



CAMAERA

# A POSSIBLE NEW DUST EMISSION SCHEME IN IFS-COMPO

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PROGRAMME OF  
THE EUROPEAN UNION



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# New dust emission scheme

New dust emission scheme adapted from the SILAM dust emission scheme, as kindly provided by Andreas. Dust emissions are parameterized as

$$A = Z_{snowfrac} * \frac{LAI_t - LAI}{LAI_t} * F_{LSM} * \max(u_{10} - u_{10,min})^3 * r^{-0.5}$$

Where

$$u_{10,min} = u_t + B * Z_{swet}$$

Where  $Z_{swet}$  is the relative soil wetness (0=dry, 1=soil capacity reached).  $B$ ,  $LAI_t$  are constants.  $Z_{nowfrac}$  is the fraction of snow depth so that dust emissions are null if snow depth is  $\geq 2$ cm.  $r^{-0.5}$

Is derived from the surface roughness. 3 options have been tested:

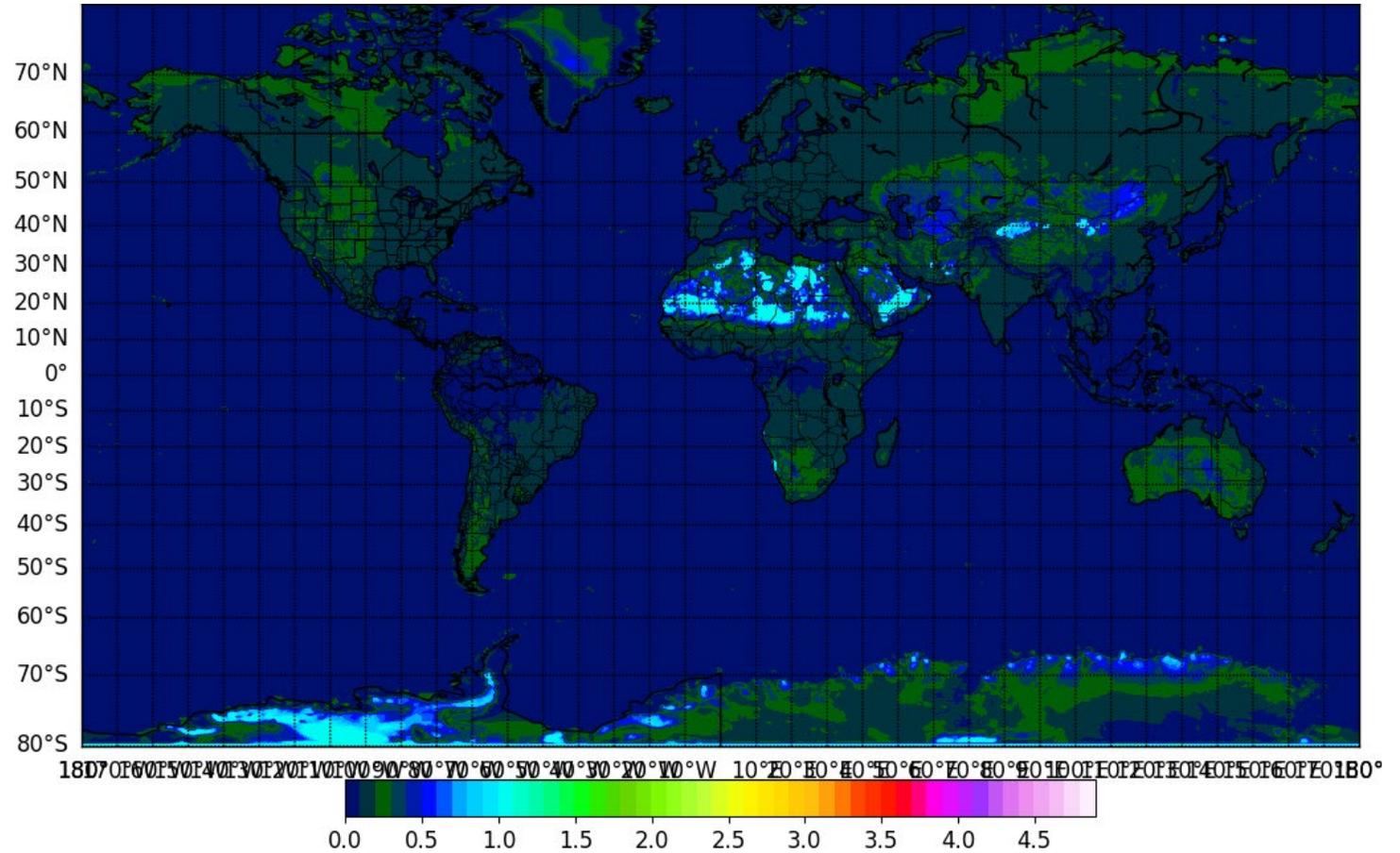
- Surface roughness from ERS (Prigent et al 2012)
- Surface roughness from ASCAT provided by FMI
- Surface roughness from ASCAT modulated by orography



# New dust emission scheme

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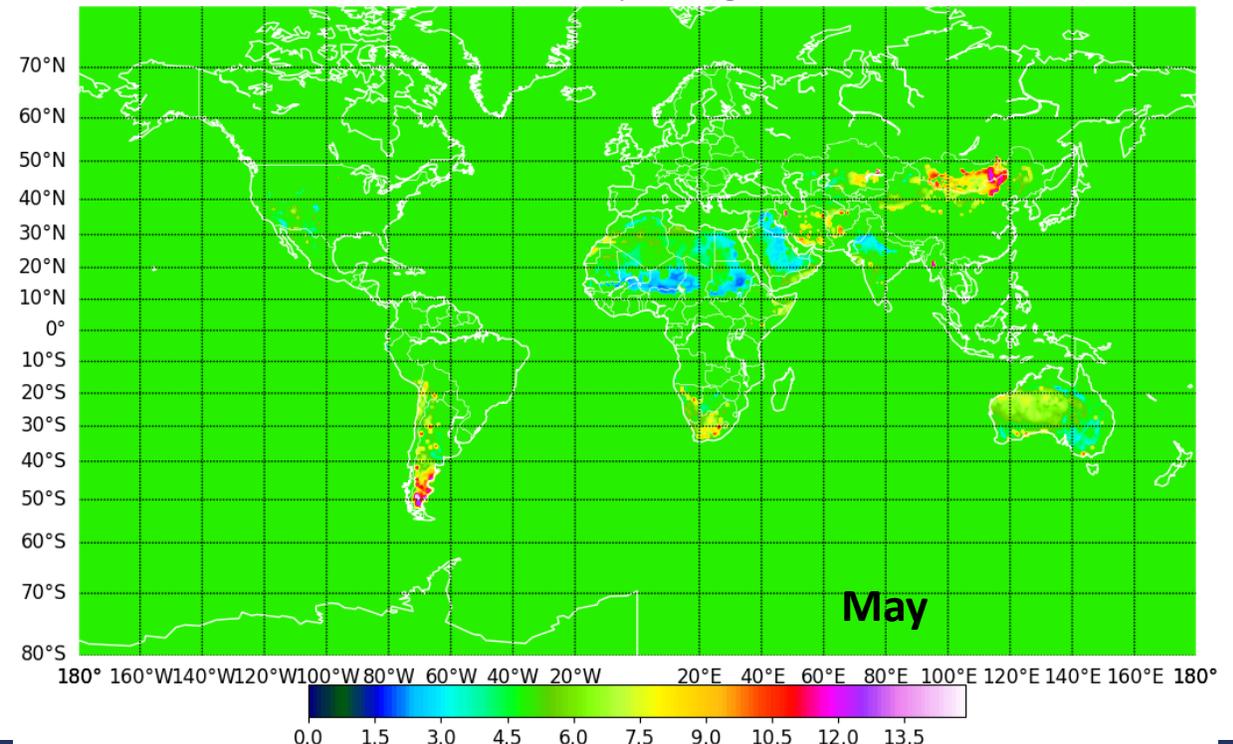
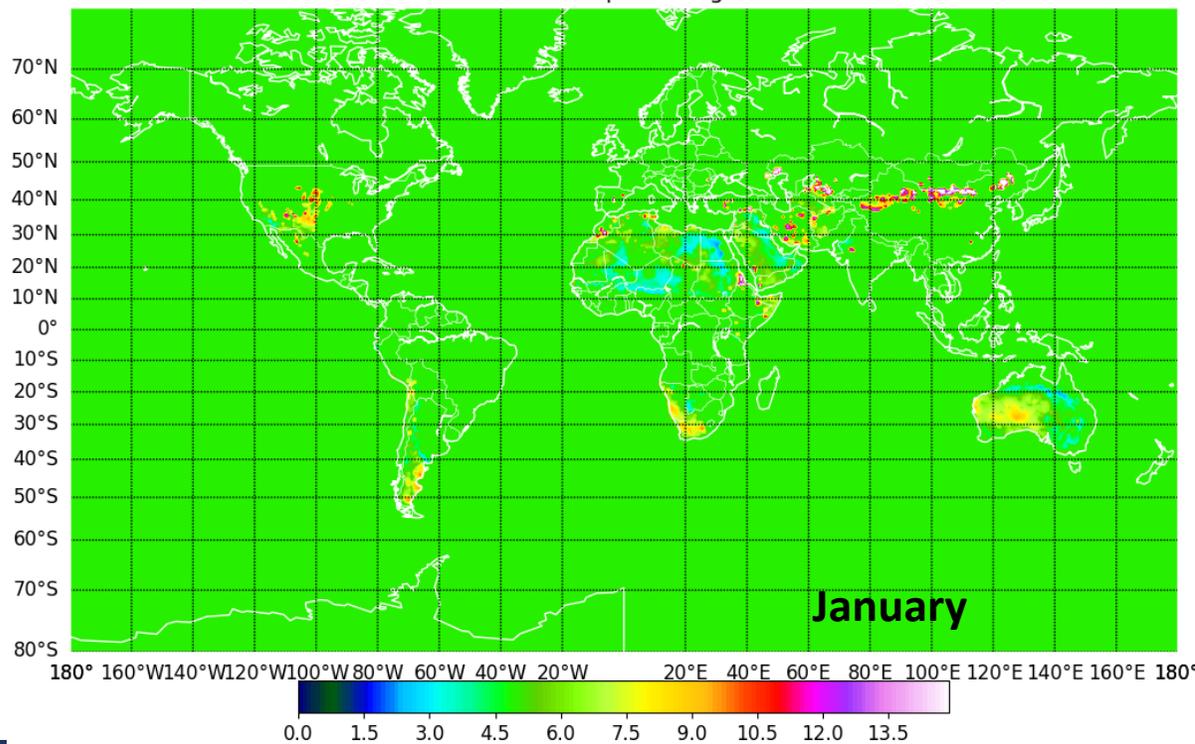




# New dust emission scheme

$$u_{10,min} = u_t + B * Z_{swet}$$

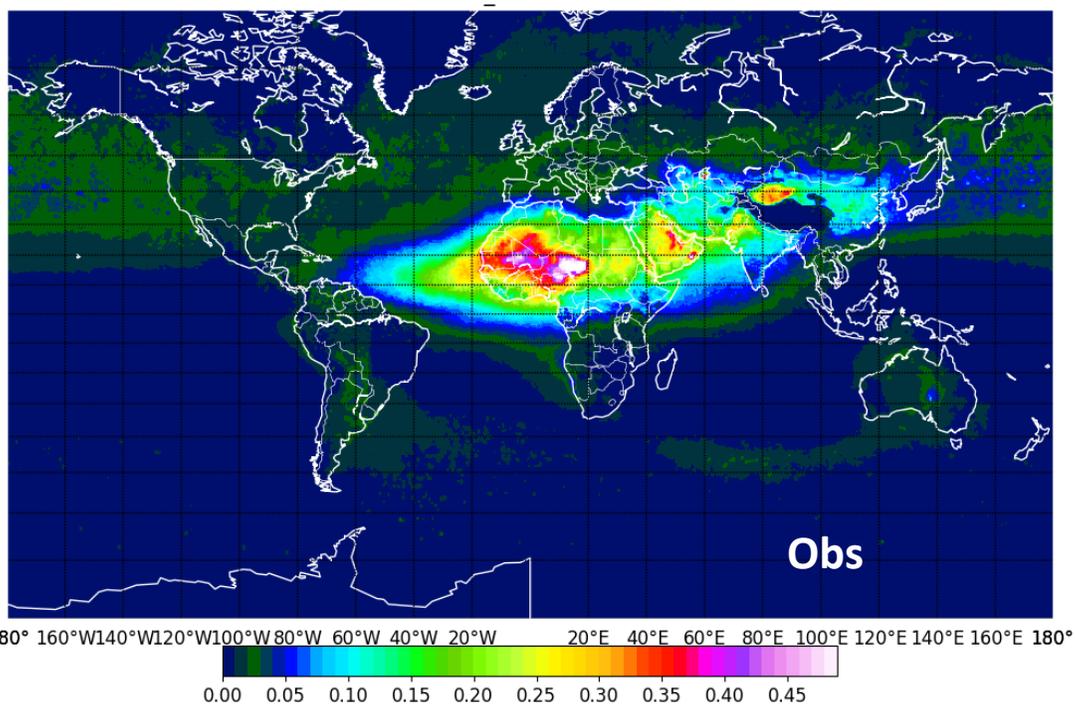
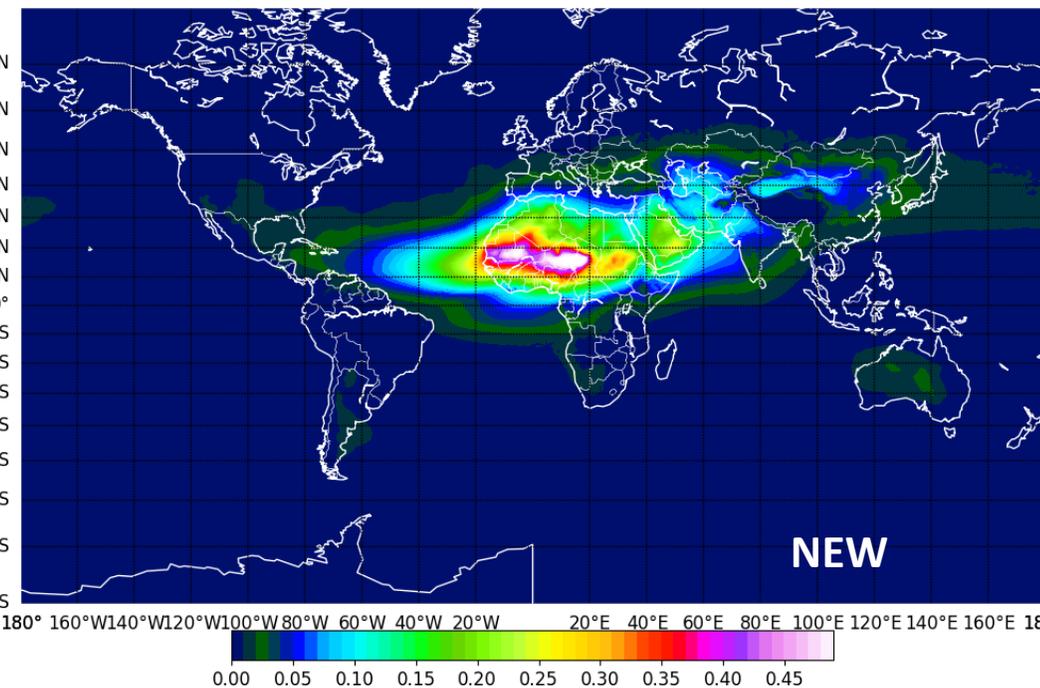
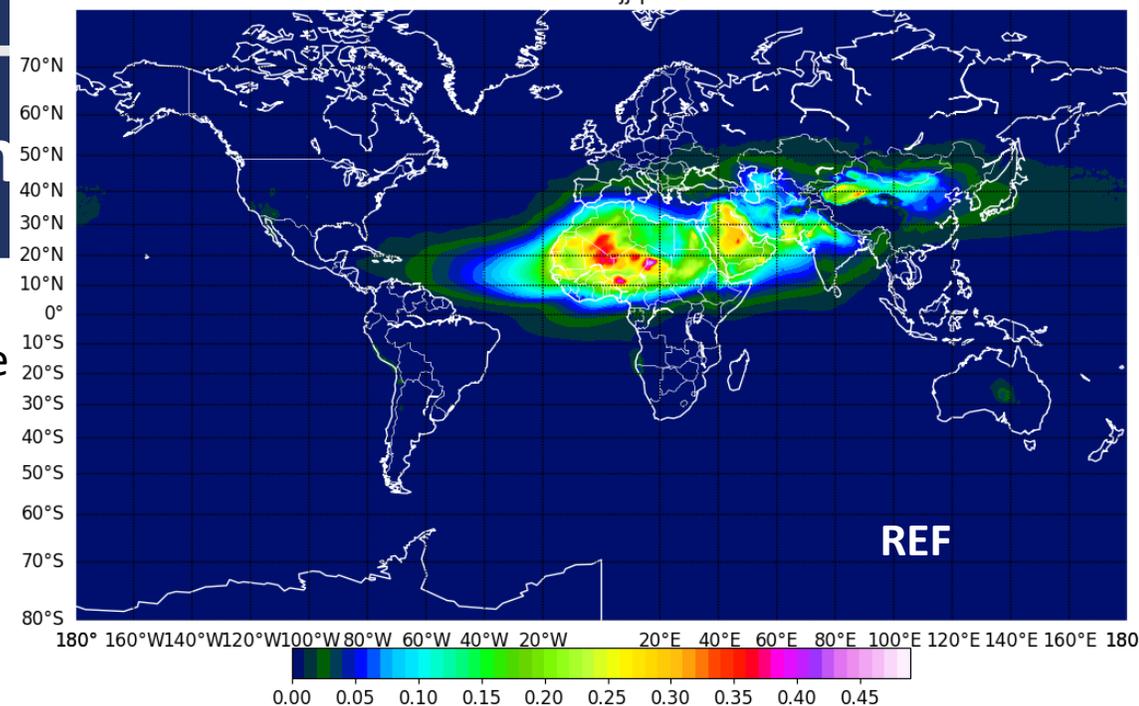
For threshold velocity  $U_t$ , a value of 5 m/s is used in the SILAM scheme. Here, we use a monthly 2D input derived from remote sensing from Pu et al (ACP, 2020) :





# Evaluation versus AOD from

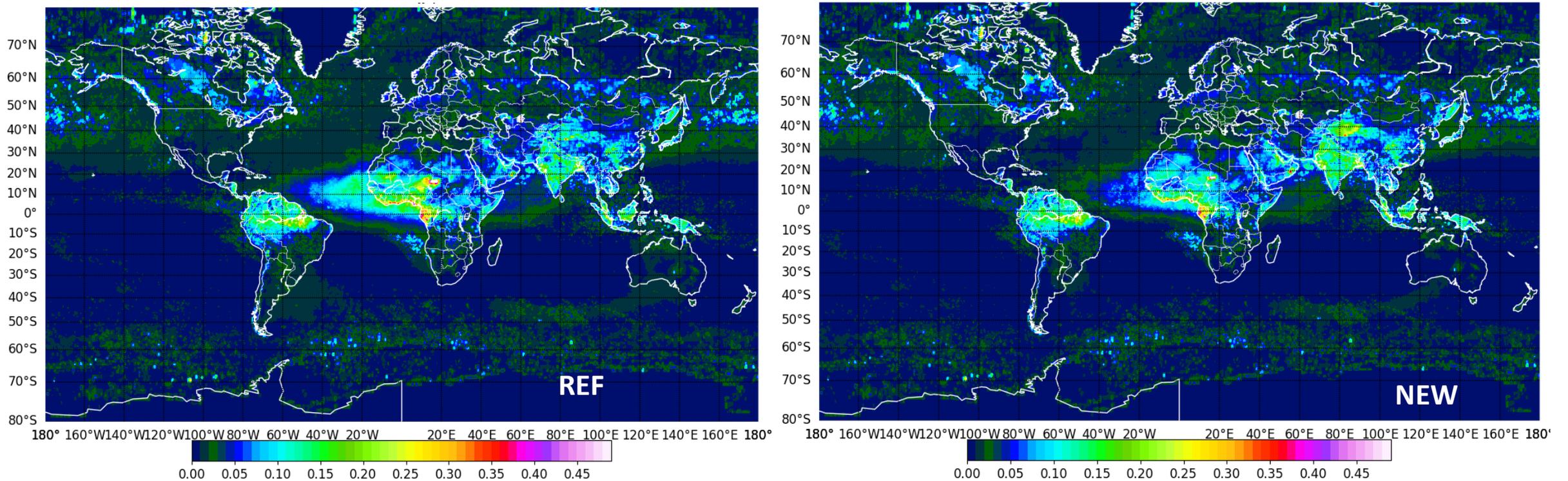
2017 dust AOD at 550nm derived from FMI merge  
AOD product (Sogacheva et al 2020)





# Evaluation versus AOD from remote sensing

RMSE of monthly 2017 dust AOD at 550nm against dataset derived from FMI merged AOD product (Sogacheva et al 2020)

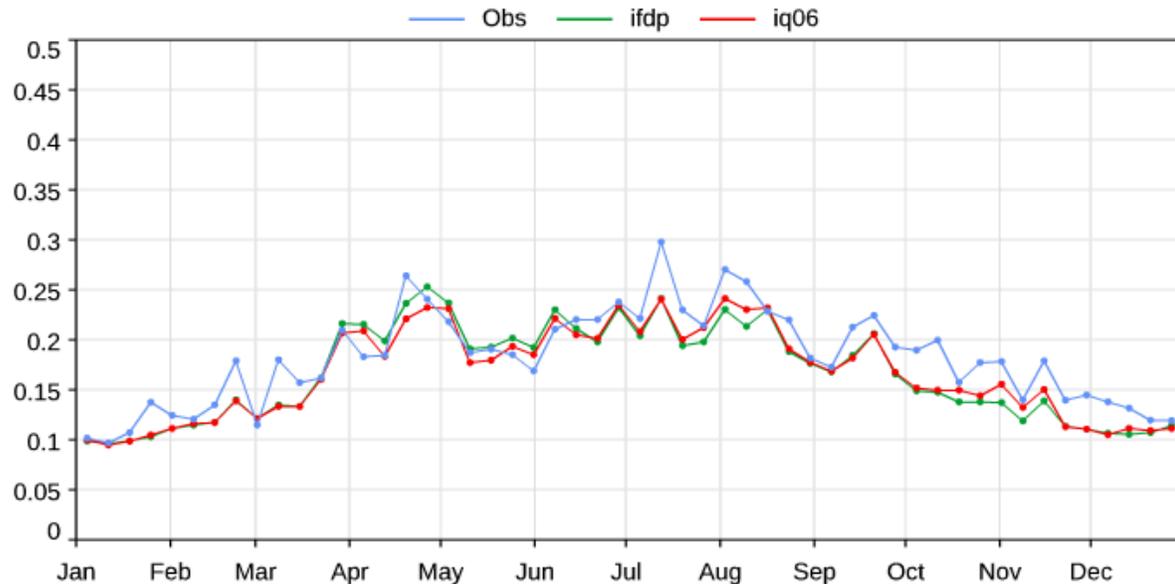




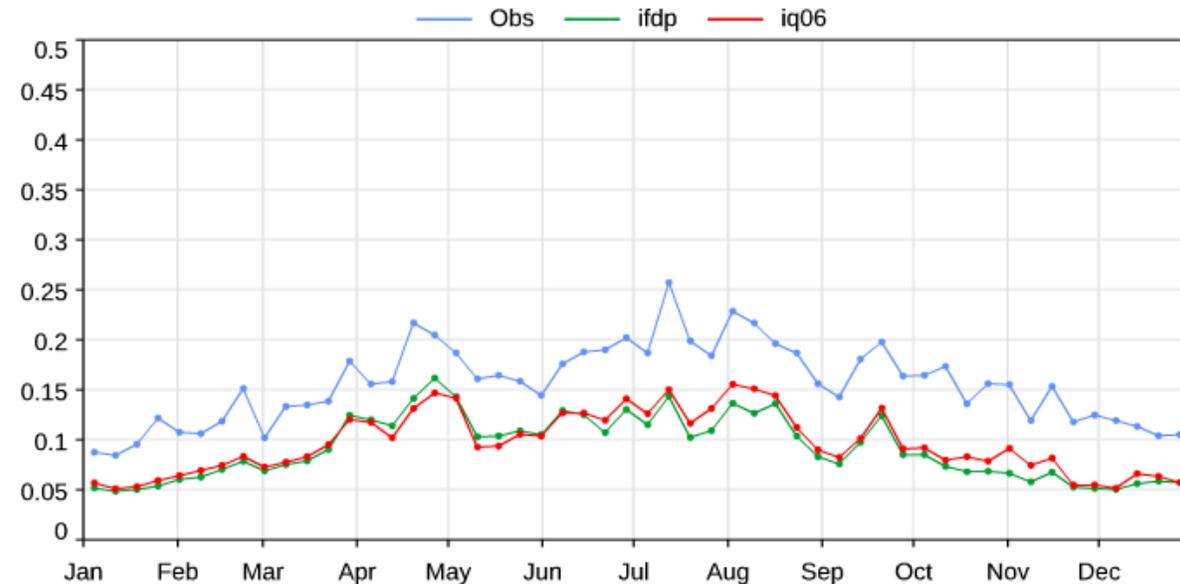
# Evaluation versus AERONET AOD

2019 weekly simulated versus obs AOD at 500/1020nm, with AE < 0.3 filter (dusty obs only)

Mean. Model against L2.0 Aeronet AOT at 500nm.  
421 sites globally. 1 Jan - 30 Dec 2019. 00Z, T+3 to 24. Ver0D 12.14.7.



Mean. Model against L2.0 Aeronet AOT at 1020nm.  
422 sites globally. 1 Jan - 30 Dec 2019. 00Z, T+3 to 24. Ver0D 12.14.7.



49R1 fc only ref (green), with new dust emission scheme (red)

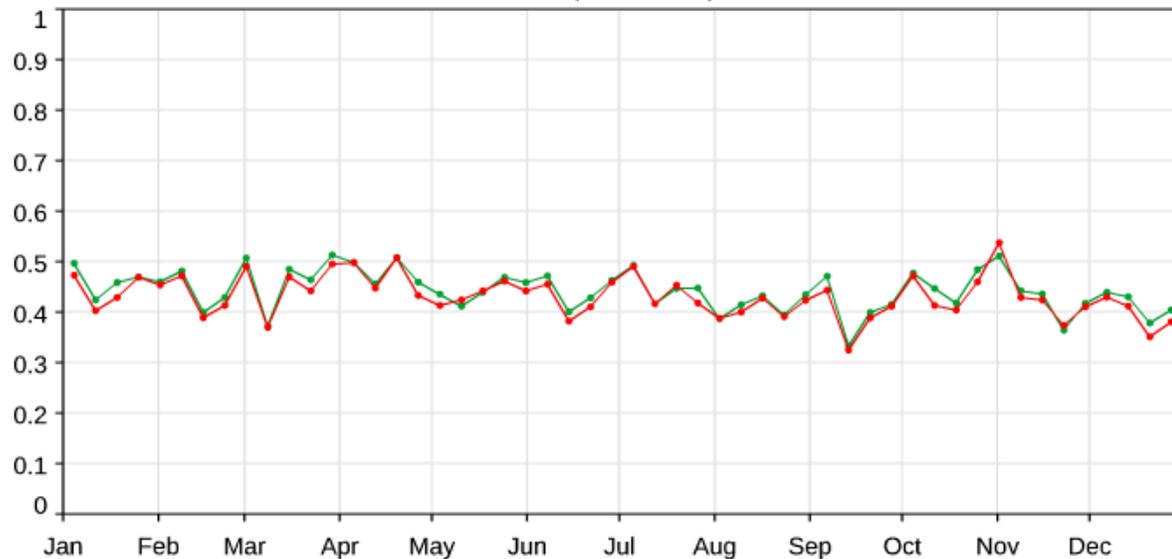


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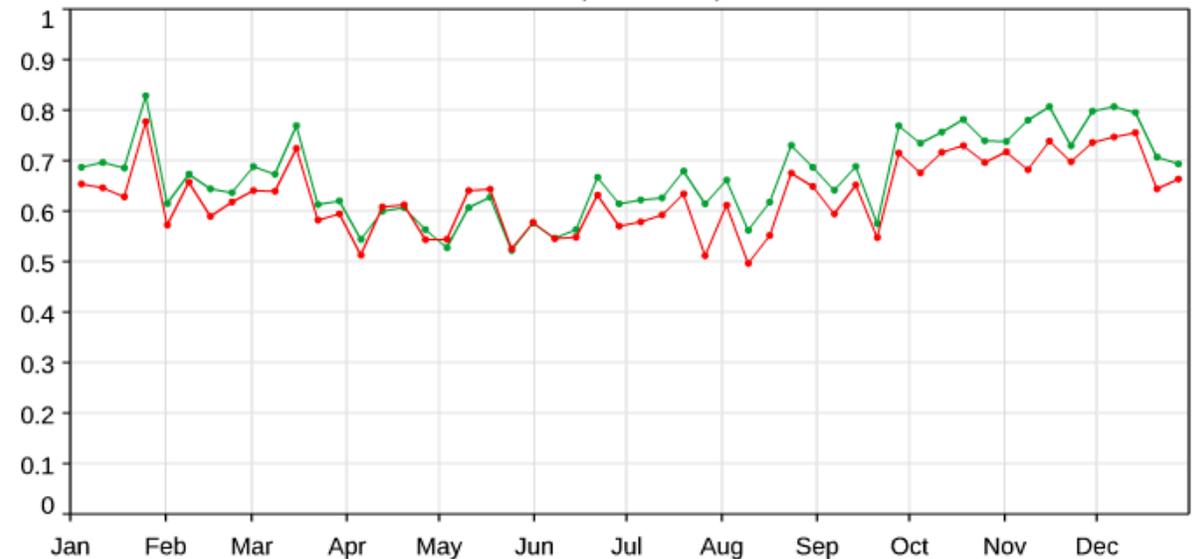
Fractional Gross Error. Model against L2.0 Aeronet AOT at 500nm.  
421 sites globally. 1 Jan - 30 Dec 2019. 00Z, T+3 to 24. Ver0D 12.14.7.

ifdp iq06



Fractional Gross Error. Model against L2.0 Aeronet AOT at 1020nm.  
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ifdp iq06

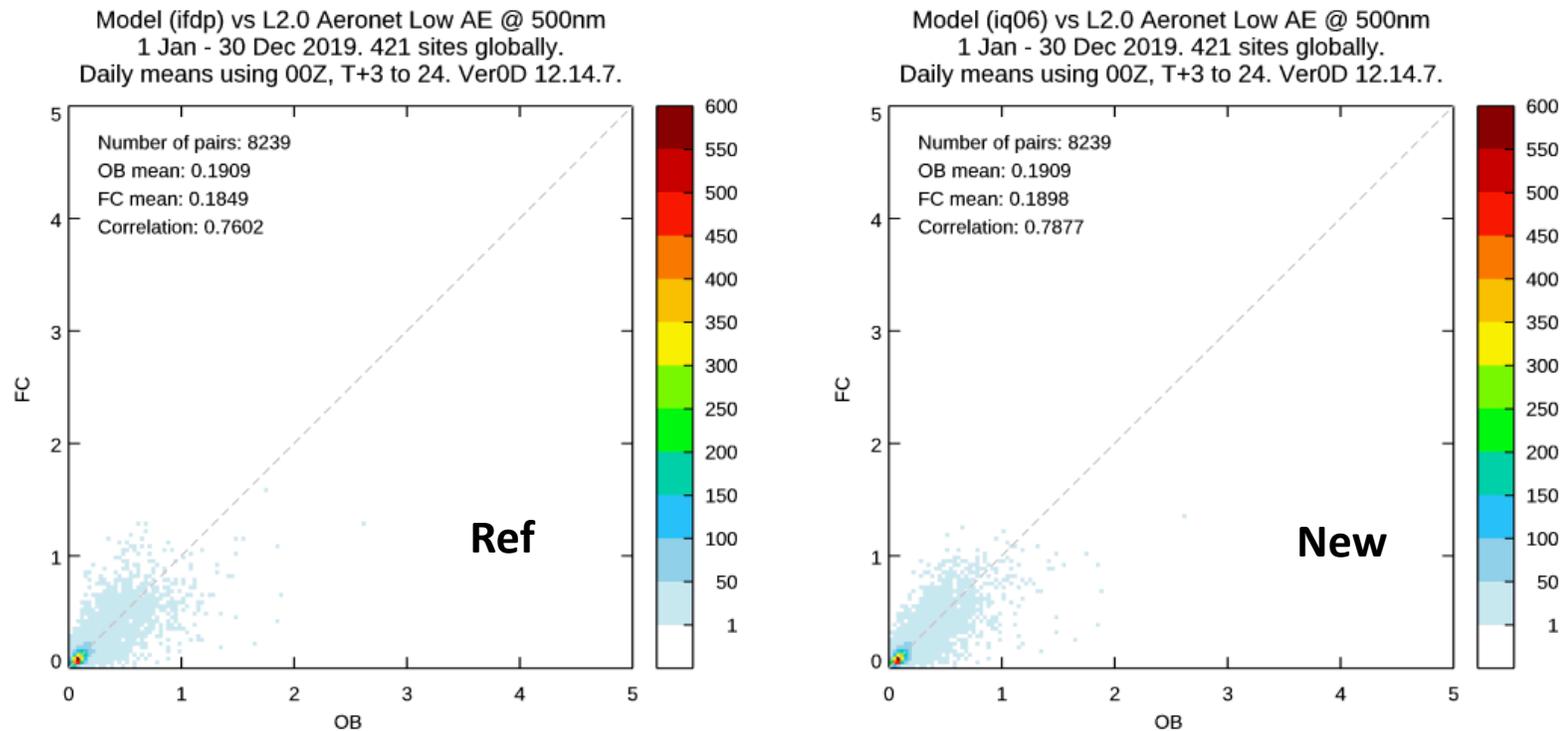


49R1 fc only ref (green), with new dust emission scheme (red)



# Evaluation versus AERONET AOD

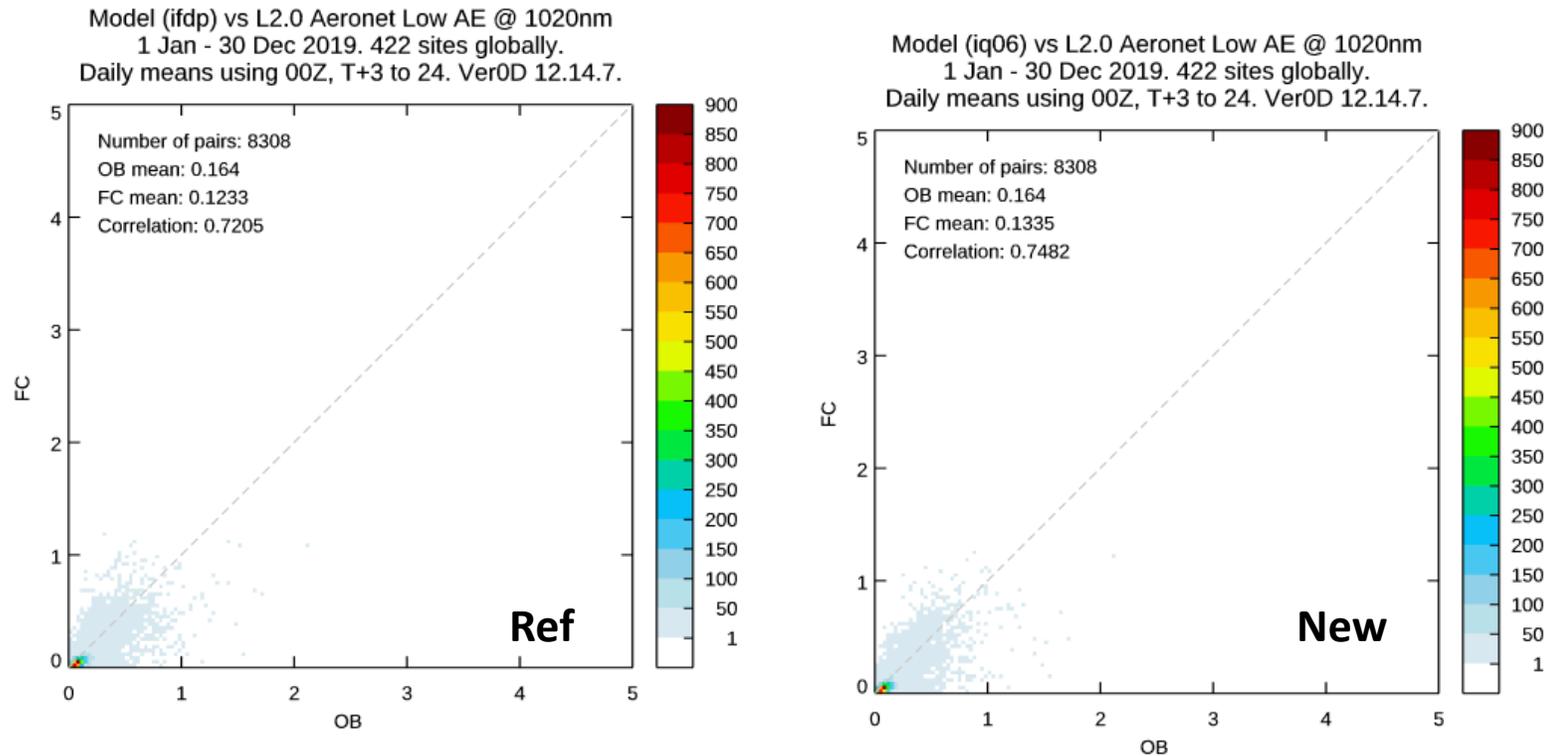
2019 daily simulated versus obs AOD at 500nm, with AE < 0.3 filter (dusty obs only)





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2019 daily simulated versus obs AOD at 500nm, with AE < 0.3 filter (dusty obs only)



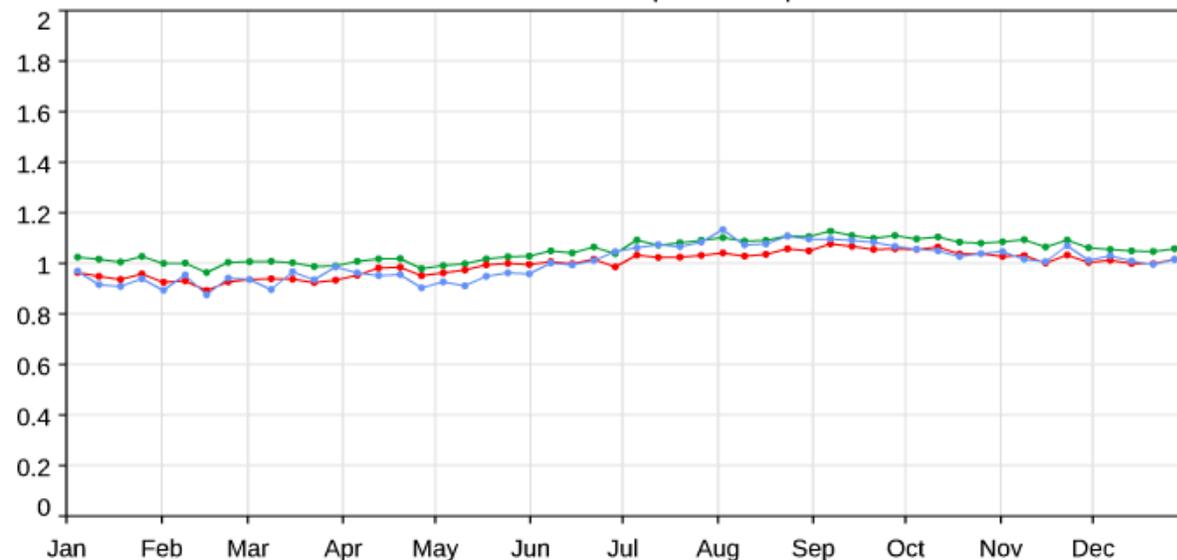


# Evaluation versus AERONET AOD

2019 weekly simulated versus obs Angstrom exponent over all AERONET stations

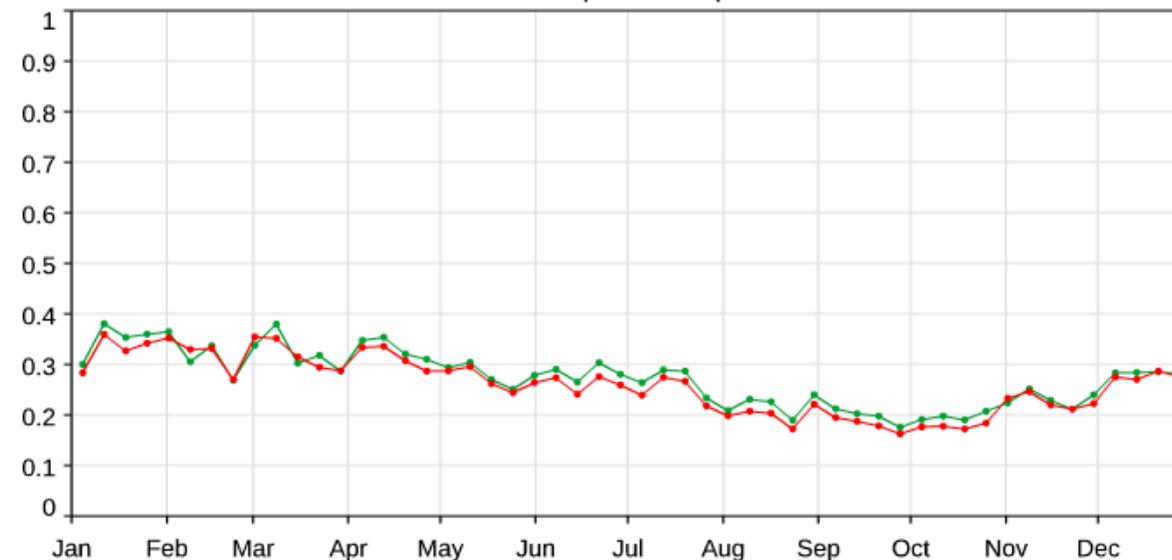
Mean. Model against L2.0 Aeronet AOT at 440nm.  
484 Voronoi-weighted sites globally ( $r_{max}=1276km$ ).  
1 Jan - 30 Dec 2019. 00Z, T+3 to 24. Ver0D 12.14.7.

— Obs — ifdp — iq06



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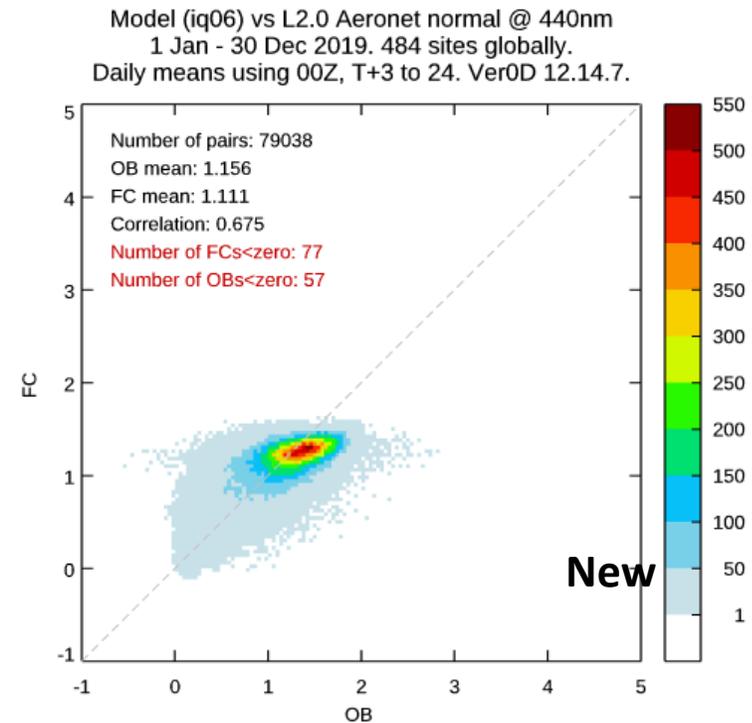
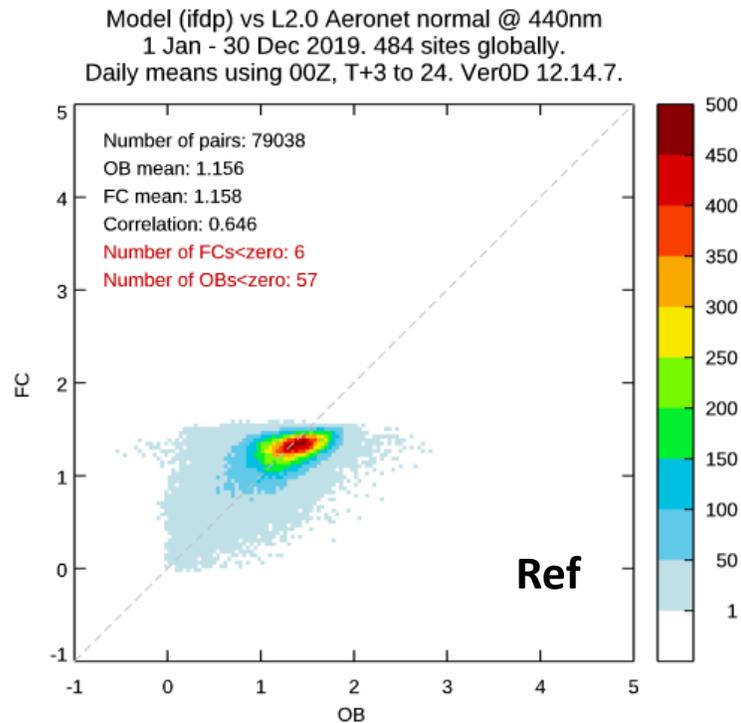


49R1 fc only ref (green), with new dust emission scheme (red)



# Evaluation versus AERONET AOD

2019 weekly simulated versus obs Angstrom exponent over all AERONET stations



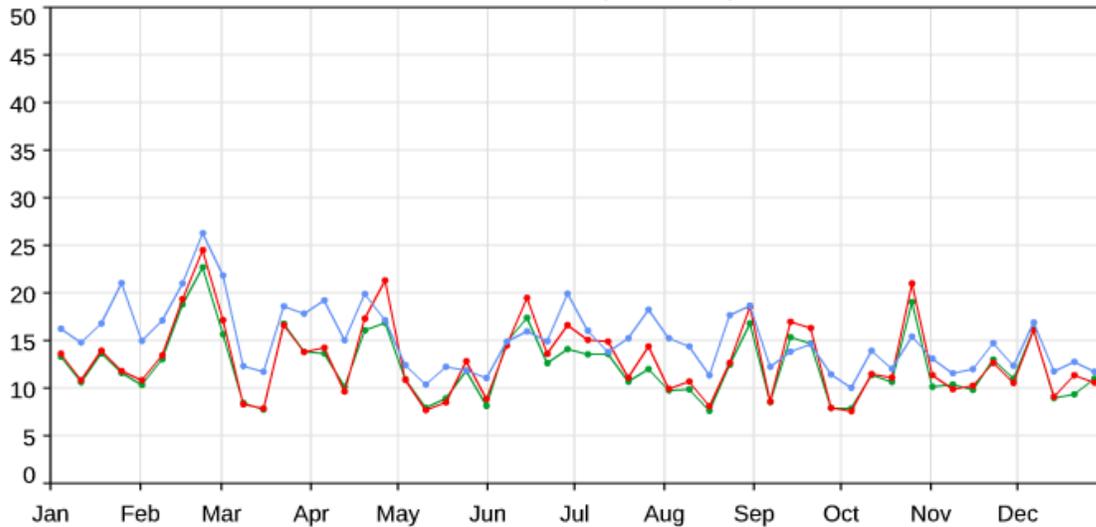


# Evaluation versus PM10

2019 weekly simulated PM10 versus background rural

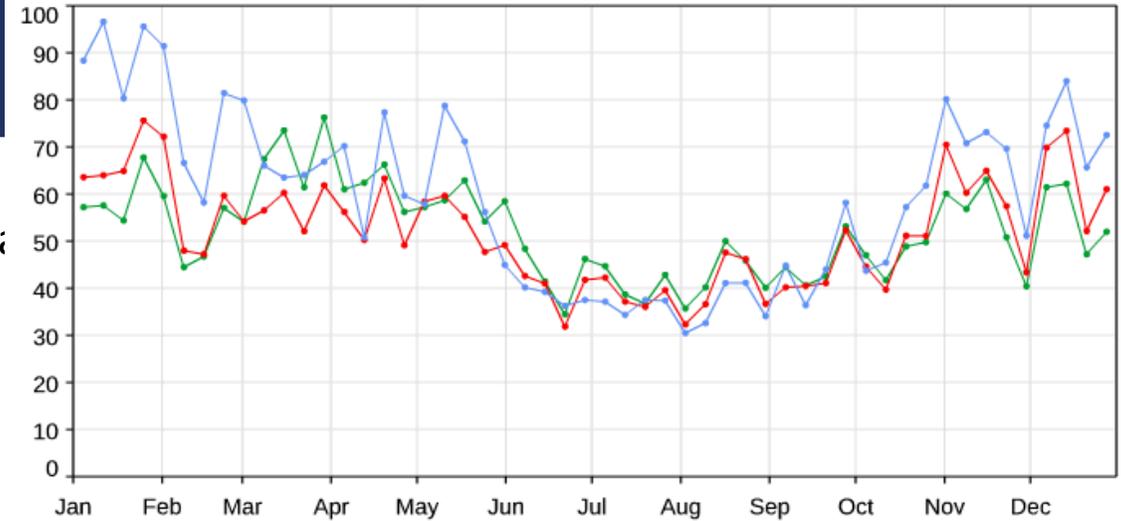
PM10 (ug/m3) Mean. Model versus AirBase.  
145 sites in background rural. 1 Jan - 30 Dec 2019. 00Z, T+3 to 24. Ver0D 12.14.7.

— Obs — ifdp — iq06



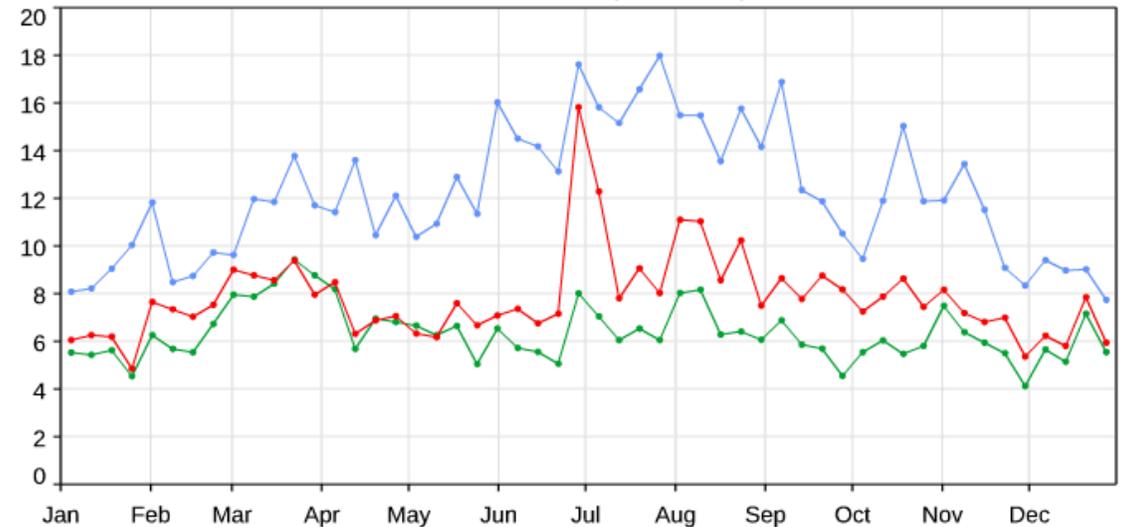
PM10 (ug/m3) Mean. Model versus China AQ.  
153 sites in China rural. 1 Jan - 30 Dec 2019. 00Z, T+3 to 24. Ver0D 12.14.7.

— Obs — ifdp — iq06



PM10 (ug/m3) Mean. Model versus AirNow.  
27 sites in N-Am rural. 1 Jan - 30 Dec 2019. 00Z, T+3 to 24. Ver0D 12.14.7.

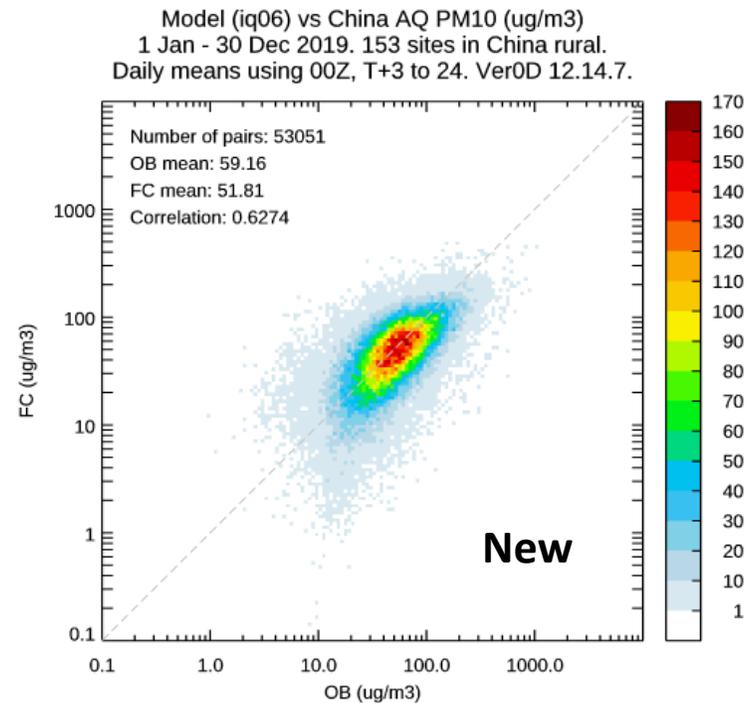
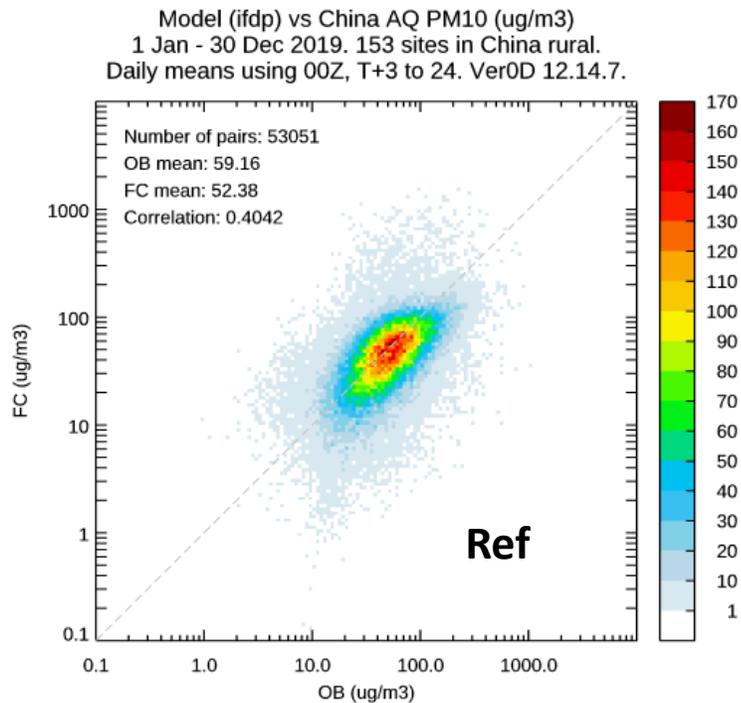
— Obs — ifdp — iq06





# Evaluation versus PM10

2019 weekly simulated PM10 versus background rural stations obs

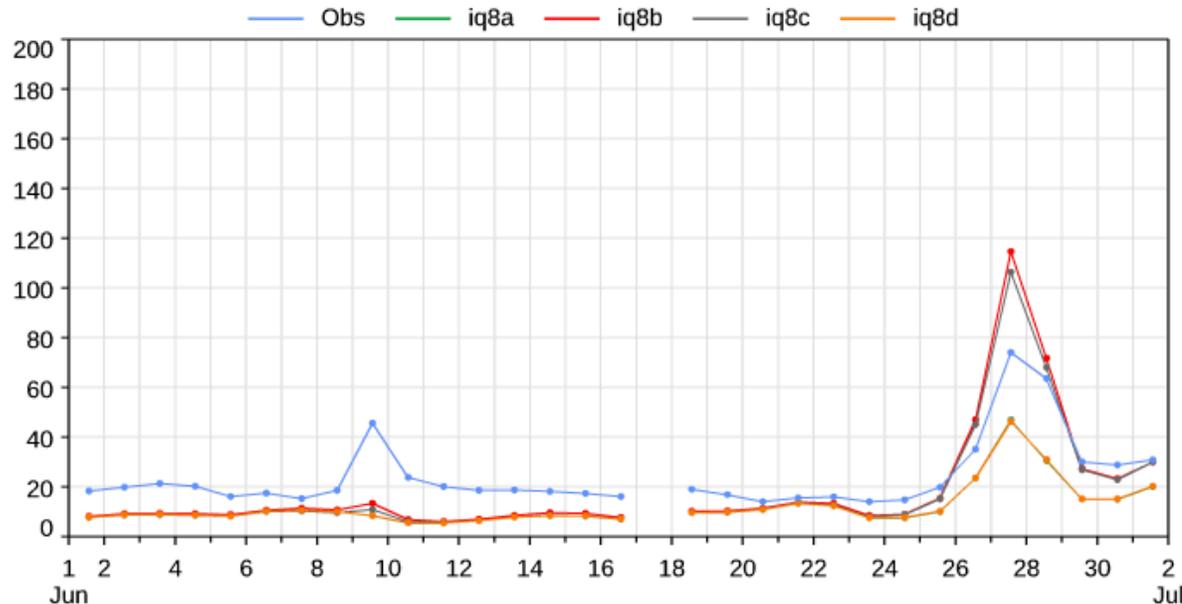




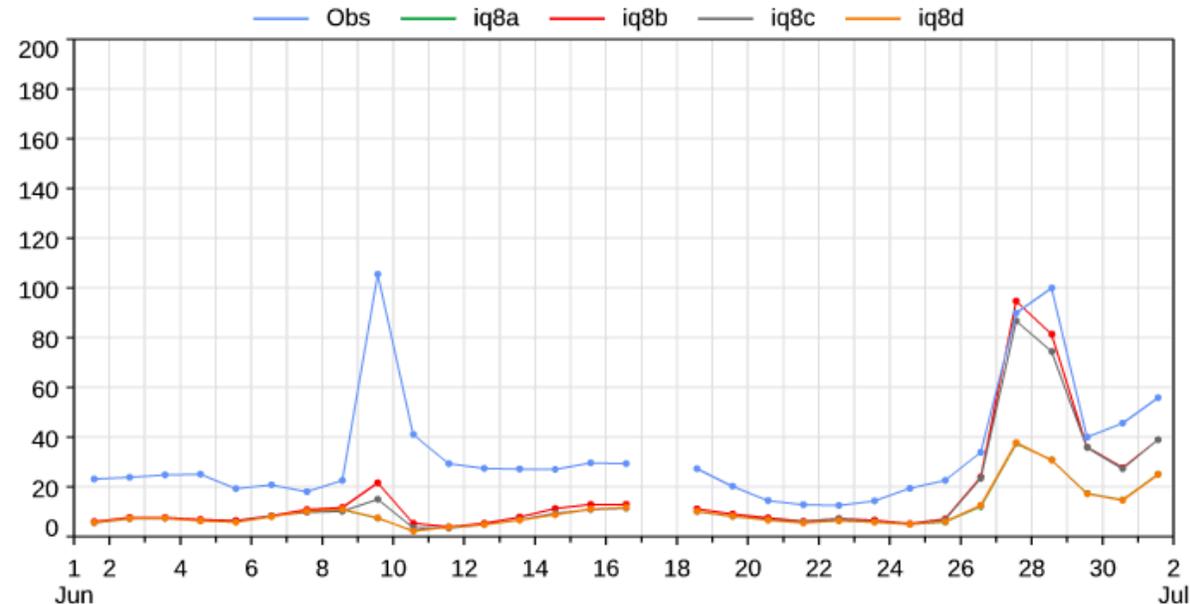
# Evaluation versus PM10 during Godzilla dust storm

June 2020 daily simulated PM10 versus South US obs

PM10 (ug/m3) Mean. Model versus AirNow.  
49 sites in South-US. 1 Jun - 1 Jul 2020. 00Z, T+3 to 24. Ver0D 12.14.5.



PM10 (ug/m3) Mean. Model versus AirNow.  
16 sites in Texas. 1 Jun - 1 Jul 2020. 00Z, T+3 to 24. Ver0D 12.14.5.



49R1 fc only ref (green, orange), with new dust emission scheme (red, gray)