EUMETSAT AC SAF

REFERENCE: **SAF/AC/DMI/V&V/RP/001**
ISSUE: 1/2020
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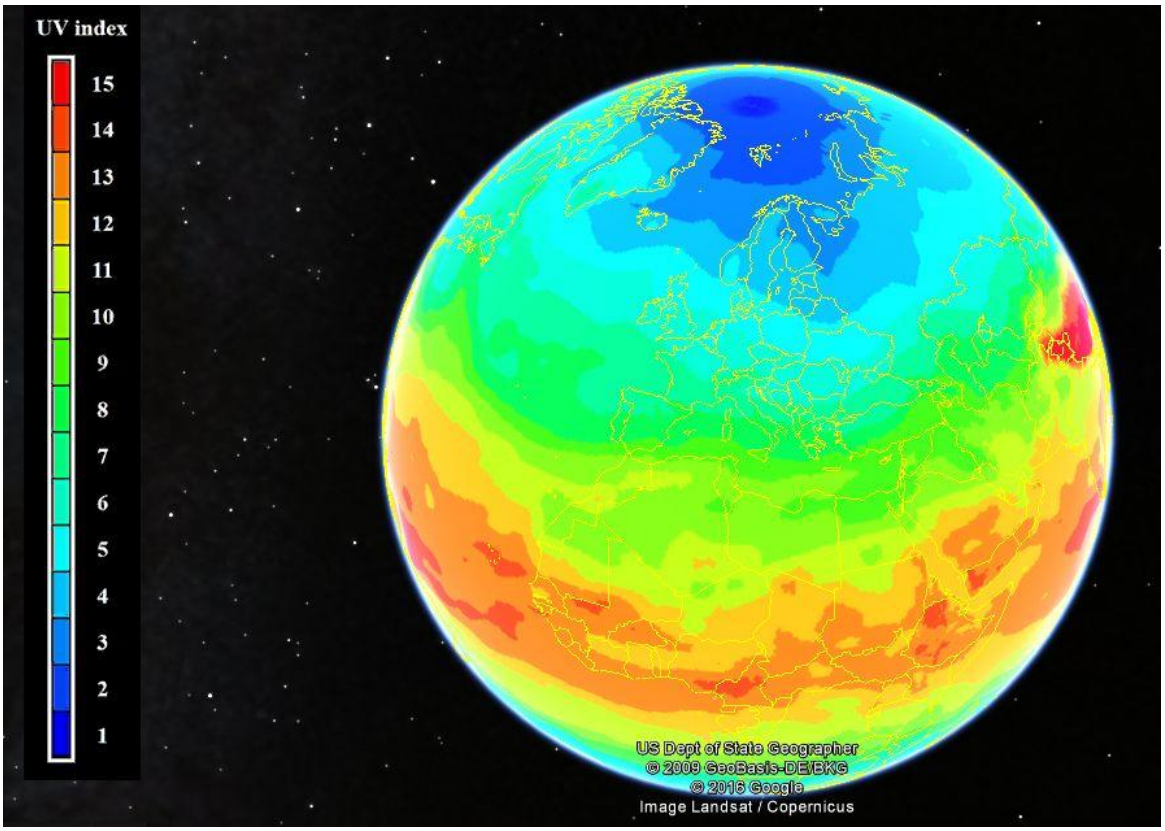
AC SAF VALIDATION REPORT

Validated products:

Name	Satellite(s)
Near real-time UV index, clear-sky Near real-time UV index, cloud-corrected	Metop-C



Author:

Name	Institute
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Reporting period: November 2019 – March 2020

Input data versions: Assimilated Total Ozone (ATO) version 4.2, since May 2014

Data processor versions: NRTUVI version 3.3, since May 2013

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Introduction to EUMETSAT Satellite Application Facility on Atmospheric Composition monitoring (AC SAF)

Background

The monitoring of atmospheric chemistry is essential due to several human caused changes in the atmosphere, like global warming, loss of stratospheric ozone, increasing UV radiation, and pollution. Furthermore, the monitoring is used to react to the threats caused by the natural hazards as well as follow the effects of the international protocols.

Therefore, monitoring the chemical composition and radiation of the atmosphere is a very important duty for EUMETSAT and the target is to provide information for policy makers, scientists and general public.

Objectives

The main objectives of the AC SAF is to process, archive, validate and disseminate atmospheric composition products (O_3, NO_2, SO_2, BrO, HCHO, H_2O, OClO, CO, NH3), aerosol products and surface ultraviolet radiation products utilising the satellites of EUMETSAT. The majority of the AC SAF products are based on data from the GOME-2 and IASI instruments onboard Metop satellites.

Another important task besides the near real-time (NRT) and offline data dissemination is the provision of long-term, high-quality atmospheric composition products resulting from reprocessing activities.

Product categories, timeliness and dissemination

NRT products are available in less than three hours after measurement. These products are disseminated via EUMETCast, WMO GTS or internet.

- Near real-time trace gas columns (total and tropospheric O_3 and NO_2, total SO_2, total HCHO, CO) and high-resolution ozone profiles
- Near real-time absorbing aerosol indexes from main science channels and polarization measurement detectors
- Near real-time UV indexes, clear-sky and cloud-corrected

Offline products are available within two weeks after measurement and disseminated via dedicated web services at EUMETSAT and AC SAF.

- Offline trace gas columns (total and tropospheric O_3 and NO_2, total SO_2, total BrO, total HCHO, total H_2O) and high-resolution ozone profiles
- Offline absorbing aerosol indexes from main science channels and polarization measurement detectors
- Offline surface UV, daily doses and daily maximum values with several weighting functions

Data records are available after reprocessing activities from the EUMETSAT Data Centre and/or the AC SAF archives.

- Data records generated in reprocessing
- Lambertian-equivalent reflectivity
- Total OClO

Users can access the AC SAF offline products and data records (free of charge) by registering at the AC SAF web site.

More information about the AC SAF project, products and services: https://acsaf.org/

AC SAF Helpdesk: helpdesk@acsaf.org

Twitter: https://twitter.com/Atmospheric_SAF

Internal product ID's for project control

	Metop-A	Metop-B	Metop-C
NUV_CLEAR	O3M-4	O3M-91	O3M-409
NUV_CLOUD	O3M-5	O3M-92	O3M-410

References documents:

O3M SAF Algorithm Theoretical Basis Document for NUV, SAF/O3M/DMI/ATBD/001, Issue 1.11, 31.03.2020

O3MSAF Product User Manual for NUV, SAF/O3M/DMI/ATBD/001, Issue 1.8, 31-03-2020

NUV Validation Report , SAF/O3M/DMI/VR/NUV/001, Issue 5, 25.04.2012

AC SAF Product Requirements Document, Issue 1.5 , 17.06.2019

NUV products are calculated using GOME-2 Assimilated Total Ozone (ATO) fields as input. Feb. 11, 2009 NUV based on Metop-A ATO (NUV-A) was declared operational. Metop-B ATO became available May 2013 and NUV-A and NUV-B since then produced in parallel. Since July 14 2014 the operational product has been NUV-B. Comparison between NUV-B and NUV-A is a part of the Quality Control shown on the NUV web page (nuv.dmi.dk). On Nov. 13 2019 the Metop-C ATO was available at DMI and the NUV processing system updated in order to produce all three NUV products.

The scope of this document is to present a comparison between the new NUV-C product, the NUV-A and especially the operational NUV-B product in order to determine if quality of the NUV-C is within the requirements in the Product Requirement Document.

All ATO input are processed using the same algorithm as described in the ATBD and using the same auxiliary data and thus three set of NUV/CLEAR maps (0.25x0.25 degrees) has been produced daily. The comparison below is only performed on the NUV/CLEAR products, however the correction for cloud cover does not depend upon the ATO input, thus the comparison below is also valid for the NUV/CLOUD products.

In the following NUV products from Nov. 15 2019 to Mar. 15 2020 (122 days) are compared by subtracting the daily global fields and calculating statistics.

In figure 1 the mean the differences are shown together with the ± 2 standard deviation and in figure 2 the relative mean difference is shown. In figures 3 and 4 the deviations are averaged over 30° intervals in latitude and longitude. A larger than average deviation are noticed for days 92-95 (Feb. 14 to 17). The effect is most prominent for NUV-B and for latitudes south of -30°. The reason for this not totally understood, but may be anomaly in the ozone assimilation. This incident was not detected in the operational quality control on the NUV web page, the QC routines and web page shall be updated in order to detect similar incidents in the future.

The overall results for the three comparisons are 0.11 corresponding to 1.9% for B-C, 0.02 (0.7%) for A-C and 0.09 (1.3%) for B-A. The most recent comparison validation of NUV-A and NUV-B against ground based measurements, showed an agreement of 7.8%.The conclusion of the results here are that accuracy the NUV-C product is also close to the target accuracy of 10% and well within the threshold of 20%

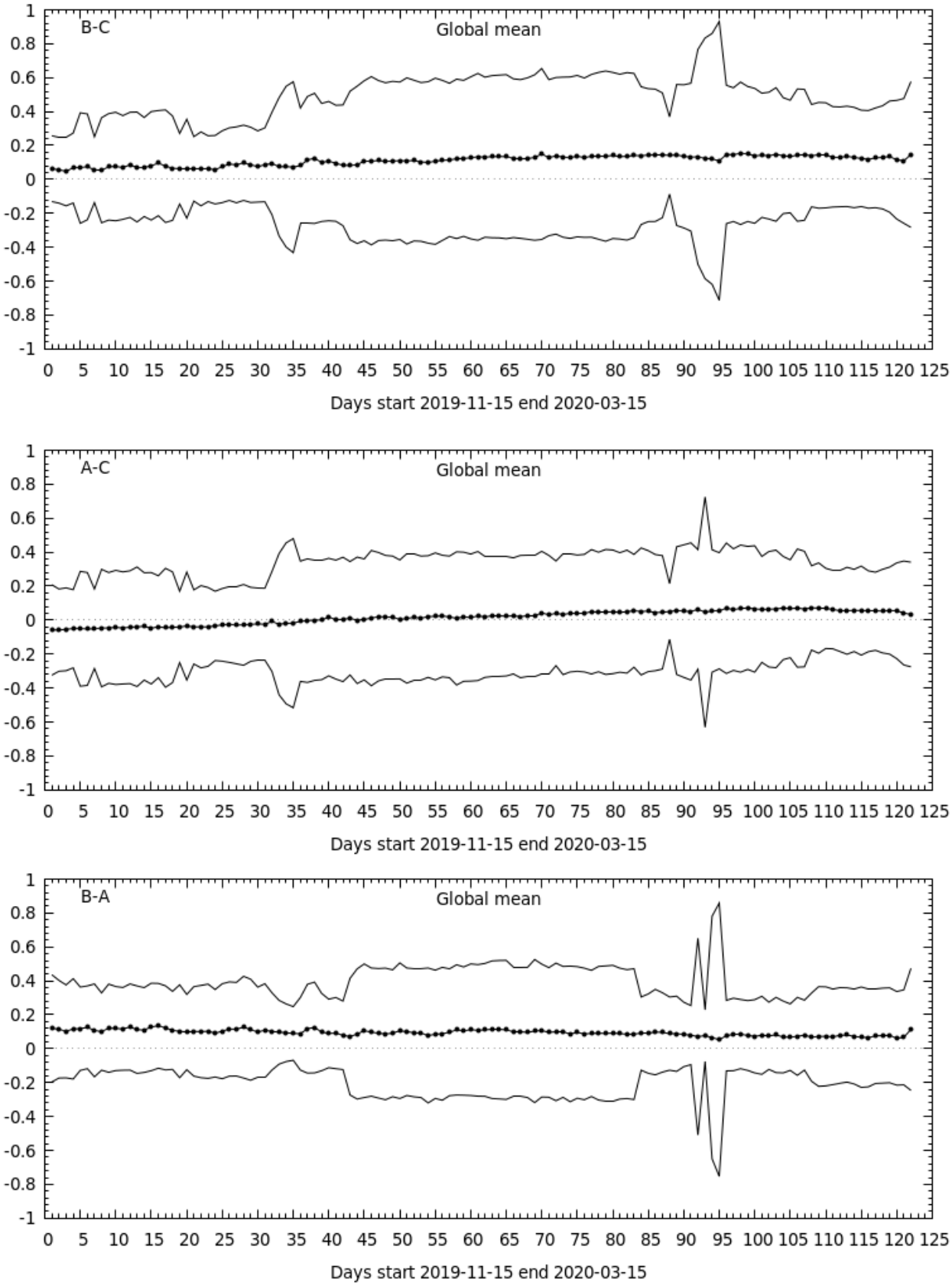

Fig. 1. Global difference between NUV-B and NUV-C (top), NUV-B and NUV-A (middle), NUV-A and NUV- C (bottom) in index value. Solid lines are the mean ± 2 standard deviations

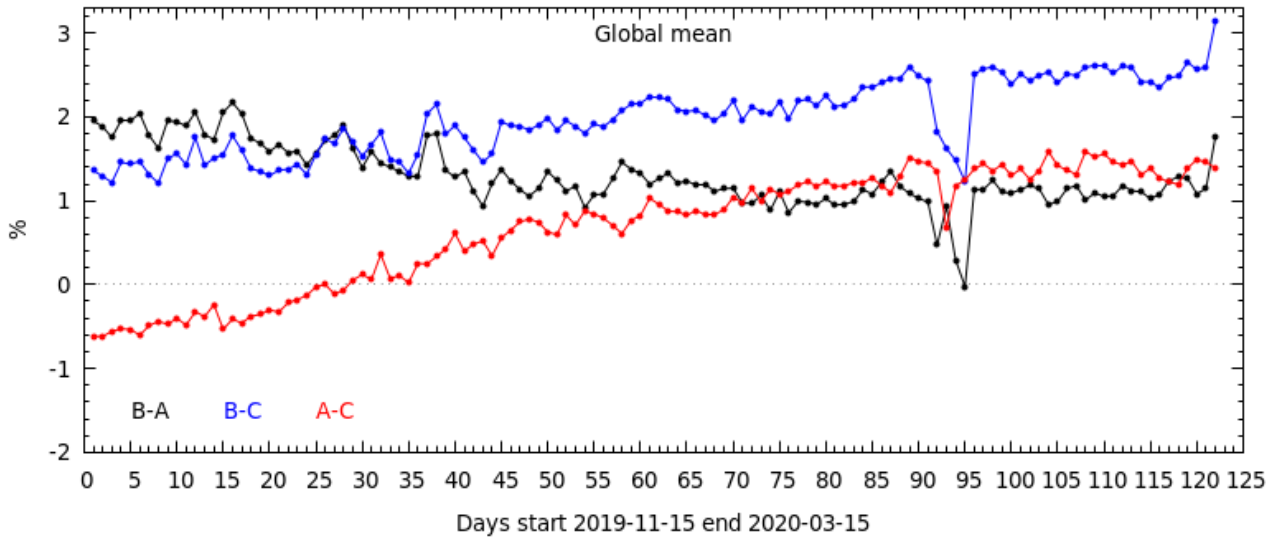

Fig. 2. The global relative difference between NUV-B and NUV-C (BC), NUV-B and NUV-A (BA), NUV-A and NUV- C (BC).

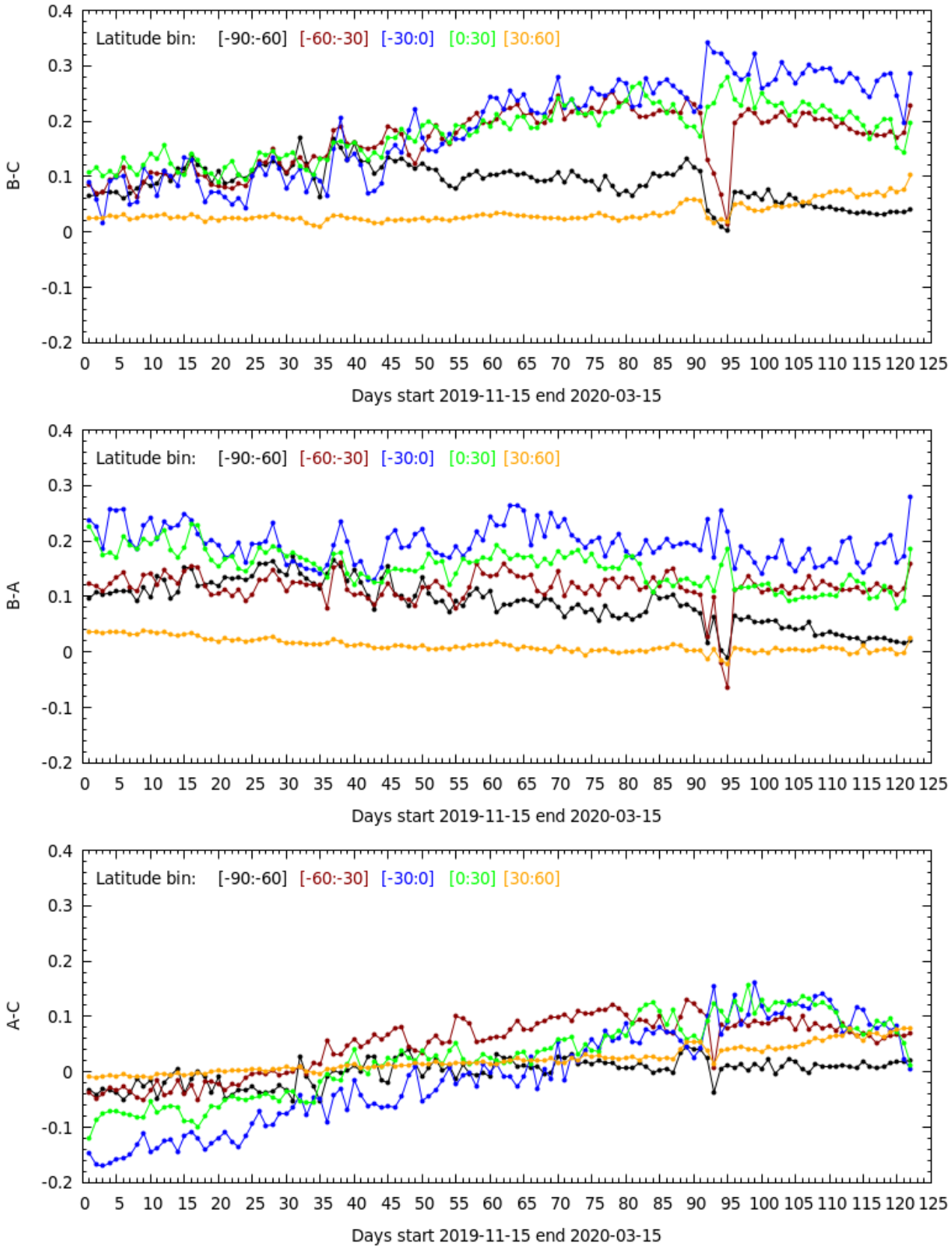

Fig. 3. Mean differences in 5 latitude intervals. Latitudes above +60° not included since UV is too small for a meaningful comparison.

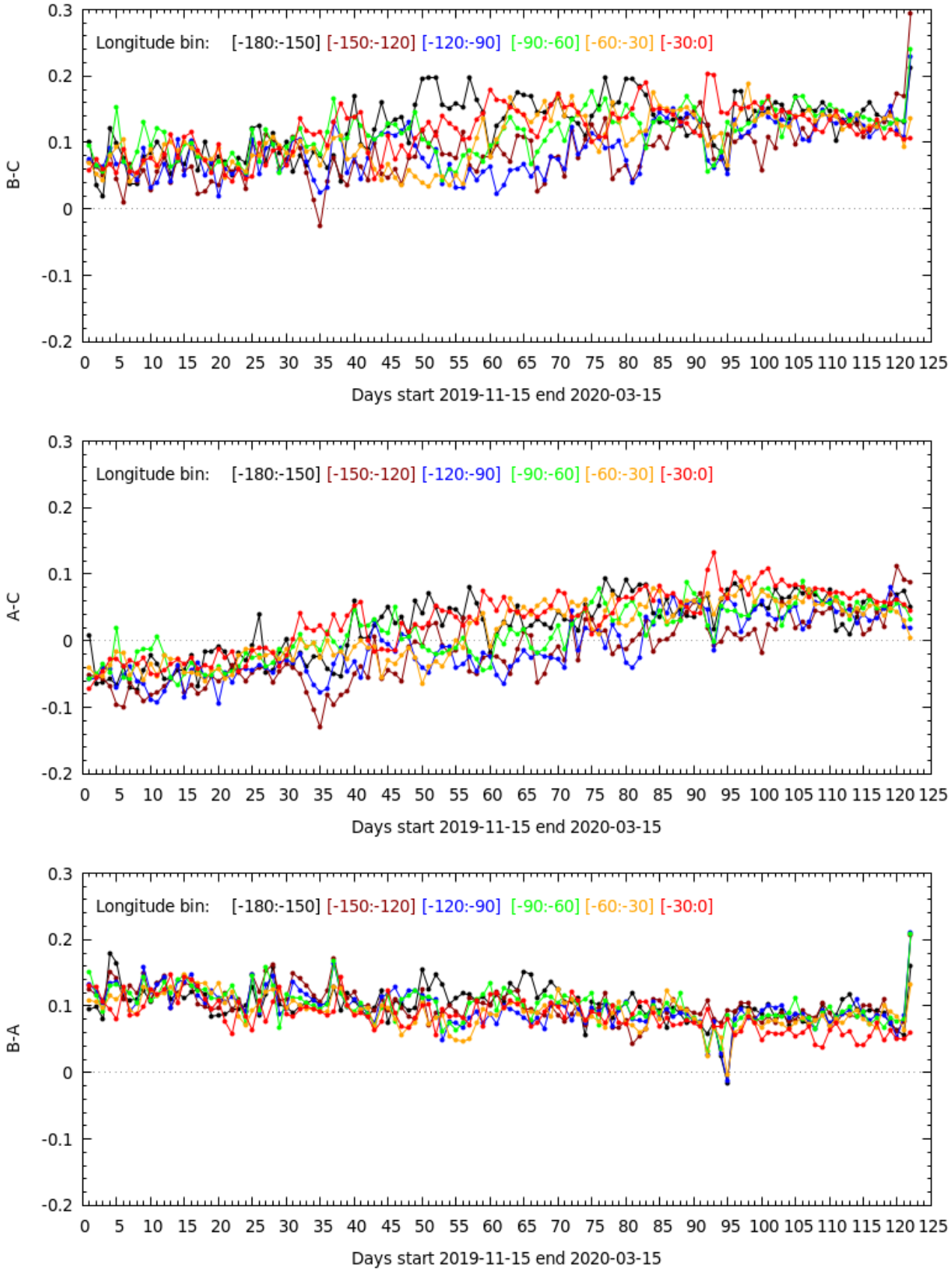

Fig. 4a. Mean differences in 6 longitude intervals, western hemisphere.

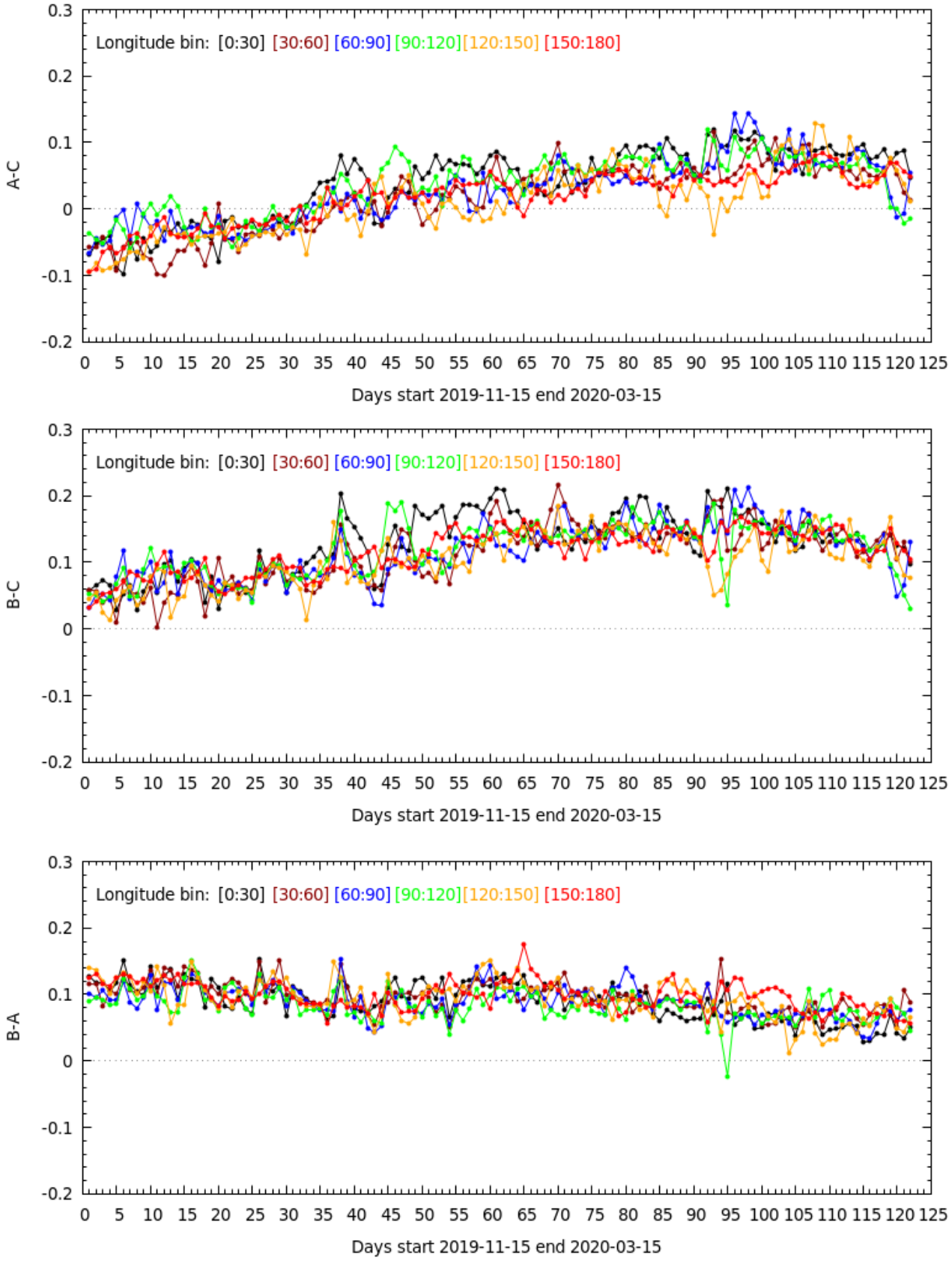

Fig. 4b. Mean differences in 6 longitude intervals, eastern hemisphere.