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The EUMETSAT  
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## **Ocean and Sea Ice SAF**

# **ASCAT-A anomalies in September and October 2014**

**SAF/OSI/CDOP2/KNMI/TEC/RP/236**

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# **Abstract**

In September and October 2014 two small anomalies occurred for the ASCAT-A scatterometer. This document gives accurate corrections for these anomalies that, when applied before reprocessing, will improve the ASCAT-A level 2 products.

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# 1 Introduction

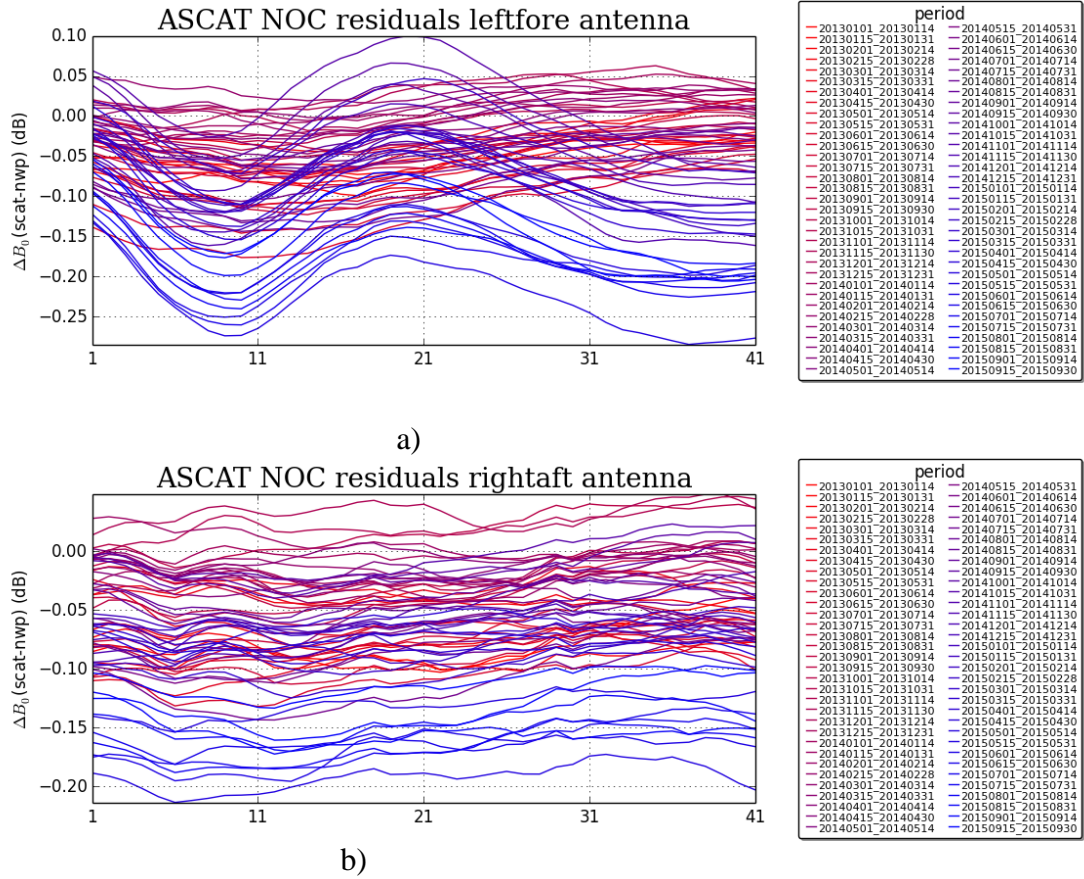
In this note two ASCAT-A anomalies that occurred in autumn 2014 are assessed accurately. It gives corrections for these anomalies that can be applied before reprocessing of the ASCAT-A level 2 products.

Two small anomalies occurred for ASCAT-A during September and October 2014. The first anomaly occurred on 13 September 2014 as an oscillation in the ocean calibration residuals for the left-fore antenna as a function of incidence angle or across swath position. The second anomaly occurred on 29 October 2014 as a drop in overall backscatter of  $\sim -0.08$  dB. The two anomalies are treated independently from each other and their possible causes and effect are in detail described in [EUMETSAT, 2015] and [Airbus, 2015]. Here we quantify the associated changes in beam calibration.

## 2 First anomaly: An oscillation in the left-fore beam

The first anomaly was originally noticed in the NWP Ocean Calibration (NOC) residuals, but is not clearly visible in the wind domain or any of the wind processing monitoring parameters, because its effect on the wind inversion is rather subtle. The most precise timing of the anomaly is 13 September 2014 as seen in NOC residuals from 9-11, 10-12 and 11-13 September 2014 in [EUMETSAT, 2015, figure 4].

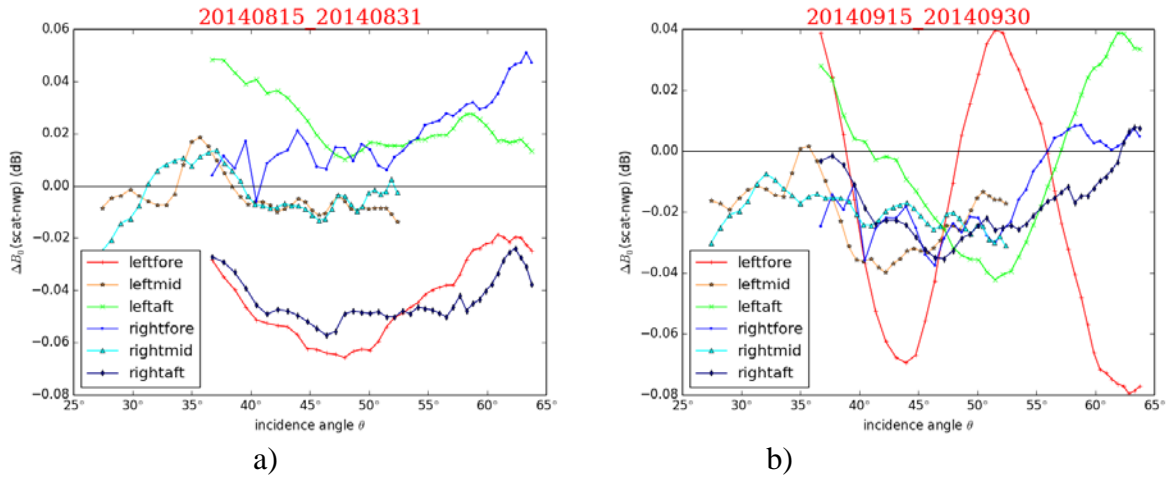
In Figure 1 the NOC residuals as a function of Wind Vector Cell number (WVC 1 is the innermost) are shown for ASCAT-A over the period from January 2013 to September 2015 for the left-fore and right-aft antenna. The oscillation for ASCAT-A can be clearly seen in the left-fore antenna but is absent in the other antennas. The oscillation is constant and persistent in time.



**Figure 1** – NOC residuals as a function of WVC number (WVC 1 is innermost) for ASCAT-A data. Data from January 2013 to September 2015 is shown. Each point represents a data period from day 1-14 or from day 15-end of the month at 12.5 km resolution.

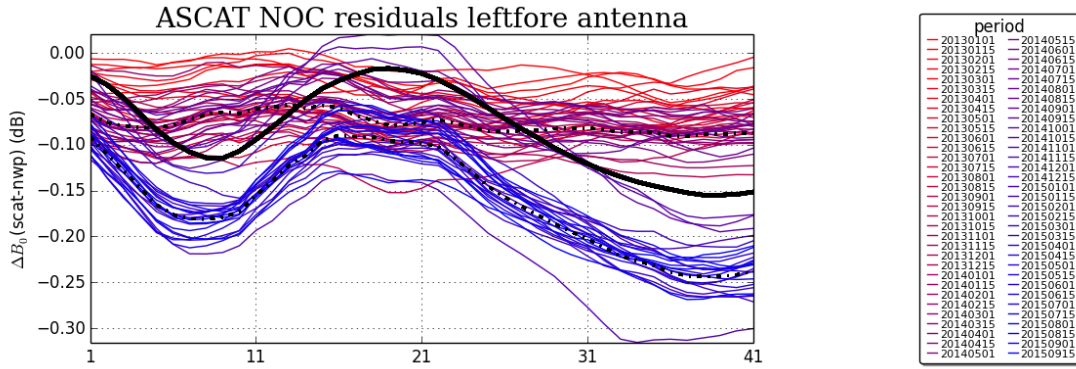
a) left-fore antenna  
b) right-aft antenna

In Figure 2 the ASCAT-A residuals from just before and just after the anomaly are shown. The sudden appearance of the left-fore antenna oscillation is evident.



**Figure 2** – NOC residuals from ASCAT-A  
a) before the anomaly: 2014-08-15 to 2014-08-31 and  
b) after the anomaly: 2014-09-15 to 2014-09-30

Changing weather conditions and seasonal effects give rise to the relatively large vertical offsets of the residuals as a function of incidence angle in Figure 1. To reduce this spread the ASCAT-A and ASCAT-B residuals are subtracted from each other in Figure 3. ASCAT-B experiences in a half-month period in good approximation the same weather conditions and seasonal effects as ASCAT-A. Thus the spread is reduced in Figure 3 as compared to Figure 1a).



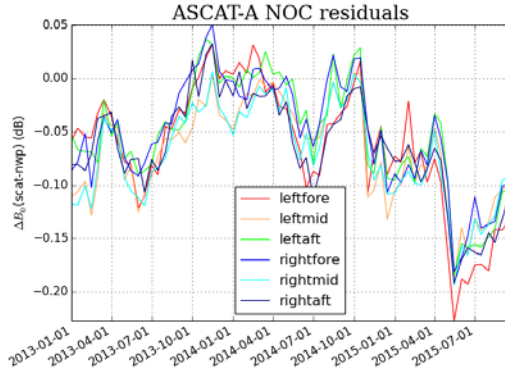
**Figure 3** – NOC difference residuals from (ASCAT-A - ASCAT-B). The black dashed lines are the averages for longer periods before and after both anomalies. The black solid line is the correction for the anomaly.

The black dashed lines show the average values over the period before both anomalies (period 1: 2013-08-15 to 2014-08-15) and the period after both anomalies (period 2: 2014-11-01 to 2015-09-15). The black solid line is the difference between the two black dashed lines and is used as correction for the anomaly. This correction is for both anomalies together. The corrections for anomaly 1 and anomaly 2 will be split in the actual implementation in AWDP (see Summary for actual numbers).

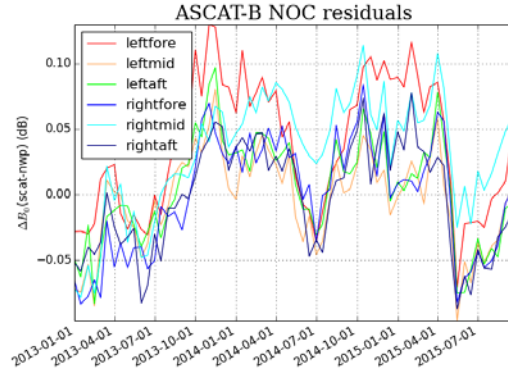
### 3 Second anomaly: An overall drop in backscatter

The second anomaly was originally noticed in the AWDP wind processing monitoring as a drop in scatterometer wind speed and has been later noticed in the wind domain by the wind processing monitoring parameters, however, its effect on the wind inversion is subtle [Ricciardulli, 2015]. The most precise timing of the anomaly is 2:00 UTC on 29 October 2014 as seen in the power gain product [EUMETSAT, 2015, figure 9]. The effect, as noticed in the power-gain product, is assumed to cause the same backscatter calibration anomaly for all antennae in all WVCs.

In Figure 4 the NOC residuals are shown for ASCAT-A and ASCAT-B over the period from January 2013 to September 2015. The anomaly for ASCAT-A can be clearly seen. The residuals for the two scatterometers show a similar trend except for the period that contains the second anomaly.



a)

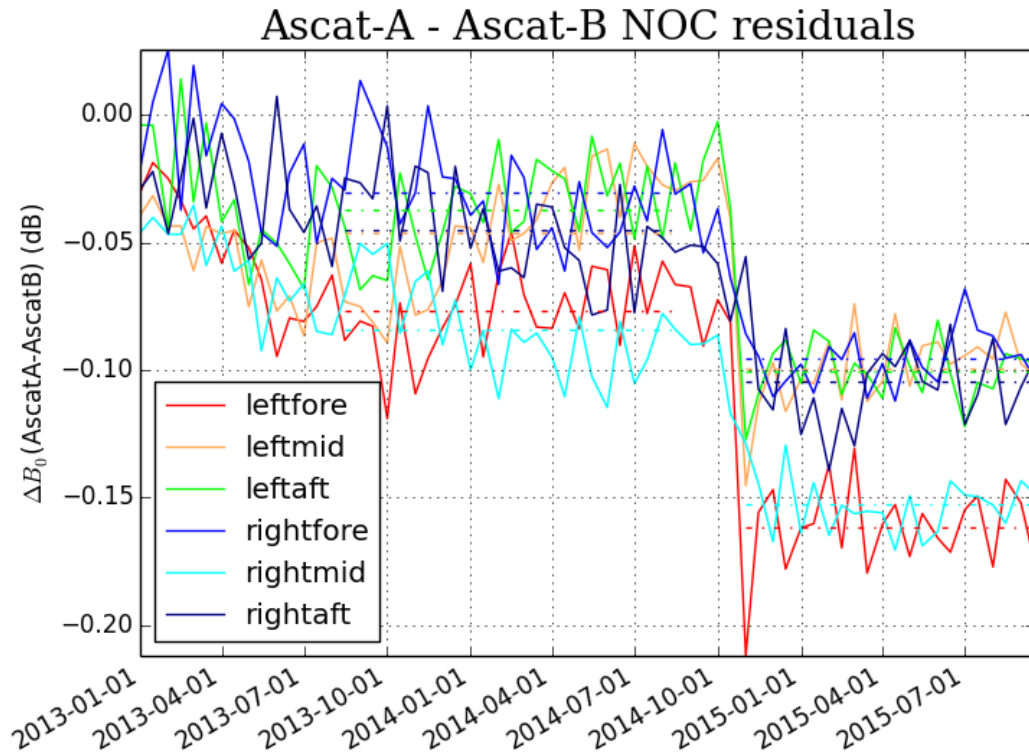


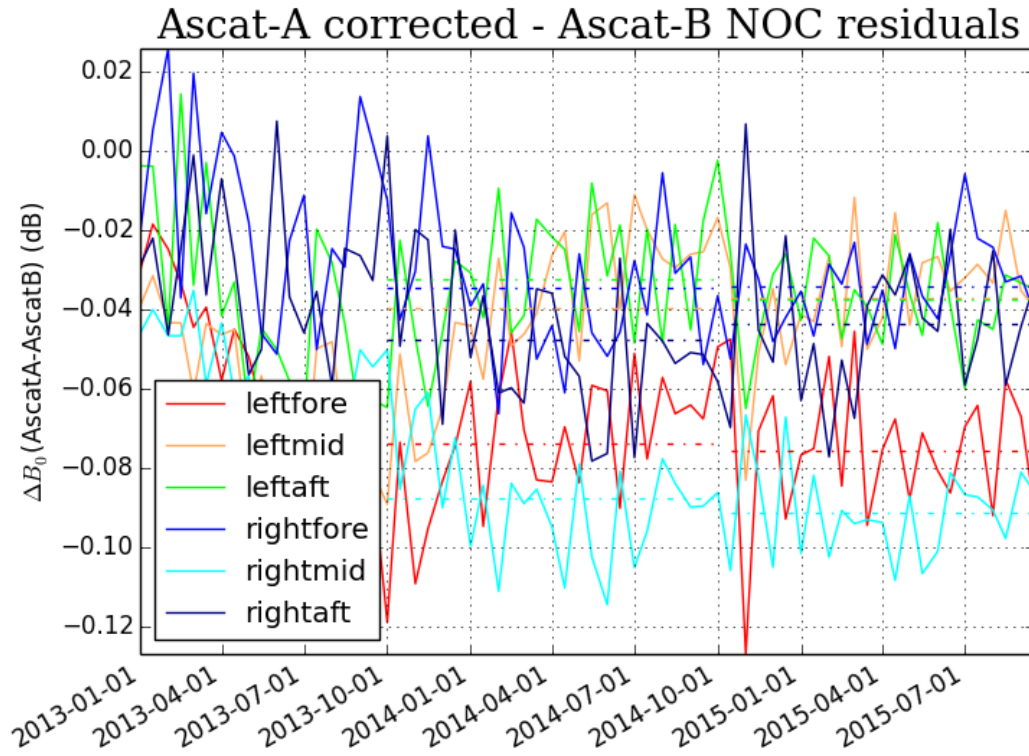
b)

**Figure 4**—NOC residuals from ASCAT data. Data from January 2013 to September 2015 is shown. Each point represents a data period from day 1-14 or from day 15-end of the month in 12.5 km resolution.

- a) ASCAT-A
- b) ASCAT-B

Even though similar, but weather-related, jumps occur on other dates, the anomaly is significant when the residuals from ASCAT-A and ASCAT-B are subtracted from each other. This is shown in Figure 5 (top).





**Figure 5** –NOC residuals from ASCAT-A and ASCAT-B as in Figure 4 are subtracted from each other, before correction (top) and after correction of ASCAT-A anomalies (bottom)

The dashed lines show the average value per antenna over the period before both anomalies (period1: 2013-08-15 to 2014-08-15) and the period after both anomalies (period2: 2014-11-01 to 2015-09-15). The jump for the left-fore antenna is somewhat bigger than the jump for the other antennas. This is probably because the correction is for both anomalies together. The mean jump for all antennas, except the left-fore, is the correction for anomaly 2. This value has to be subtracted from the previously presented correction for the left-fore antenna in section 1 to obtain the first left-fore antenna anomaly.

The value of the jumps is specified below:

Jump per antenna (left fore, left mid, left aft, right fore, right mid, right aft):

[-0.085 -0.053 -0.063 -0.065 -0.069 -0.060] dB

Mean jump for all antennas except, left fore : -0.062 dB with a 1-sigma spread of 0.005 dB.

In Figure 5 (bottom) the NOC residuals are shown after the correction for the ASCAT-A anomalies is applied. As can be seen the level of the NOC residuals shows no significant jump anymore.



# Summary

In September and October 2014 two small anomalies occurred for the ASCAT-A scatterometer. This document gives accurate corrections for these anomalies that, when applied before reprocessing, will improve the ASCAT-A level 2 products.

The first anomaly correction is provided in Table 1.

1	2	3	4	5	6	7	8	9	10	11
-0.04	-0.03	-0.01	0.00	0.02	0.04	0.05	0.05	0.05	0.04	0.03
12	13	14	15	16	17	18	19	20	21	22
0.02	0.00	-0.01	-0.02	-0.03	-0.04	-0.04	-0.05	-0.04	-0.04	-0.03
23	24	25	26	27	28	29	30	31	32	33
-0.02	-0.01	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.07
34	35	36	37	38	39	40	41			
0.08	0.08	0.09	0.09	0.09	0.09	0.09	0.09			

**Table 1** – The numerical backscatter correction in dB for the ASCAT-A left-fore beam anomaly on 13 September 2014 12:00 UTC at each 12.5-km WVC, counted from the innermost WVC.

The numerical backscatter correction of the ASCAT-A gain anomaly on 29 October 2014 2:00 UTC is estimated to be **+0.062 dB**.

# Glossary

ASCAT	- Advanced SCATterometer
AWDP	- ASCAT Wind Data Processor
NOC	- NWP Ocean Calibration
WVC	- Wind Vector Cell

# References

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