



CAMAERA

IMPACT OF USING REGIONAL EMISSIONS IN IFS-COMPO

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PROGRAMME OF
THE EUROPEAN UNION

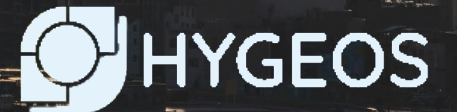


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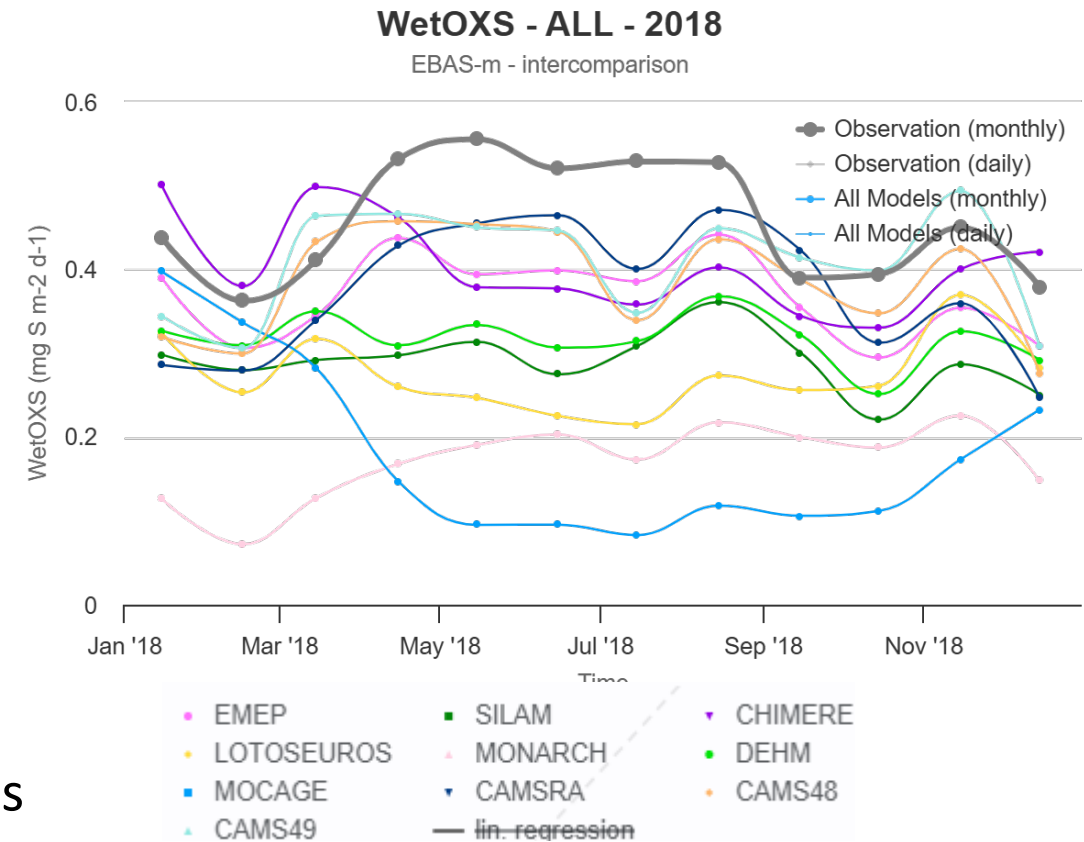


INTRODUCTION

Improve the consistency between regional and global models (WP9 & 10)

Intercomparison of regional and global models using similar emissions and resolution

- Build on the task 4041 model intercomparison carried out by METNorway in CAMS2_40
- Merge regional emissions into global
- Comparison and evaluation of the simulated fields by the regional and global models
- Extra regional models participation: MINNI (ENEA) and GEM-AQ (IOS-PIB)





INTERCOMPARISON SPECIFICS

Task 4041 intercomparison

- Year 2018
- Meteorological forcing from the IFS every 3h
- Chemical BC from IFS-COMPO every 3h
- Emissions CAMS-REG-v5.1 REF2 v2.0.1 for year 2018
- GFAS expe=0001
- PM split consistent with REF2 v2.0.1
- CAMS regional domain
- 0.1 x 0.1 degree resolution

IFS-COMPO simulations

- Using regional emissions over Europe (CAMS-REG-v5.1 REF2 v2.0.1) and global ones elsewhere (CAMS_GLOB_ANTv6.1)
- Or using global emissions over Europe
- Low resolution (0.5 x 0.5°) and high resolution (0.1 x 0.1°)
- Cycling forecasts : use of meteorology analysis

GEM-AQ and MINNI simulations

- 0.1x0.1 degree resolution



MERGING REGIONAL AND GLOBAL EMISSIONS

- **Regional emissions:** resolution 0.1 x 0.05, 8 initial parameters, use of PM split, csv format, annual emissions, 12 sectors
- **Global emissions:** resolution 0.1 x 0.1, 36 species, netcdf/grib format, mensual emissions, 21 sectors

Merging has been carried out for the the following species :

methane, carbon-monoxide, ammonia, non-methane-vocs, nitrogen-oxides, sulphur-dioxide, sulfate, organic-carbon, black-carbon



MERGING REGIONAL AND GLOBAL EMISSIONS

The definition of sectors doesn't overlap perfectly

Regional sectors	Global sectors
A_PublicPower	Power generation (ene)
B_Industry	Refineries (ref) + Industrial process (ind)
C_OtherStationaryComb	Commercial (com) + Residential (res)
D_Fugitives	Fugitives (fef)
E_Solvents	Solvents (slv)
F_RoadTransport_exhaust_gasoline :F1,F2,F3,F4	Road transportation (tro)
G_Shipping	Ships (shp)
H_Aviation	Off Road transportation (tnr)
I_OffRoad	Off Road transportation (tnr)
J_Waste	Solid waste and waste water (swd) + Solid waste landfills (swl)
K_AgriLivestock	Agriculture livestock (agl)
L_AgriOther	Agriculture soils (ags) + Agricultural waste burning (awb)



MERGING THE REGIONAL AND GLOBAL EMISSIONS

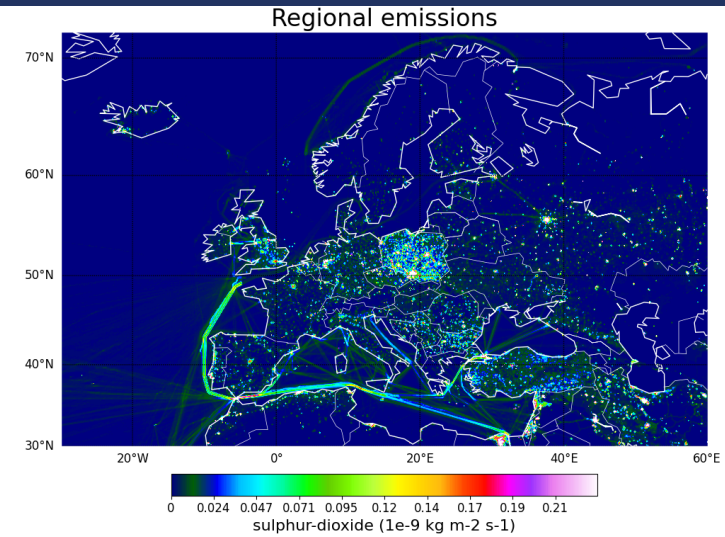
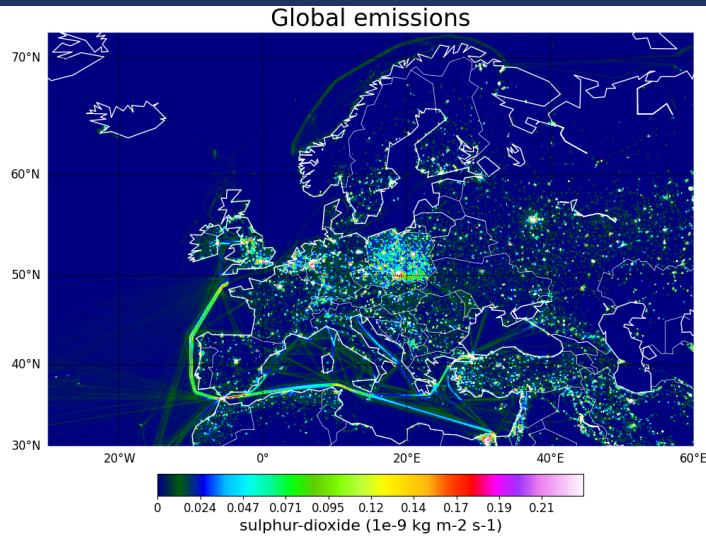
The definition of sectors doesn't overlap perfectly : hypothesis made

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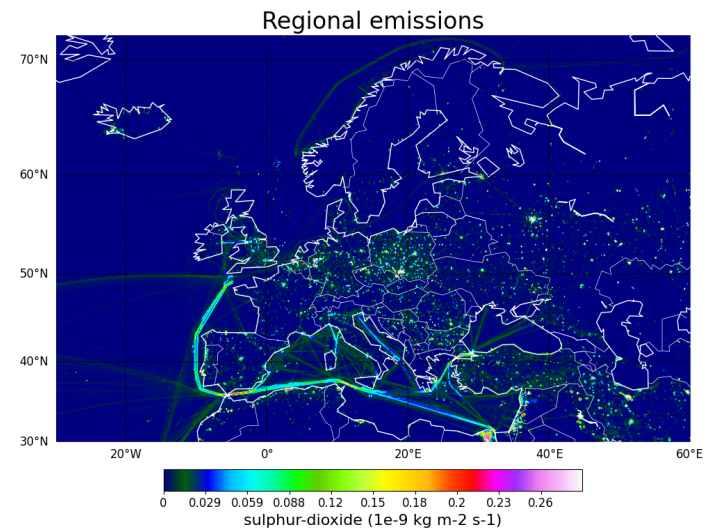
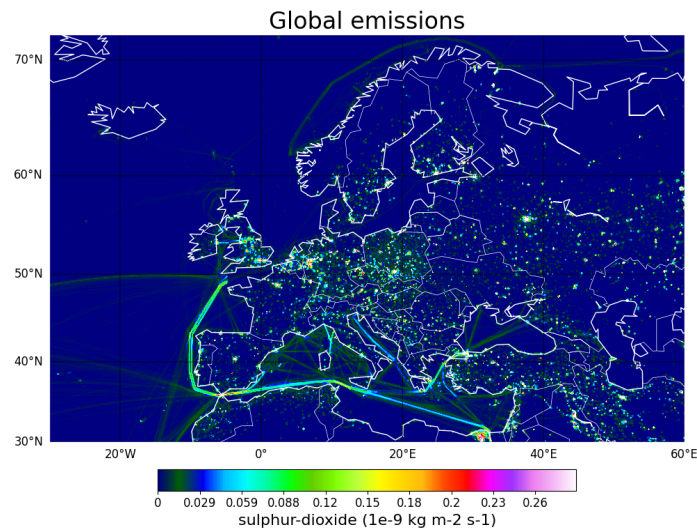


TOTAL EMISSIONS OF SO2

January 2018



July 2018

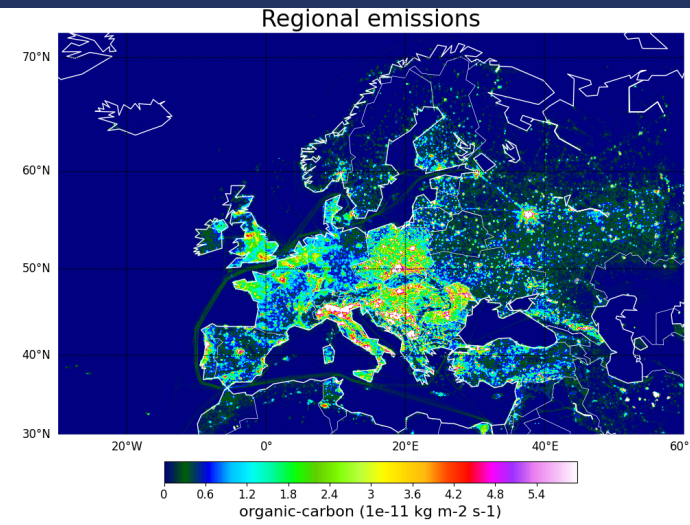
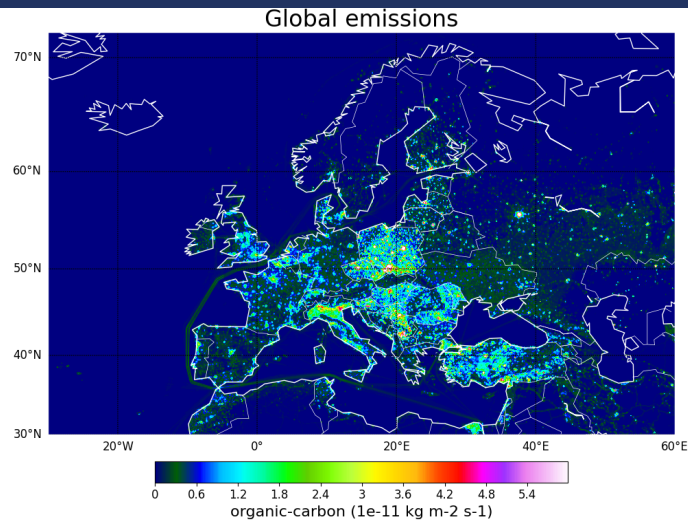


Emissions similar and of the same order of magnitude for SO₂, NH₃, CO

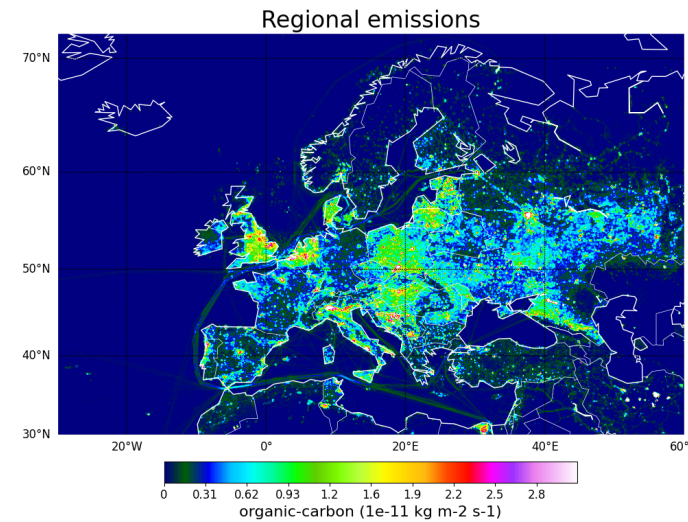
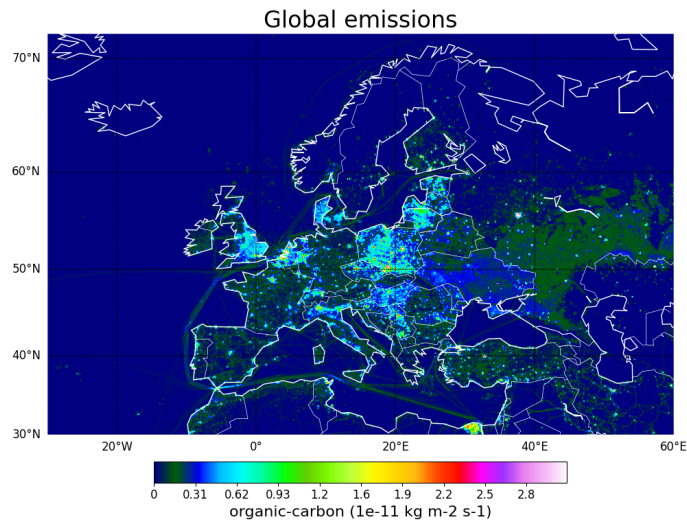


TOTAL EMISSIONS OF OC

January 2018



July 2018



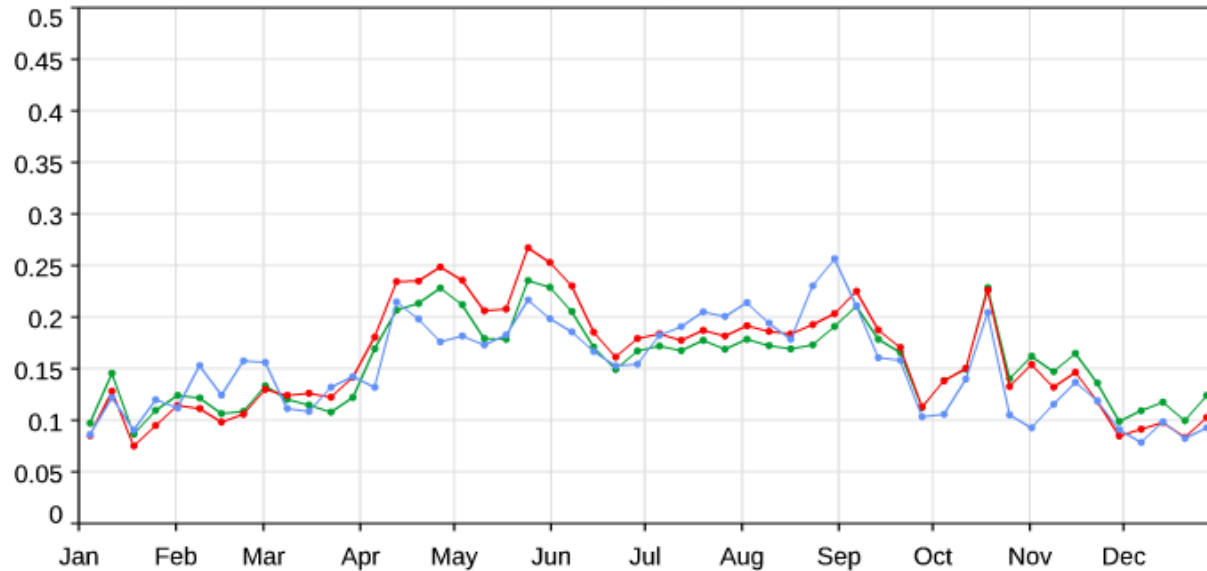
Regional emissions are higher because the condensable fraction of gas is included in the emissions



AOD EVALUATION

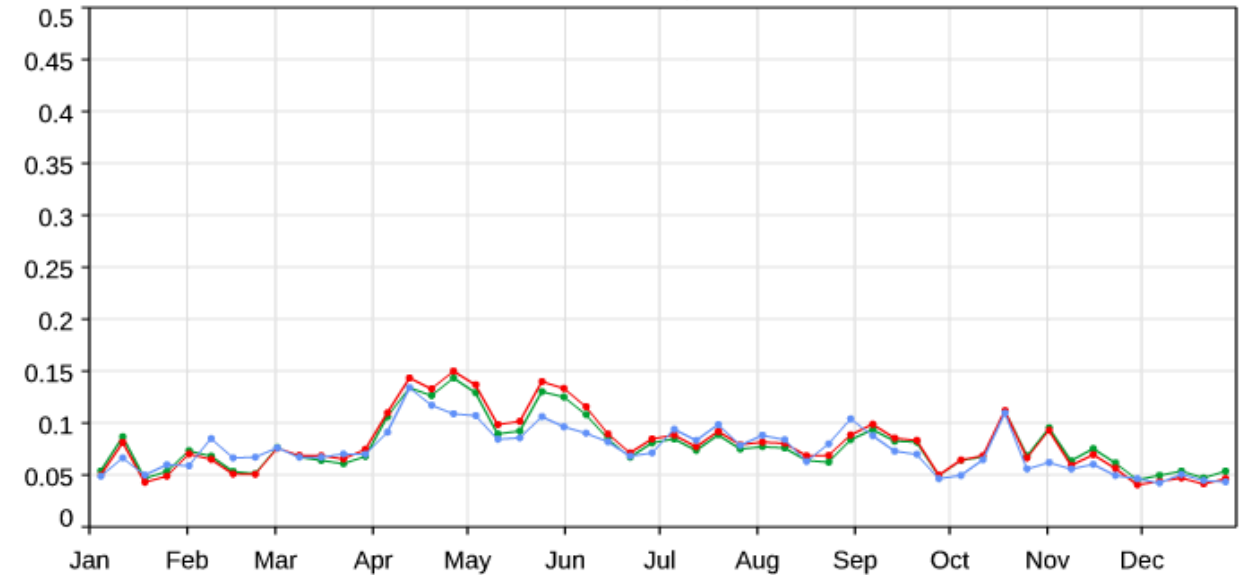
Mean. Model against L2.0 Aeronet AOT at 500nm.
119 sites in Europe. 1 Jan - 30 Dec 2018. 00Z, T+3 to 24. Ver0D 12.8.3.

— Obs — ibg7 — ibu7



Mean. Model against L2.0 Aeronet AOT at 1020nm.
133 sites in Europe. 1 Jan - 30 Dec 2018. 00Z, T+3 to 24. Ver0D 12.8.3.

— Obs — ibg7 — ibu7



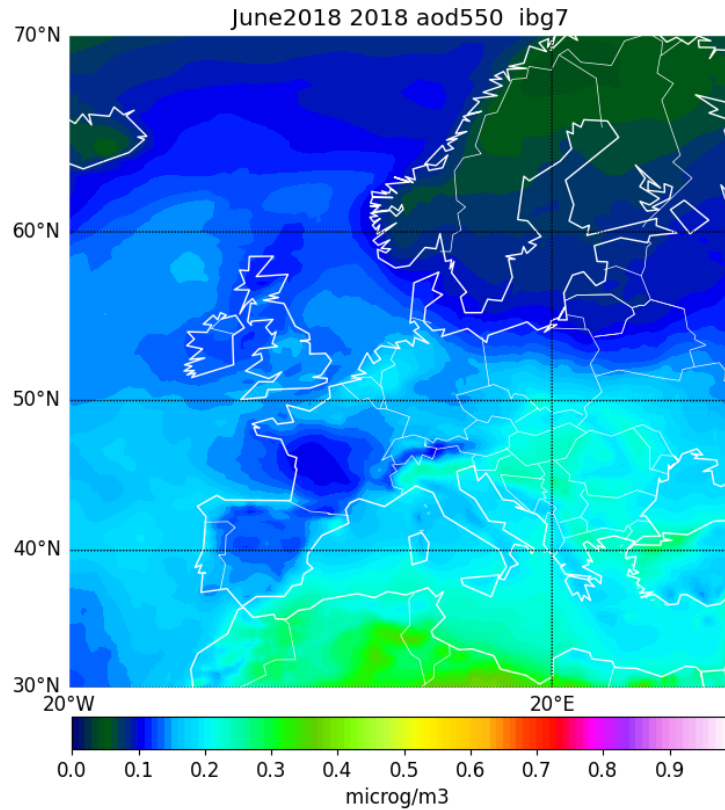
- Observations
- ibg7 = regional emissions on Europe
- ibu7 = global emissions

Small impact for AOD at 1020 nm
for the two experiments
Positive impact at 500 nm for
summertime

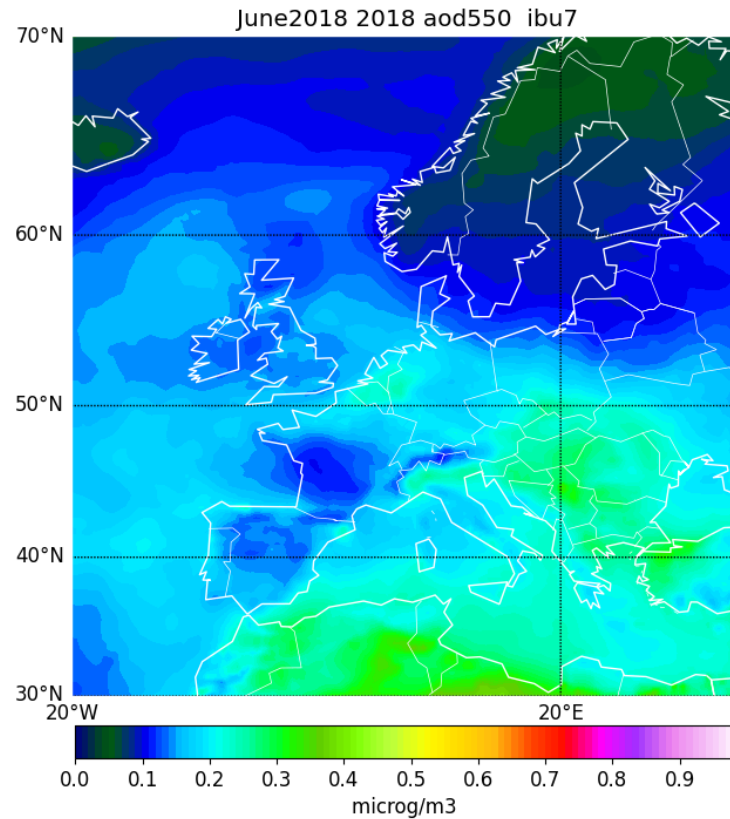


AOD EVALUATION

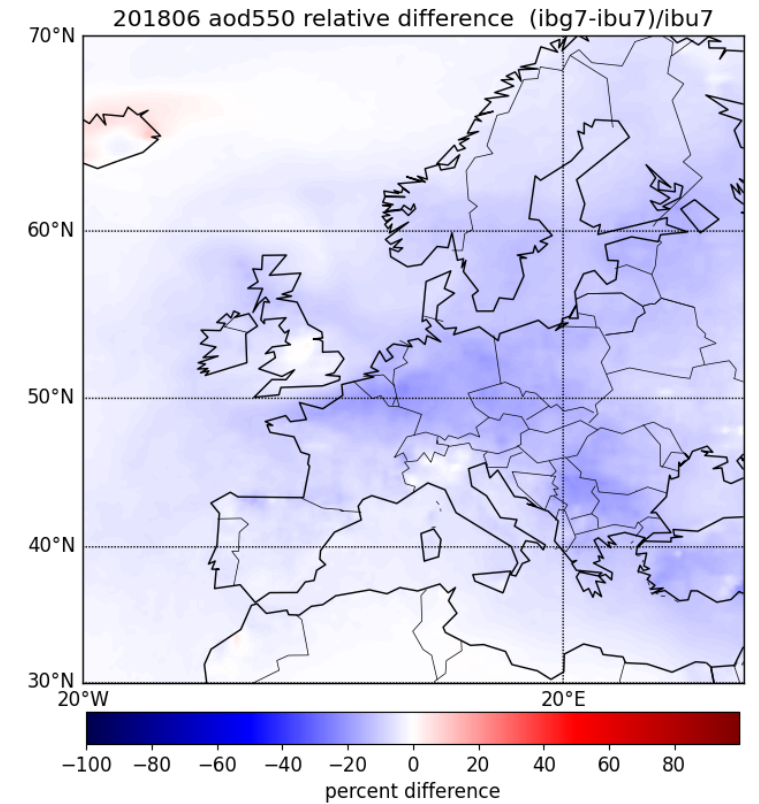
Small impact on the results for AOD 500 nm



Exp with regional emissions



Exp with global emissions



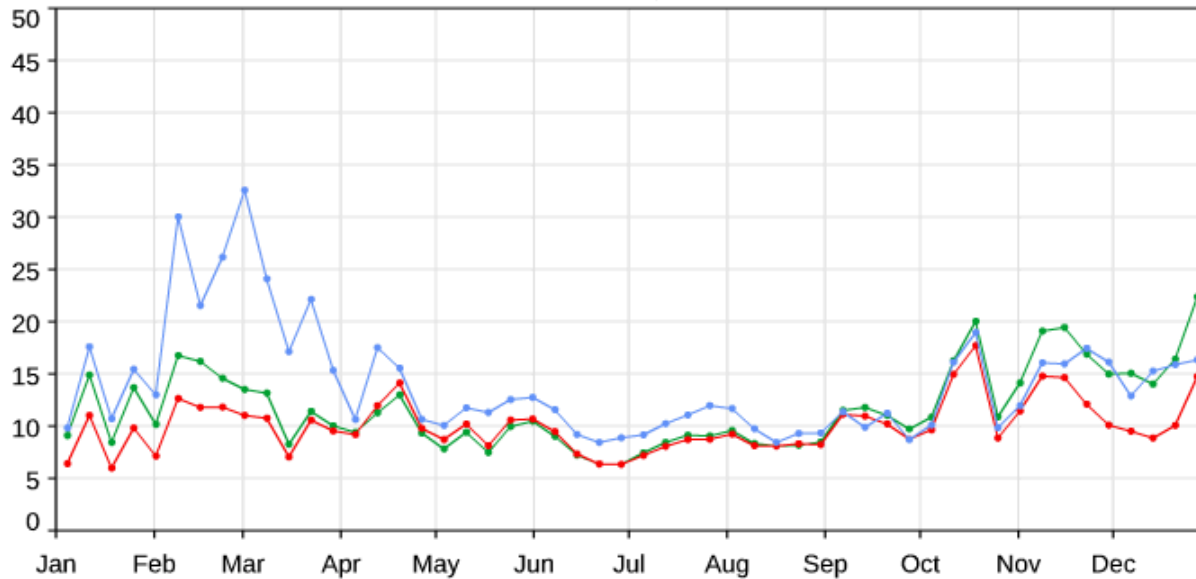
Relative difference



PM EVALUATION

PM2.5 (ug/m3) Mean. Model versus AirBase.
967 sites in Europe. 1 Jan - 30 Dec 2018. 00Z, T+3 to 24. Ver0D 12.8.3.

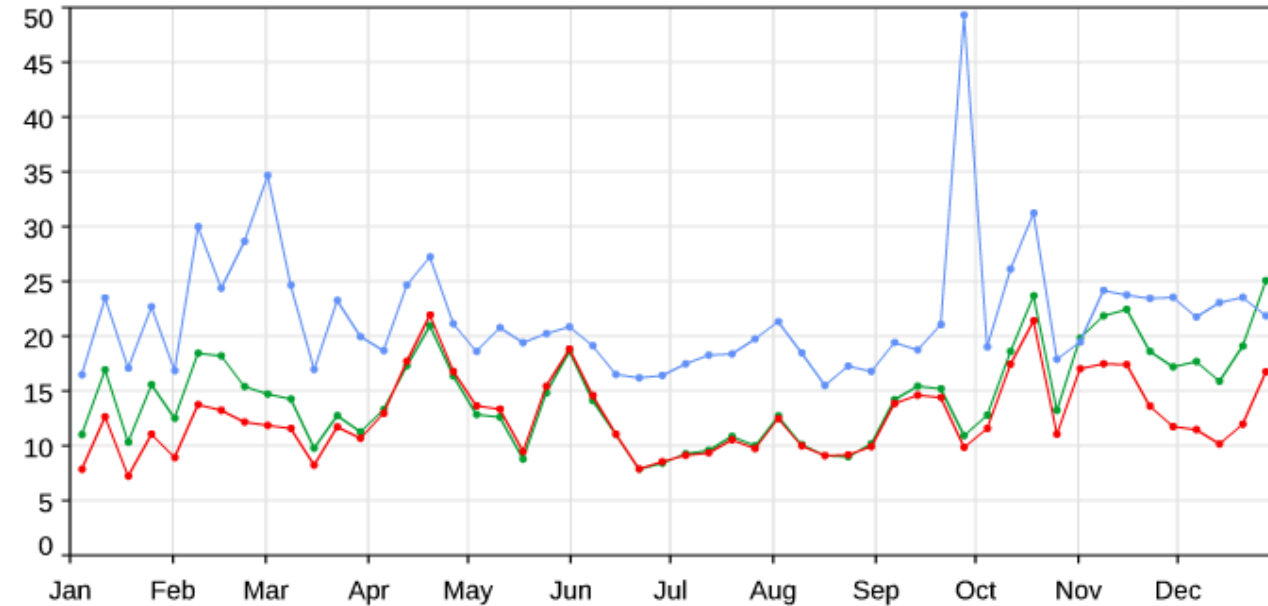
— Obs — ibg7 — ibu7



- Observations
- ibg7 = regional emissions on Europe
- ibu7 = global emissions

PM10 (ug/m3) Mean. Model versus AirBase.
2130 sites in Europe. 1 Jan - 30 Dec 2018. 00Z, T+3 to 24. Ver0D 12.8.3.

— Obs — ibg7 — ibu7

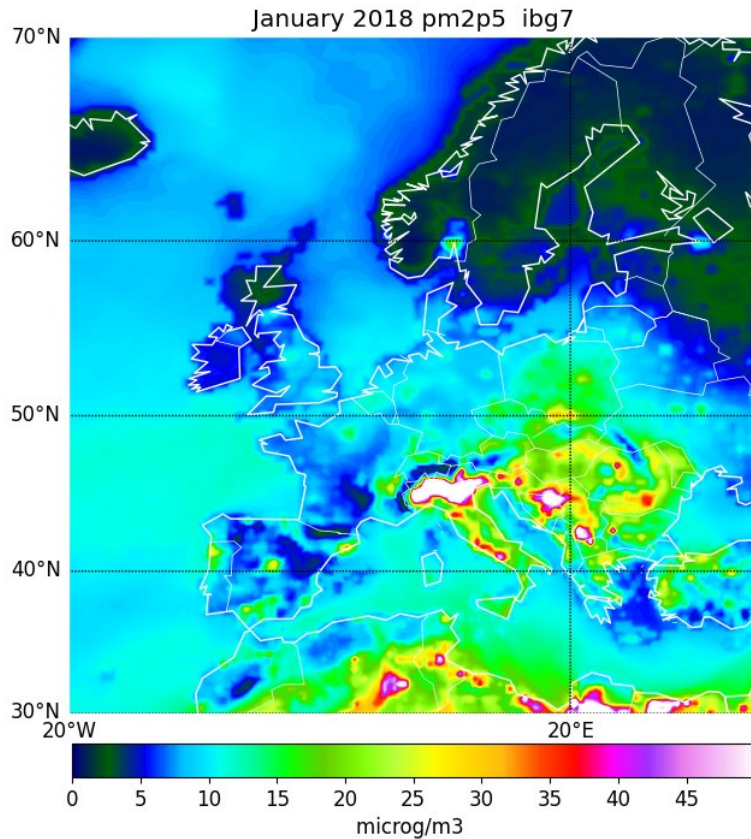


PM similar in summertime
PM higher in winter for the regional emissions
Difference due to the condensable fraction

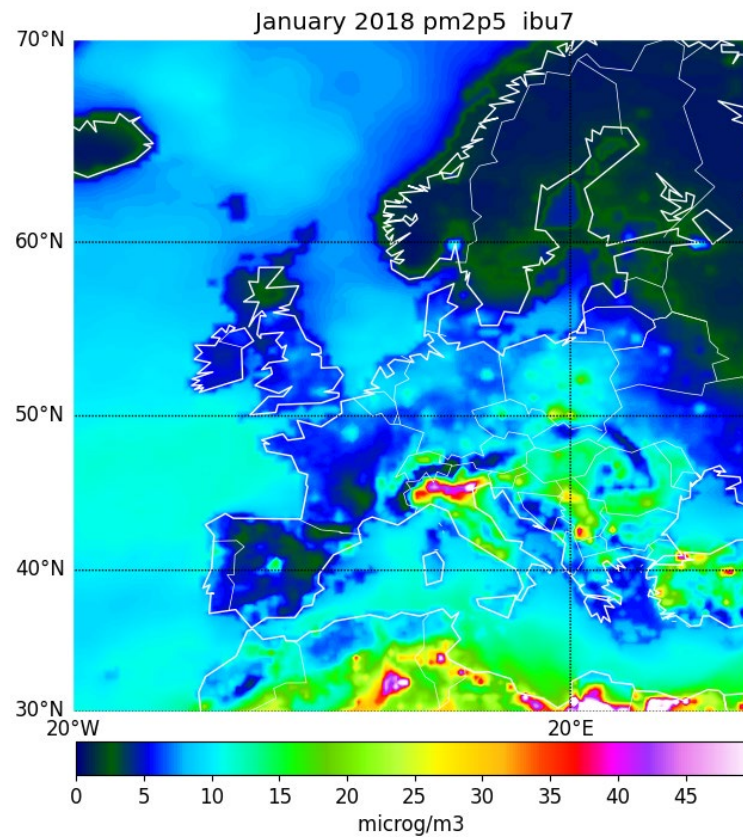


PM EVALUATION

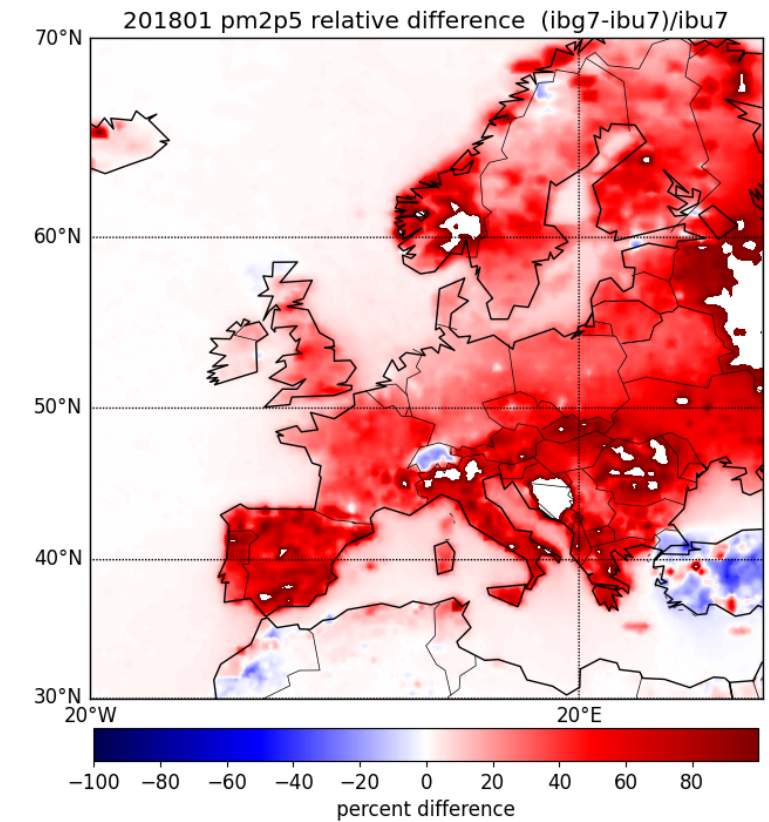
PM higher in winter for the regional emissions



Exp with regional emissions



Exp with global emissions

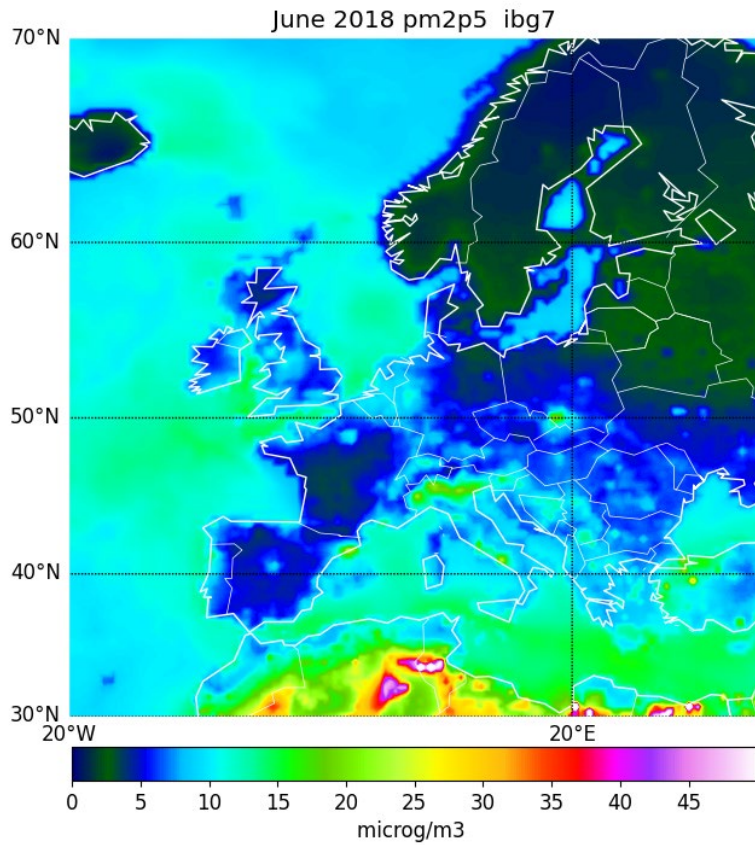


Relative difference

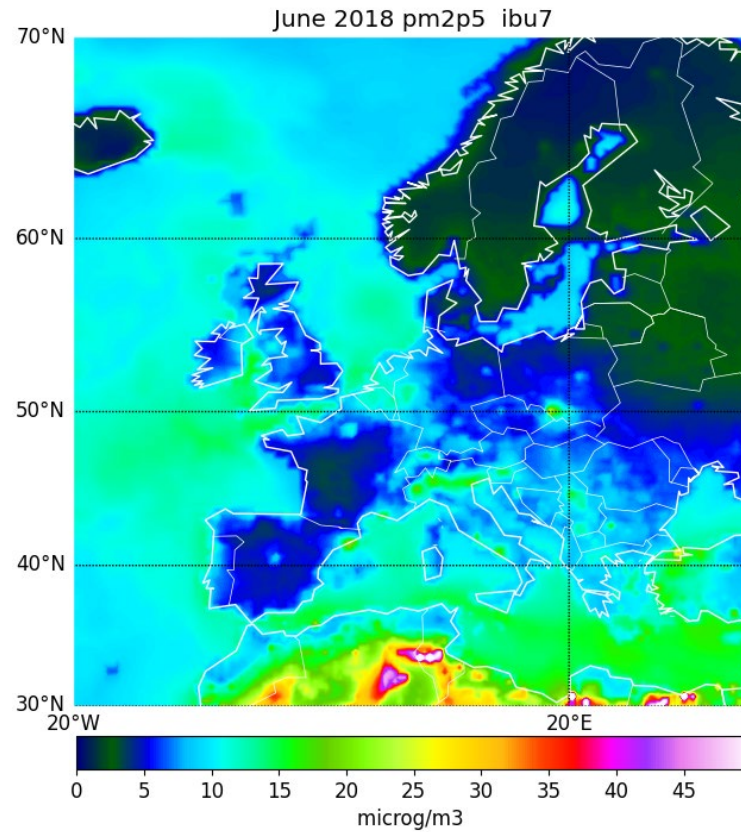


PM EVALUATION

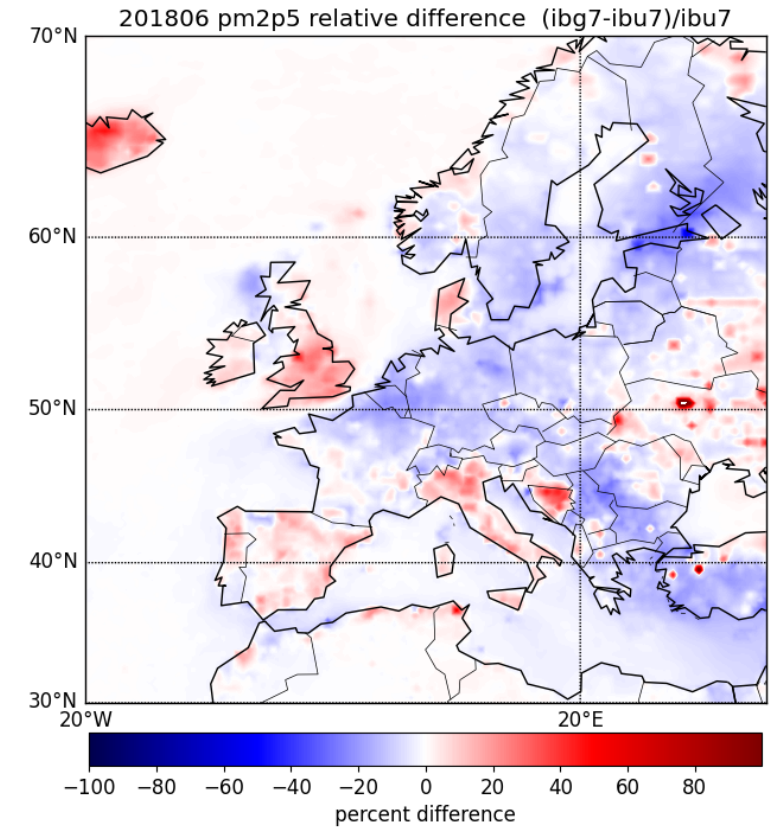
Similar results in summer for PM_{2.5}



Exp with regional emissions



Exp with global emissions

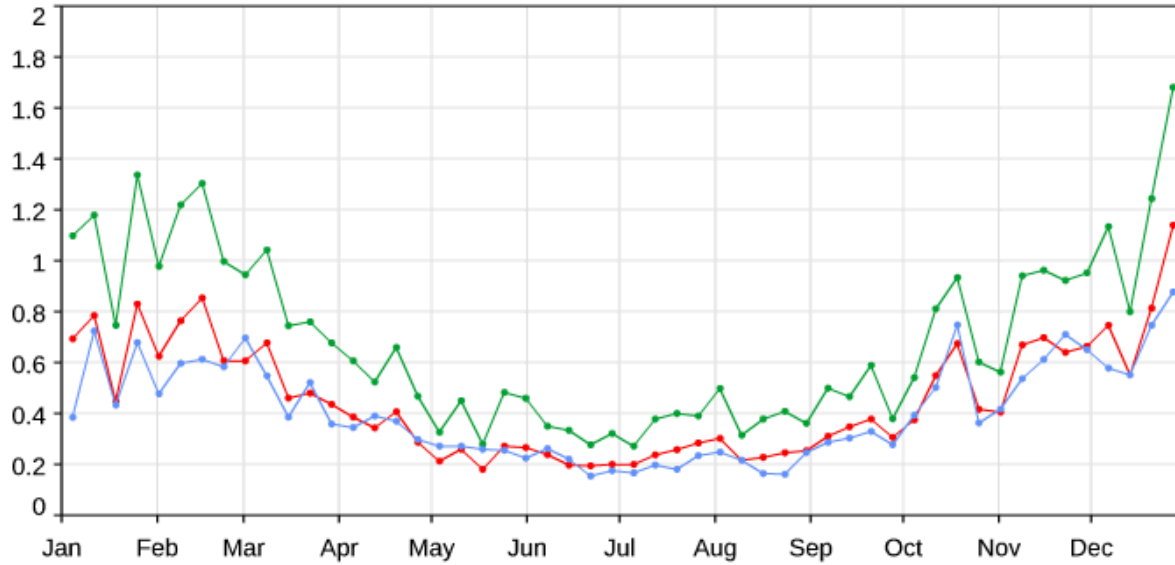


Relative difference



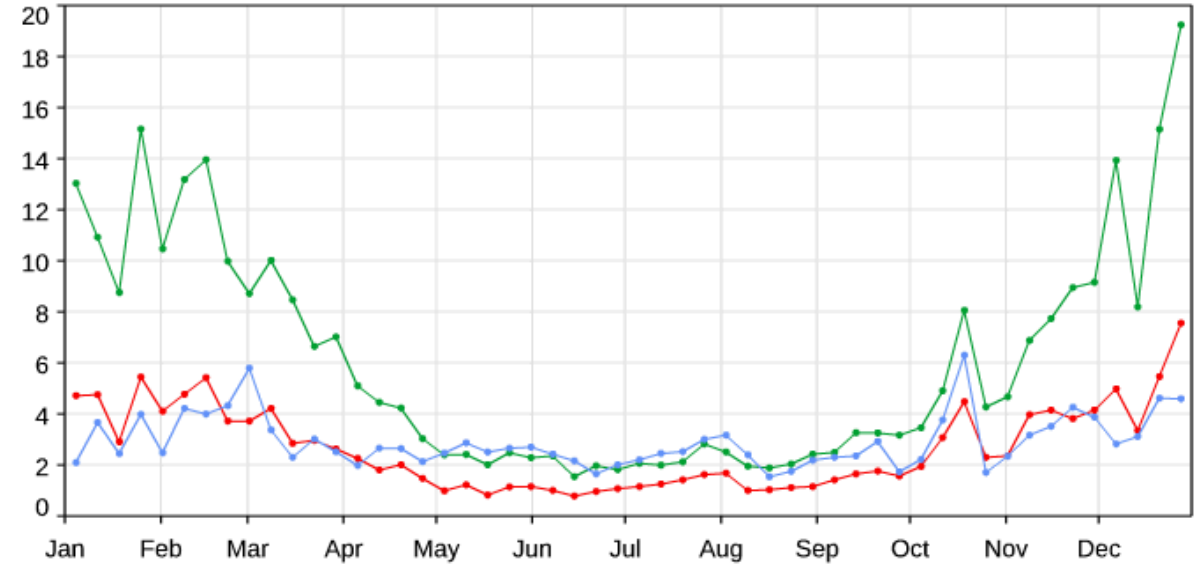
EBAS EVALUATION

BC_surf (ug/m3) Mean. Model versus EBAS.
8 sites in Europe. 1 Jan - 30 Dec 2018. 00Z, T+3 to 24. Ver0D 12.8.3.
— Obs — ibg7_ebas — ibu7_ebas



- Observations
- ibg7 = regional emissions on Europe
- ibu7 = global emissions

OM_surf (ug/m3) Mean. Model versus EBAS.
8 sites in Europe. 1 Jan - 30 Dec 2018. 00Z, T+3 to 24. Ver0D 12.8.3.
— Obs — ibg7_ebas — ibu7_ebas

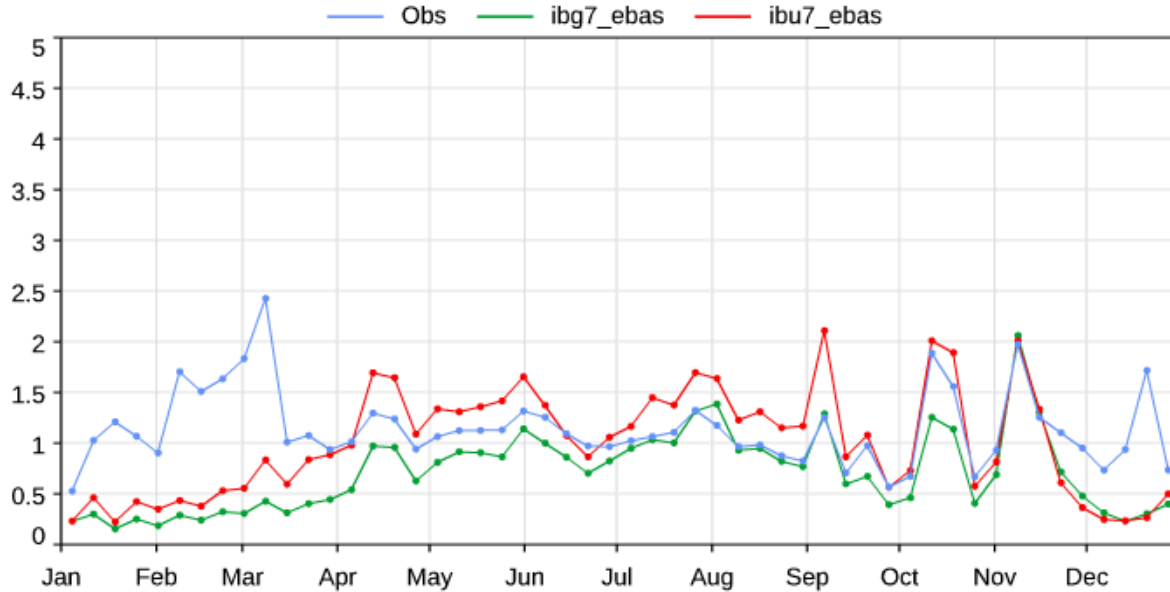


Regional emissions too high compared to EBAS due to the presence of the condensable fraction of gas



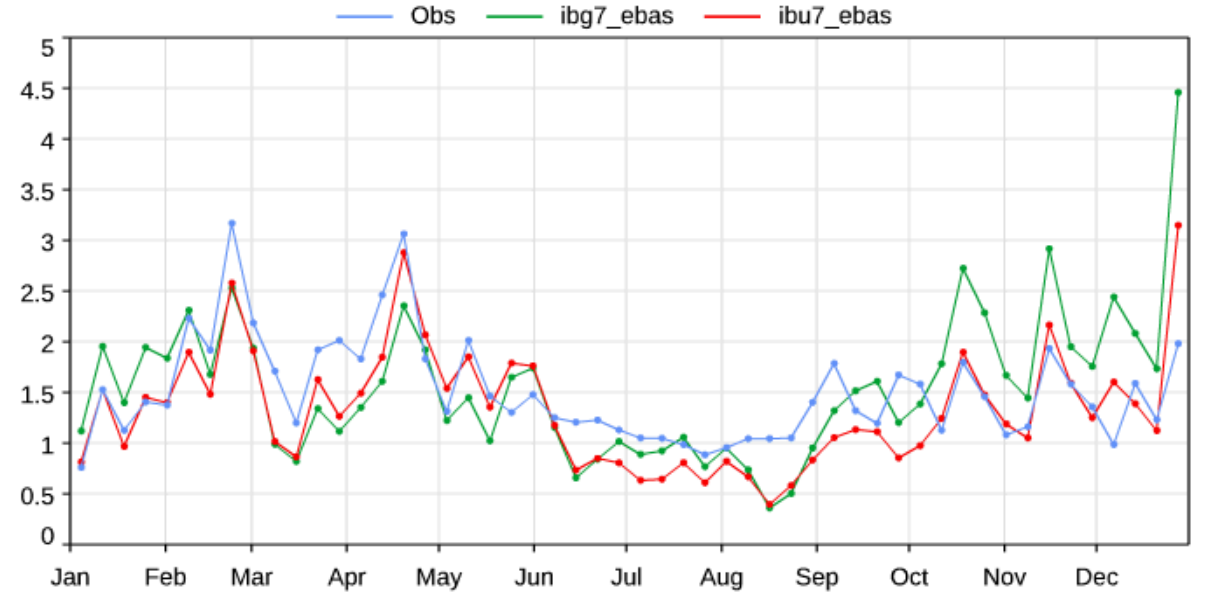
EBAS EVALUATION

SO₄_surf (ug/m³) Mean. Model versus EBAS.
23 sites in Europe. 1 Jan - 30 Dec 2018. 00Z, T+3 to 24. Ver0D 12.8.3.



- Observations
- ibg7 = regional emissions on Europe
- ibu7 = global emissions

NO₃_surf (ug/m³) Mean. Model versus EBAS.
18 sites in Europe. 1 Jan - 30 Dec 2018. 00Z, T+3 to 24. Ver0D 12.8.3.



Results with regional emissions higher compared to EBAS in summertime for NO₃
Regional emissions have negative impact on SO₄



CONCLUSION

- Comparison of regional and global emissions in IFS-COMPO
- Results for year 2018 experiments ibu7 and ibg7
- Differences in PM due to organic carbon/organic matter, because regional emissions include the condensable fraction and not the global emissions
- Experiments at high resolution are on-going