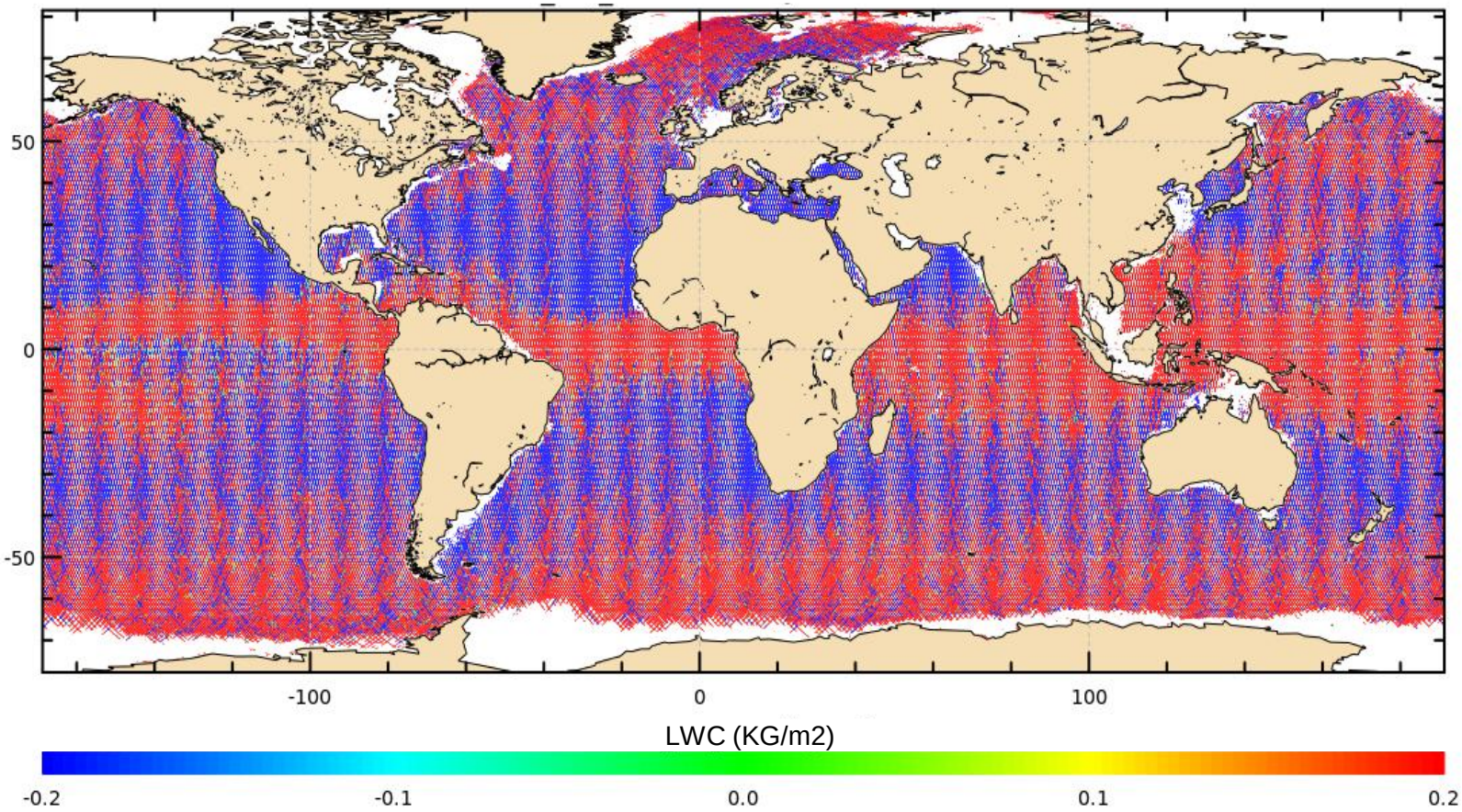
% of flagged data by grid boxes



After improvements of the algorithm settings the percentage of flagged measurements drops to 8 % for abs(LAT) < 55°.
The 4 tracks visible are due to maneuvers (cycle 2).
The Sea ice is took into account in the settings.

The radiometer liquid water content

LWC from AltiKa products (cycle 2)

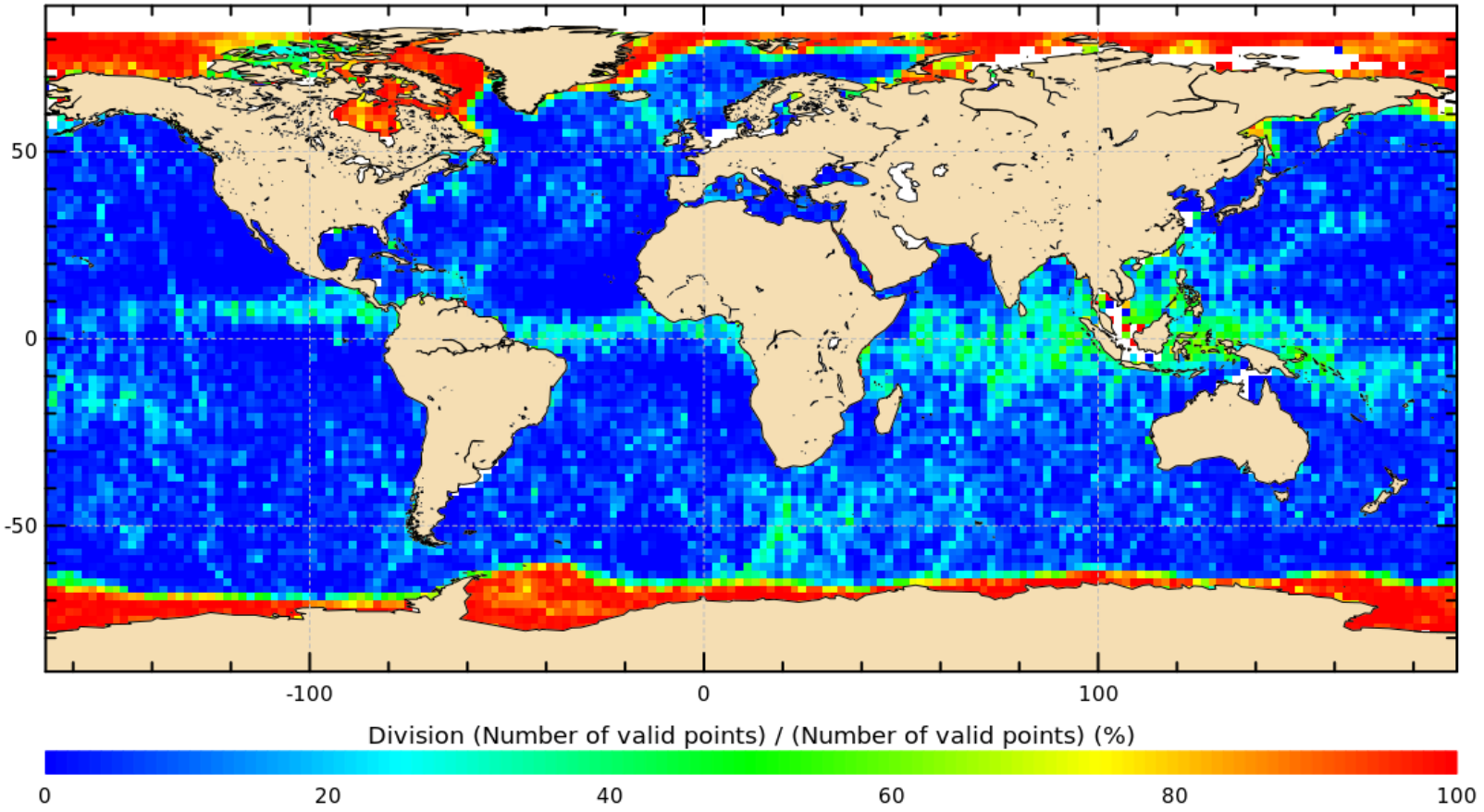


In order to compute a pure rain flag, we can combine radiometer LWC from AltiKa products and the Matching Pursuit flag.

As this cartography shows, the LWC is not optimal on output of the neural network (cf ML. Frery) but we used it as complementary information.

Matching Pursuit + LWC > 0

% of flagged data by grid boxes

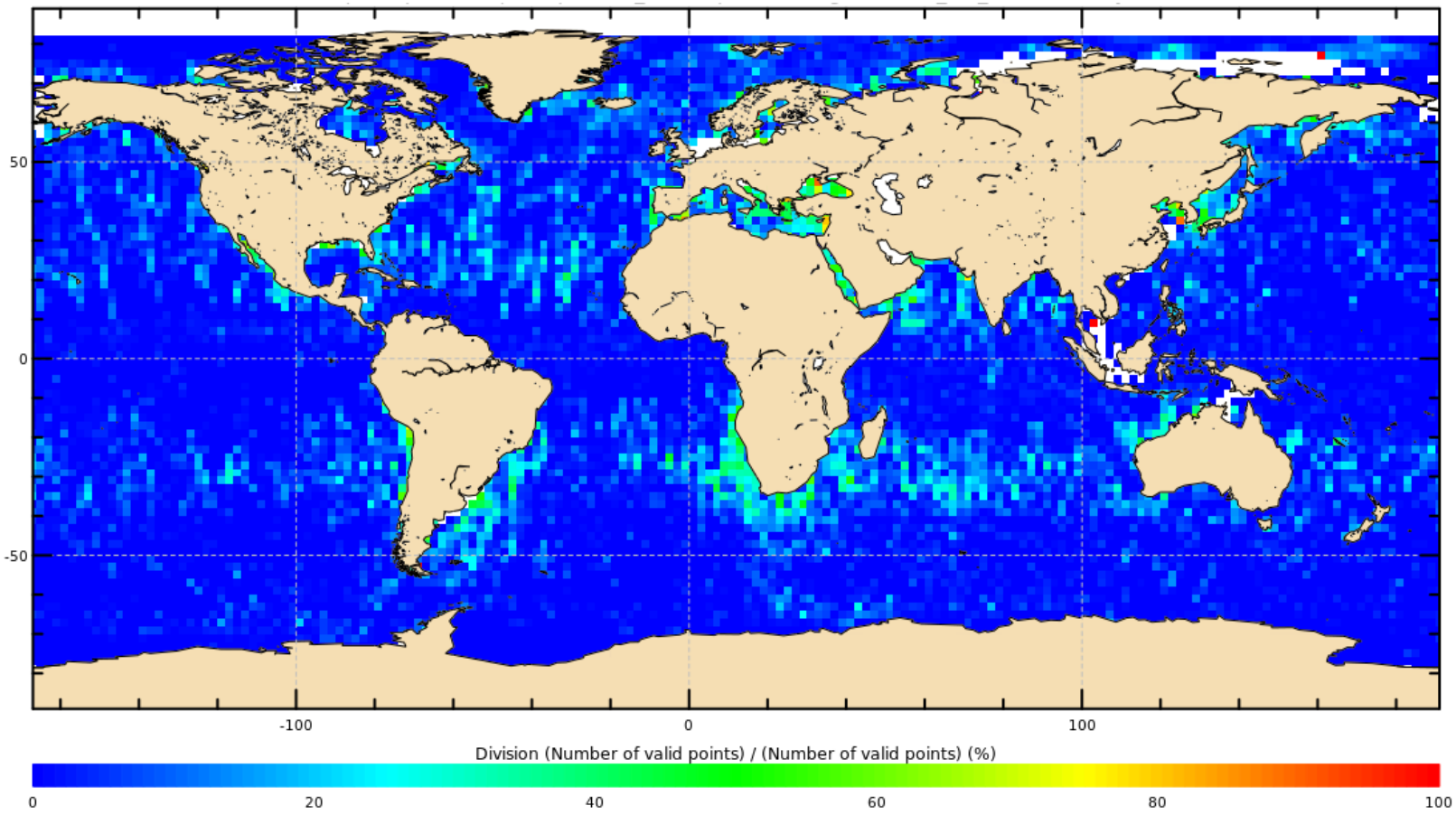


After combination of Matching Pursuit and LWC >0 we get:

➔ 5% of flagged measurements for abs(LAT < 55°)

Matching Pursuit + LWC < 0

% of flagged data by grid boxes



This cartography shows the positions of disturbed waveforms with a < 0 LWC:

➔ 3% of flagged measure for abs(LAT < 55°)

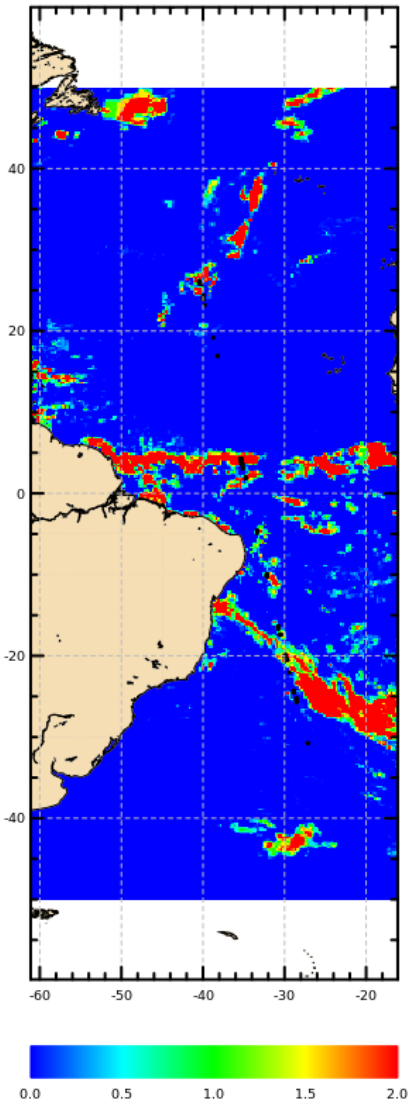
Comparison with TRMM data

- In order to validate the rain flag that we computed, we compare the rain flag with cartography of precipitation measured by the TRMM mission retrieved via Giovanni : http://gdata1.sci.gsfc.nasa.gov/daac-bin/G3/gui.cgi?instance_id=TRMM_3B42RT

- The only limitation of this comparison is the time delay between TRMM measurements and AltiKa measurements which can reach 3 hours.

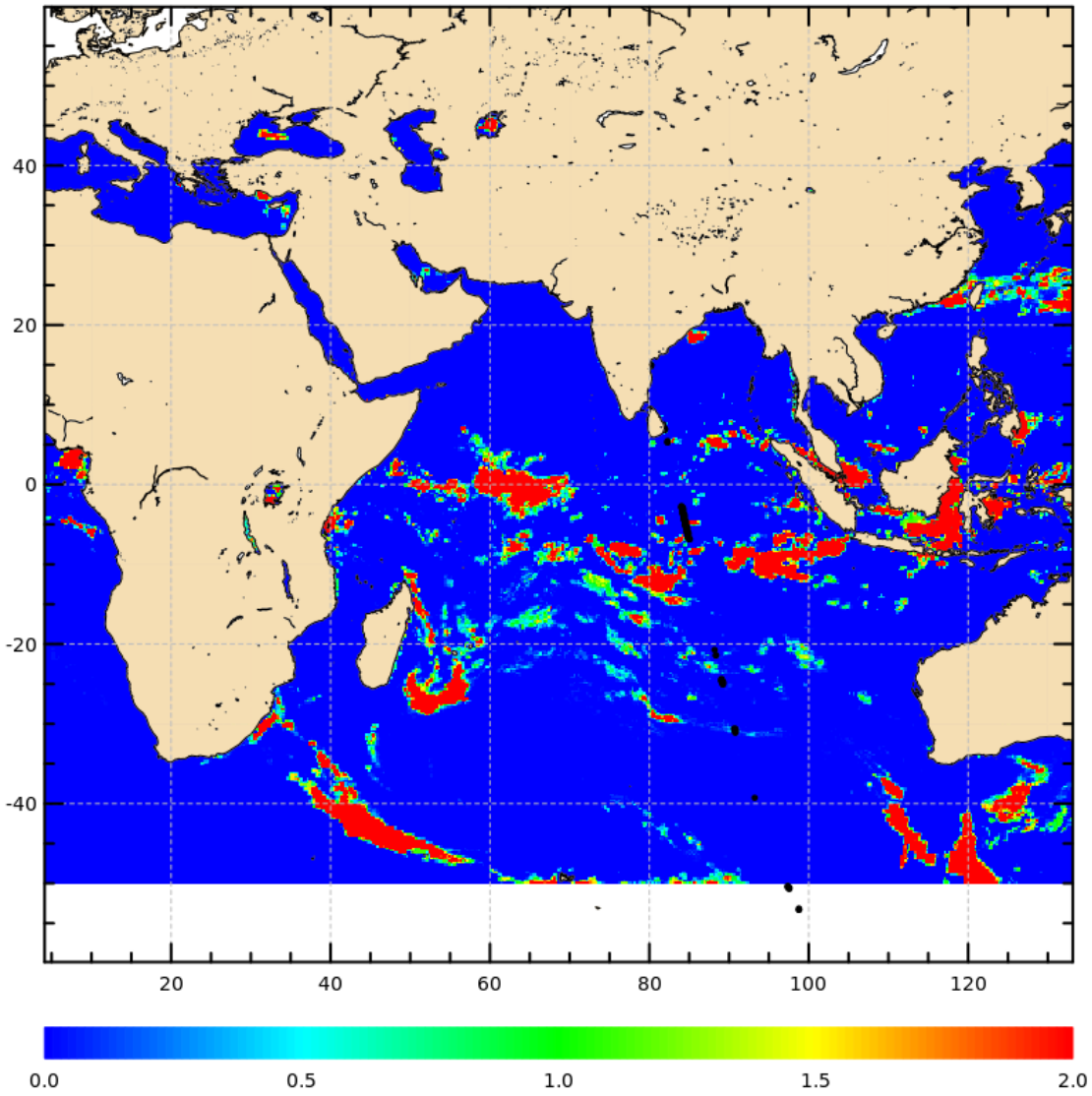
- Quite good agreement between the rain flag and TRMM measurements even if the flag is a bit restrictive.

Cycle 2 track 61



Comparison with TRMM data

Cycle 2 track 23



New version of the Matching Pursuit by J. Tournadre

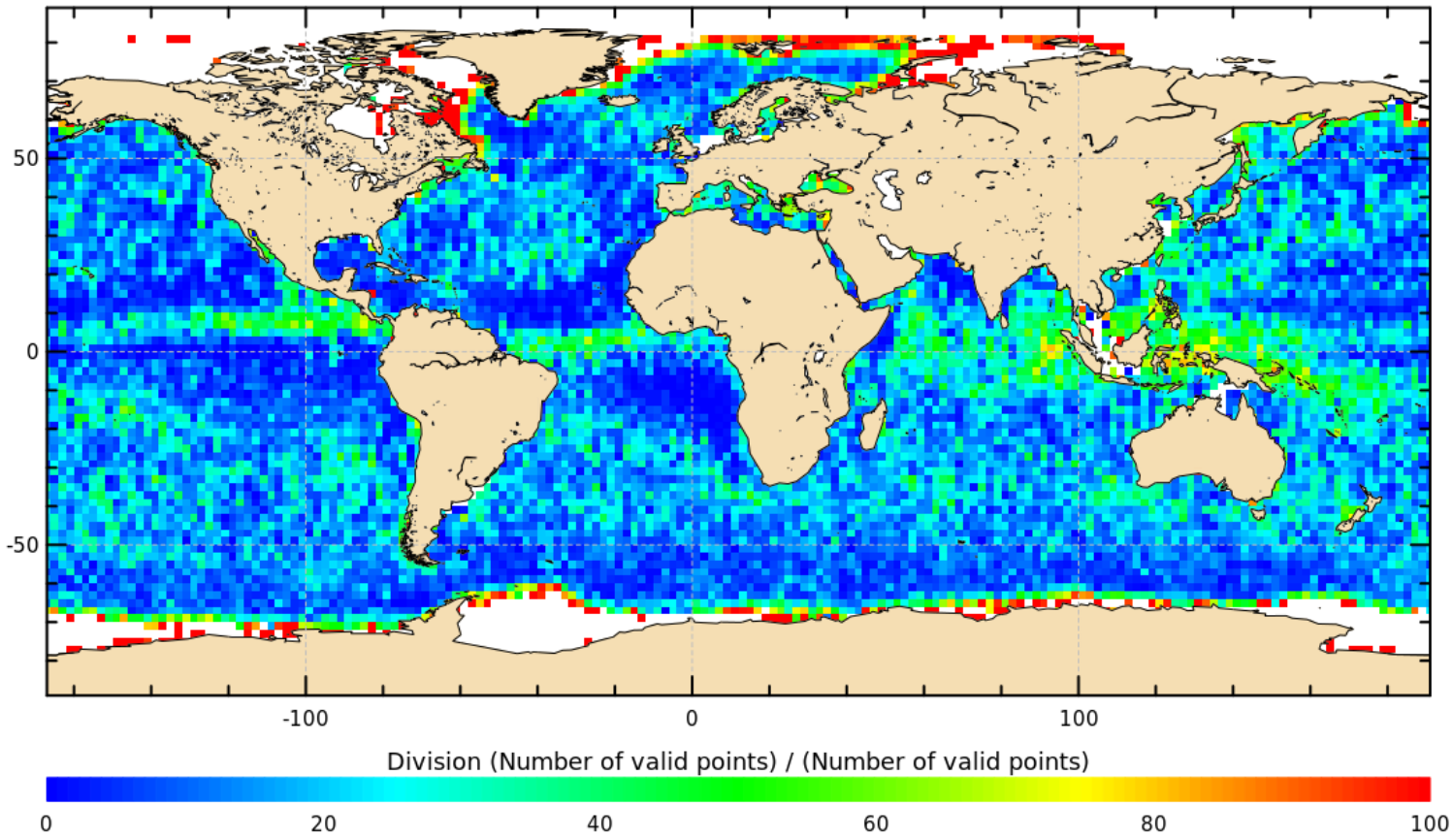
- Since the beginning of the AltiKa SIGDR production, J. Tournadre has modified the algorithm to process data with constant packet dimension (16384 pts). So a track is now divided into several packets.

- The settings have been adapted to the new version, for example land and ice must be removed before data processing and a clipping is necessary on input data.

- This new version required source code modifications.

New version of the MP algorithm

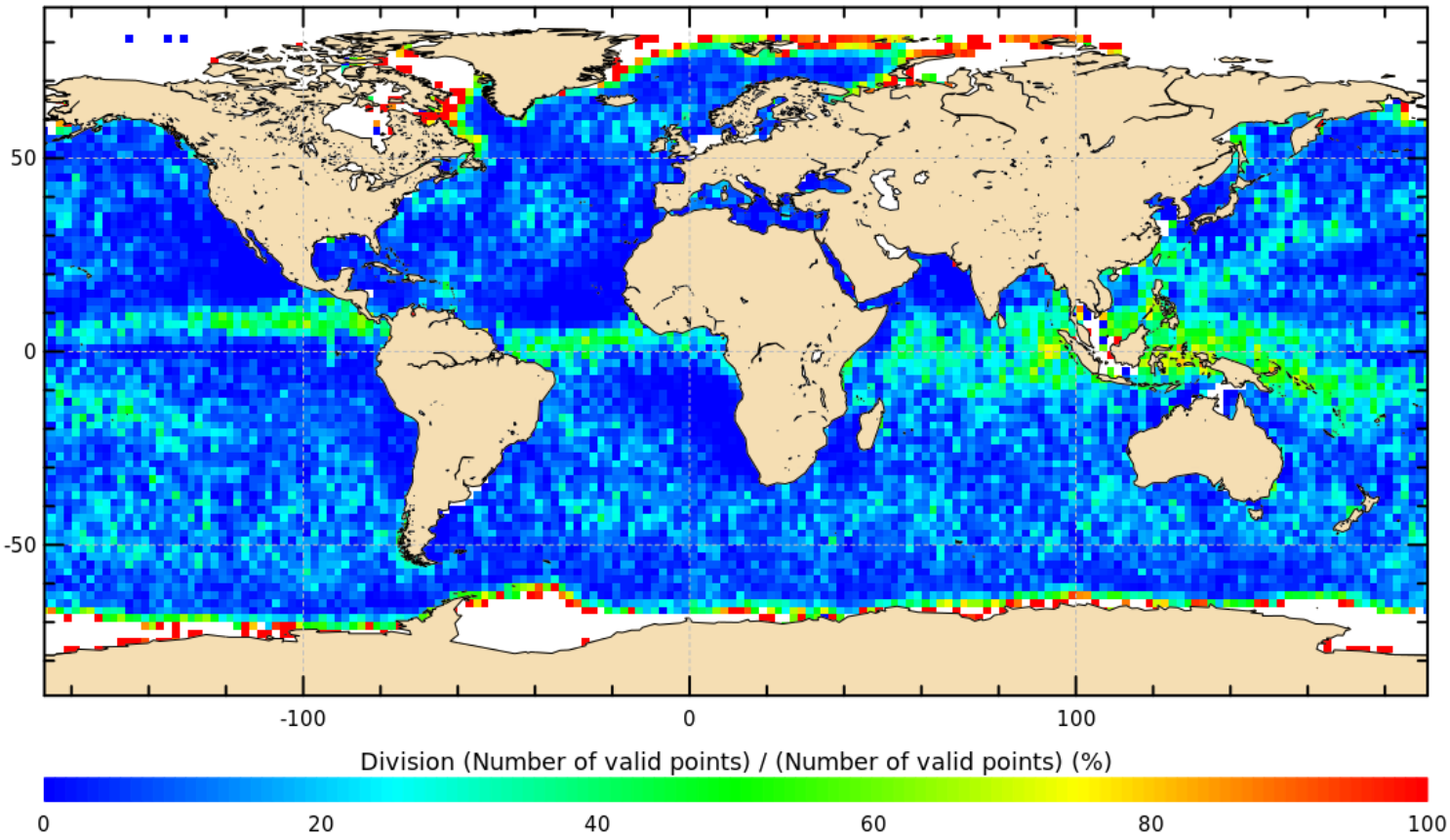
% of flagged data by grid boxes



➔ 17% of flagged points abs(LAT) < 55°

New MP + LWC > 0

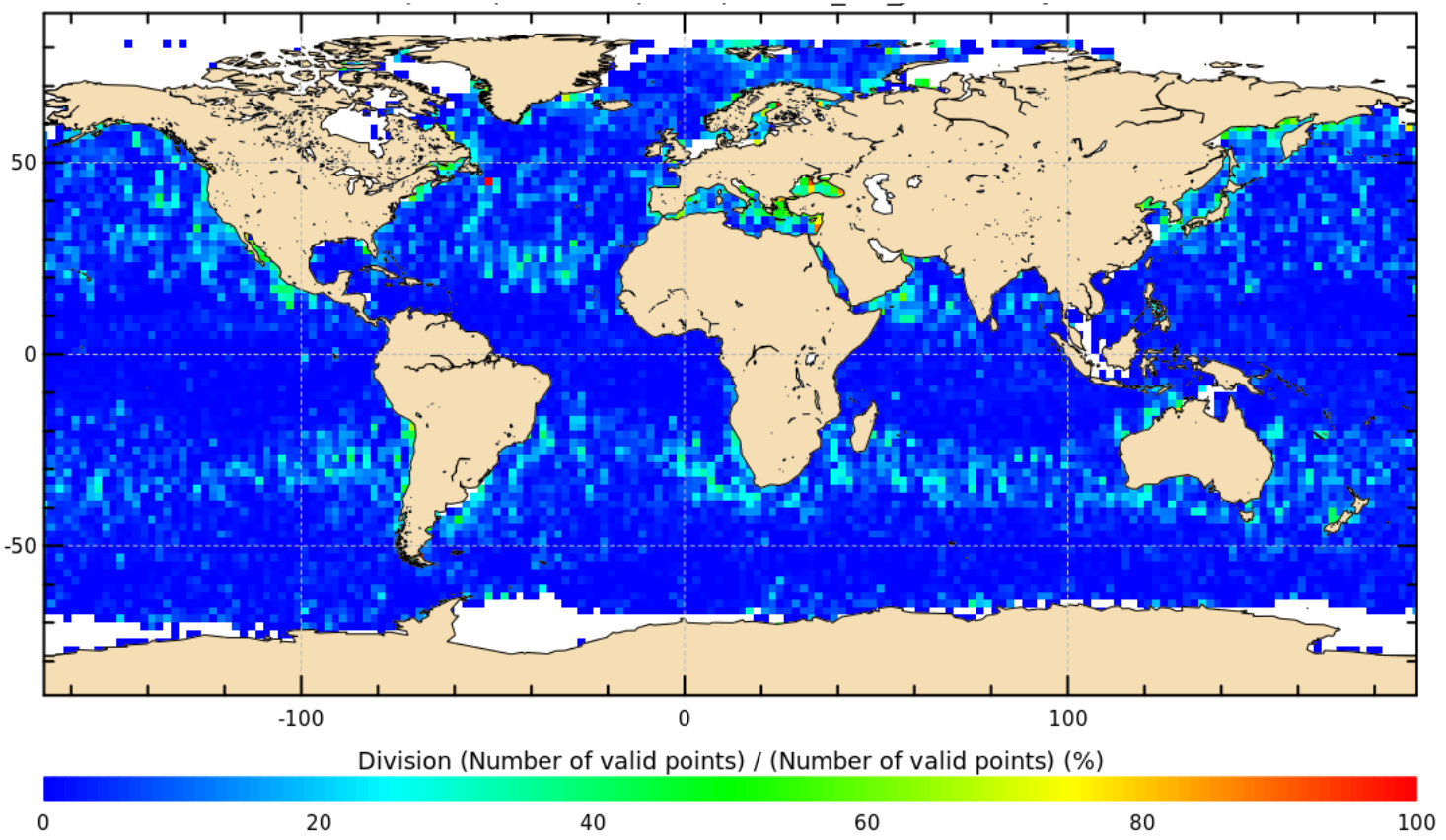
% of flagged data by grid boxes



➔ 12% of flagged points abs(LAT) < 55°

JT Modifications + LWC < 0

% of flagged data by grid boxes



➔ 5% of flagged points abs(LAT) < 55°

Comparison with TRMM data

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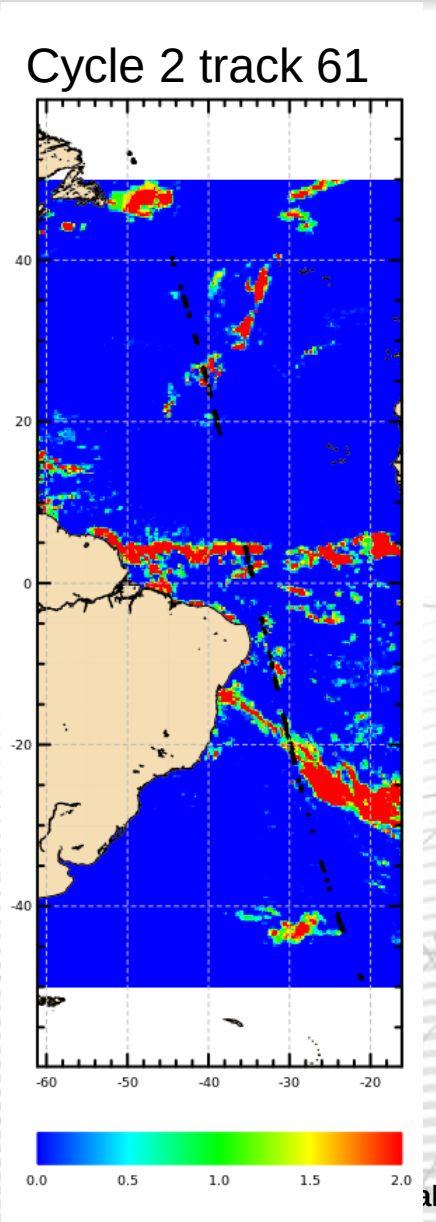
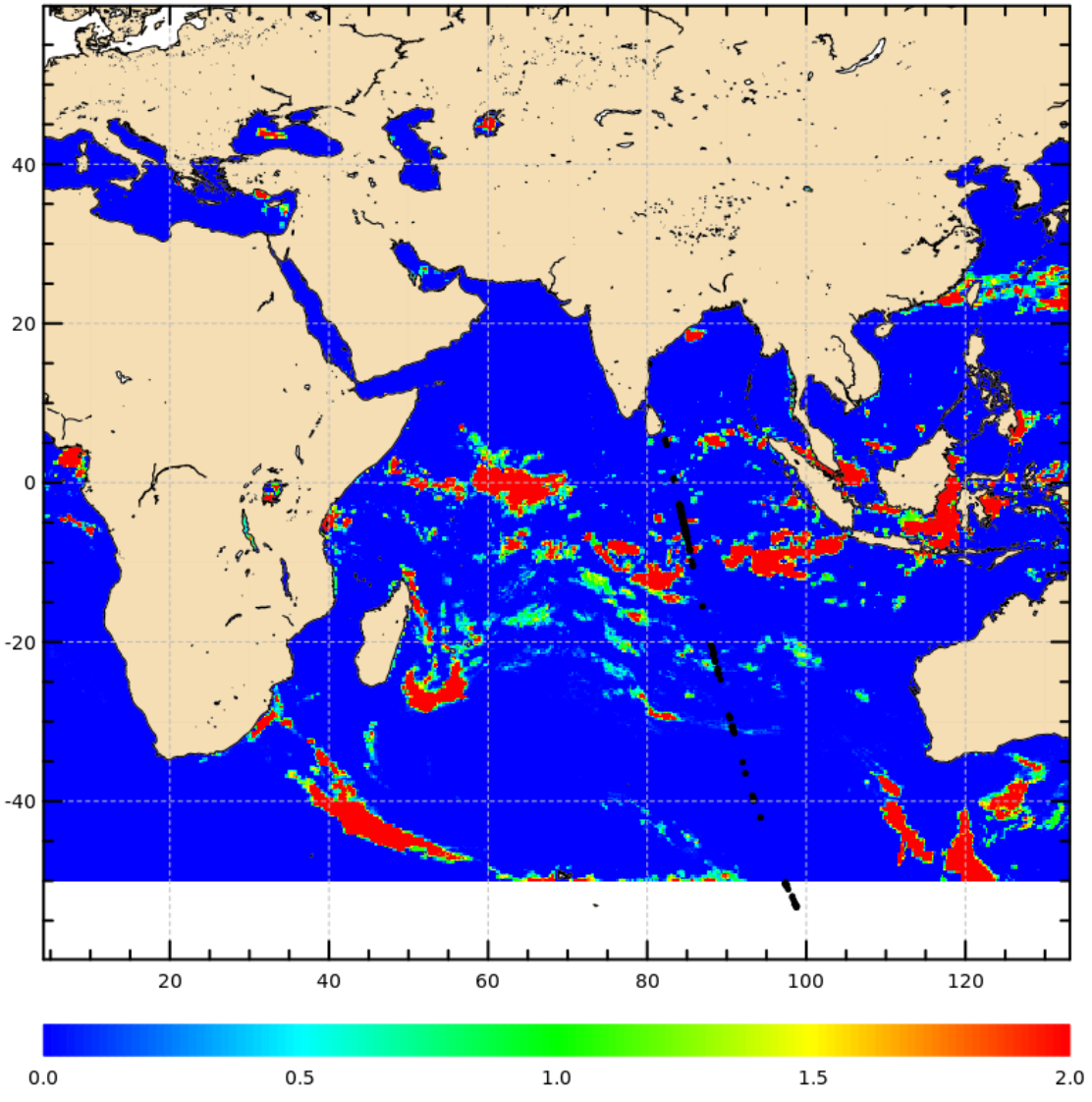
- Quite good agreement between the rain flag and TRMM measurements. The new version is less restrictive and more data are flagged.



Comparison with TRMM data

Cycle 2 track 23



Conclusions

- The Matching Pursuit in the ground segment needs to be upgrade, the settings are not optima.

- With a parameters update and input data selection, the algorithm provides good results. The tested configuration is a bit restrictive but it is possible to release it.

- J. Tournadre has tested a new version of the algorithm which process data with a constant packet dimension. The new version provides good results and identifies a bit more data.

- Combining the outputs of the Matching Pursuit algorithm and the radiometer liquid water content lead to a consistent rain flag definition.

- The two versions have a good agreement with TRMM measurements on rain cells.

- One of the 2 solutions will be selected to implement in the ground processing.

Thank you for your attention !