Removing Radio Frequency Interferences is possible: The SMOS example

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SMAP CAL/VAL workshop
September 1, 2015
SMOS, launched in 2009, was the first satellite to operate in L-band, but does not have any on-board hardware to filter RFI.

Although active emissions in the protected band are illegal according to ITU-RR 5.340, RFI were globally present.

The SMOS team put in place several strategies to improve the RFI situation:

1. RFI detection and Flagging
2. Image mitigation techniques
3. Increase situation awareness
4. Support initiatives to improve regulatory framework
5. Enforce countries to switch off illegal RFI
RFI in SMOS Observations:

SMOS observations show the presence of RFI
RFI probability Map observed from 5\textsuperscript{th} to 19\textsuperscript{th} December 2014

Source: Philippe Richaume (CESBIO)

http://www.cesbio.ups-tlse.fr/SMOS_blog
RFI in SMAP Observations:

Unfiltered SMAP observations show similar presence of RFI

Source: M. Aksoy
Filtered SMAP observations remove most, but not all, RFI.

However, filtering data has a cost in terms of radiometric noise and undetected RFI is likely to be present in the data.

Source: M. Aksoy
Approach to improve RFI situation

Detection / Reporting to Authorities / Cancellation of RFI source

• Identify, geo-locate and characterise the RFI sources
• Provide this information regularly to the National Spectrum Management Authorities so that they can initiate investigations in order to identify the type of emitter and take appropriate actions

This procedure has obtained important successes in eliminating RFI at L-band.
Clear reduction of RFI along the mission, particularly the stronger RFIs.

RFI CAN BE REMOVED!!
Conclusions

- RFI are an important threat to remote sensing missions.
- On-board hardware and software to deal with RFI are a must in all new missions.
- But it is of main importance, not just for one mission, but for the rest of the scientific community to target RFIs from root.
- The experience of SMOS shows that RFIs can be eliminated.
- Cooperation between SMOS and SMAP can be very beneficial for both missions, and will strengthen a common L-band position in international organizations.
Probability of sustained hard RFI occurrences (no outliers detection) for 20100315 - 07 days period from BB post-processing of OPER/REPR SML2 UDP & DAP - ASCENDING only passes - Dual & Full polarizations products

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