On the importance of aerosol composition for estimating incoming solar radiation in West Africa: analysis in the Dakar and Niamey stations during the dry season .

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Objectif:

Correction of existing bias on surface radiation (DSSF) products distributed by LAND-SAF (Satellite Application Facility LAND) project.

Methodology:

Mixture method Developed by Ceamanos and al (2014) to calculate the DSSF BOA (diffuse, direct and global radiation)

LibRadtran

Radiative transfer code

INPUT:

In situ data (all 10 minutes) : AOD, PW, SZA, OZONE, SURFACE ALBEDO

AEROSOL MODEL : OPAC database (Hess et al. 1998)

2 CONFIGURATIONS

to calculate the DSSF

Methodology: 2 configurations

(1) OPAC-dust

total AOD + dust model of OPAC

(2) Mixture methode

2 AOD (fine and coarse mode)

Each mode is associated with a single component (model)

Measurement stations and selected days:

2 STATIONS: Dakar (15°N, 17°W) and Niamey (14°N, 2°E)
In situ: AERONET sun photometer and radiation

Classification of days (in terms of aerosols load)

***Clean* day: AOD<0.15 regardless α**

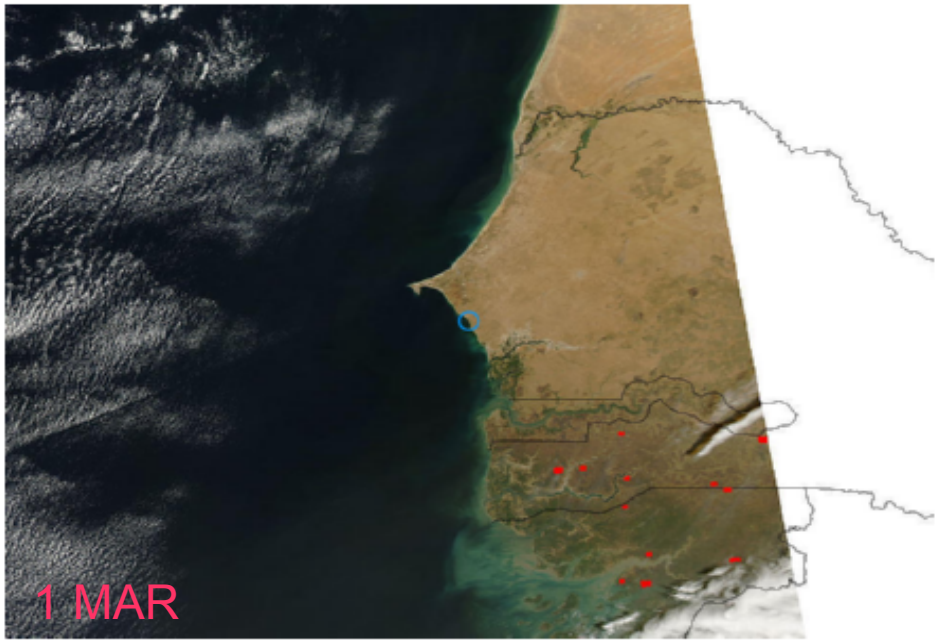
***Standard* day: 0.15<AOD<0.6 and α<0.4**

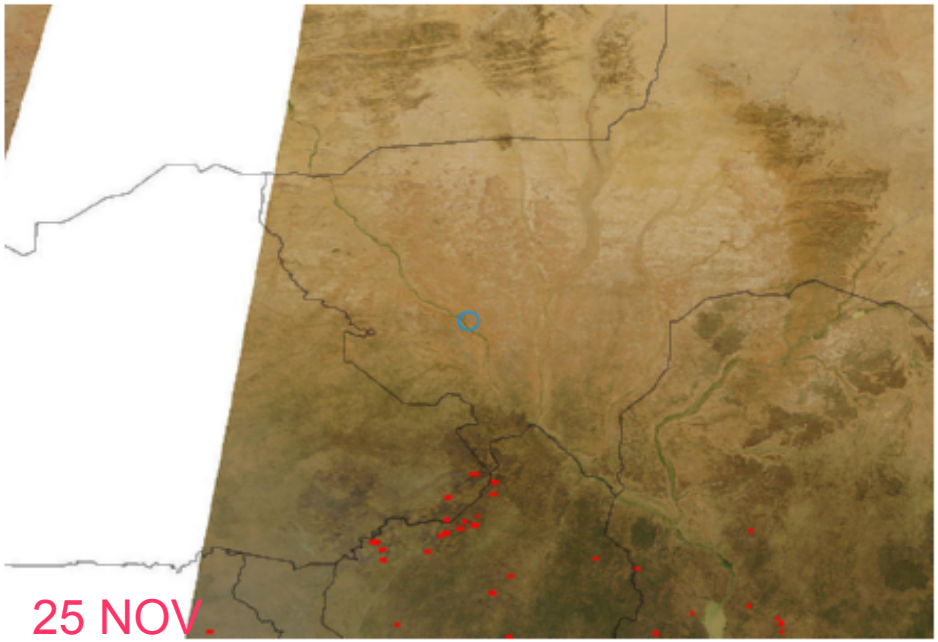
***Mixture* day: AOD>0.15 and α>0.4**

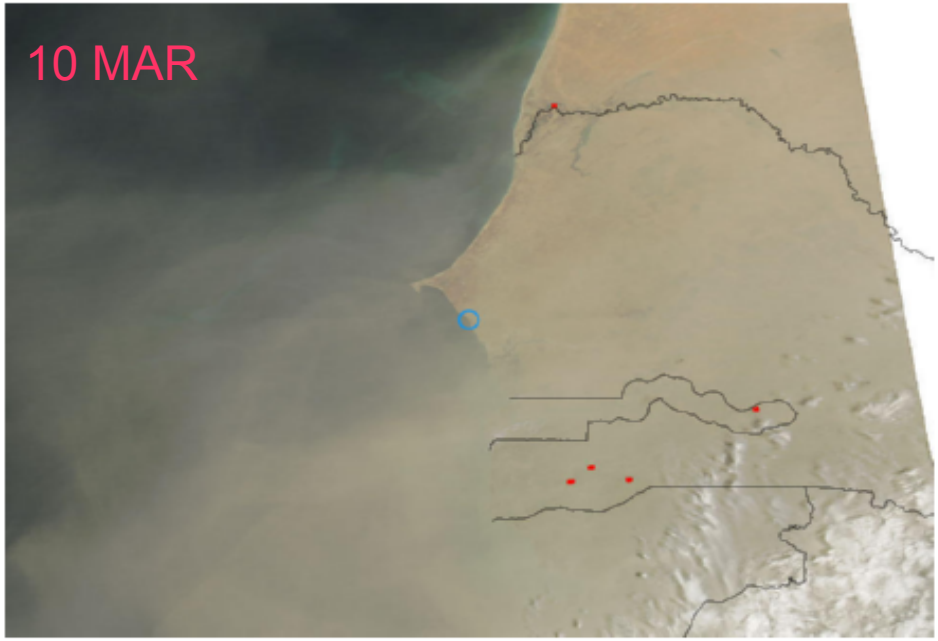
***Dusty* day: AOD>0.6 and α<0.15**

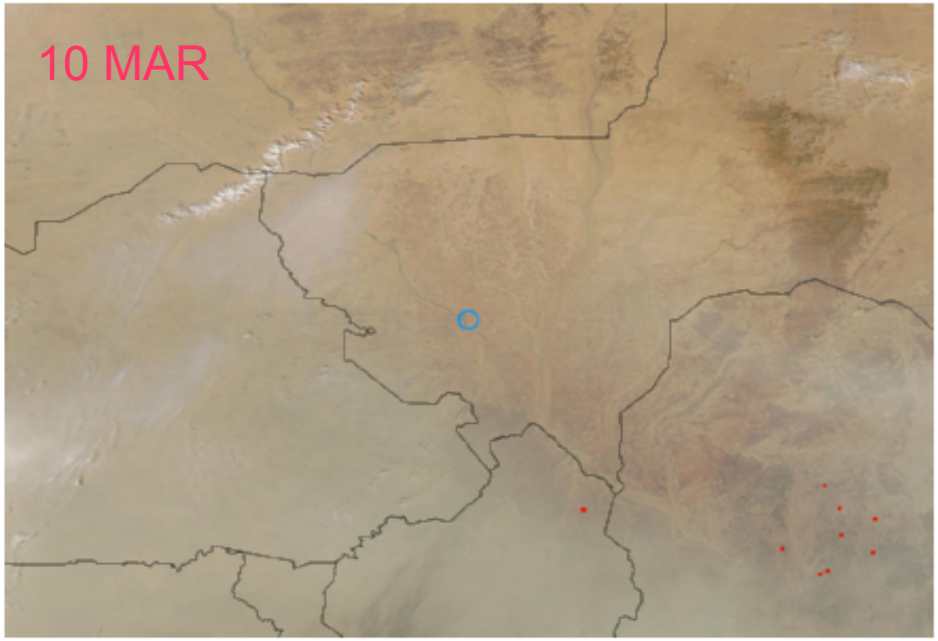
Choice of five days by aerosol type for each station::

DAKAR																				
Day type	*Clean*					*Standard*					*Mixture*					*Dusty*				
Date	06 02 16	06 02 22	06 02 25	06 02 28	06 03 01	06 02 23	06 02 24	06 03 15	06 03 31	06 04 01	06 01 21	06 02 01	06 02 03	06 02 04	06 05 03	06 03 10	06 03 11	06 03 12	06 03 13	06 04 05
δ	0.12	0.10	0.15	0.13	0.09	0.19	0.23	0.51	0.50	0.45	0.91	0.25	0.42	0.30	0.44	1.93	2.46	1.69	0.91	0.73
δ_c	0.07	0.06	0.10	0.07	0.06	0.11	0.13	0.35	0.33	0.32	0.26	0.08	0.11	0.08	0.09	1.41	1.62	1.24	0.66	0.52
δ_f	0.05	0.04	0.05	0.06	0.03	0.08	0.10	0.16	0.17	0.13	0.65	0.17	0.31	0.22	0.35	0.52	0.84	0.45	0.25	0.21
$\alpha_{440-870}$	0.38	0.30	0.13	0.41	0.27	0.57	0.38	0.15	0.20	0.15	0.85	0.86	0.91	0.92	1.14	0.11	0.12	0.10	0.12	0.16
SSA	0.91	0.88	0.93	0.87	0.90	0.89	0.89	0.92	0.92	0.92	0.83	0.80	0.85	0.82	0.88	0.94	0.95	0.95	0.94	0.94


1 MAR


25 NOV


10 MAR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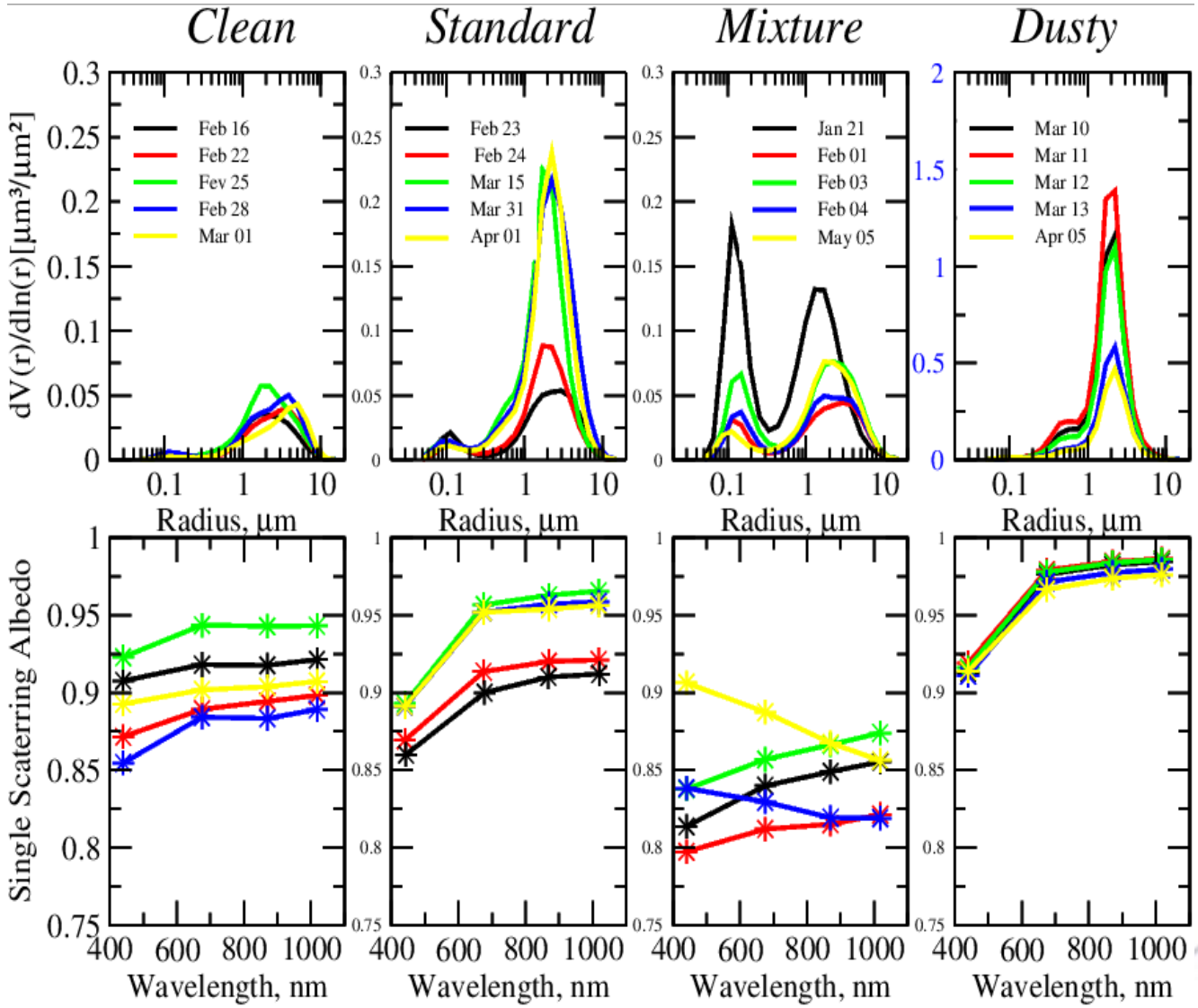
Optical properties of selected days : Dakar



(1) Predominance of coarse mode except for mixed days or both modes are quite similar

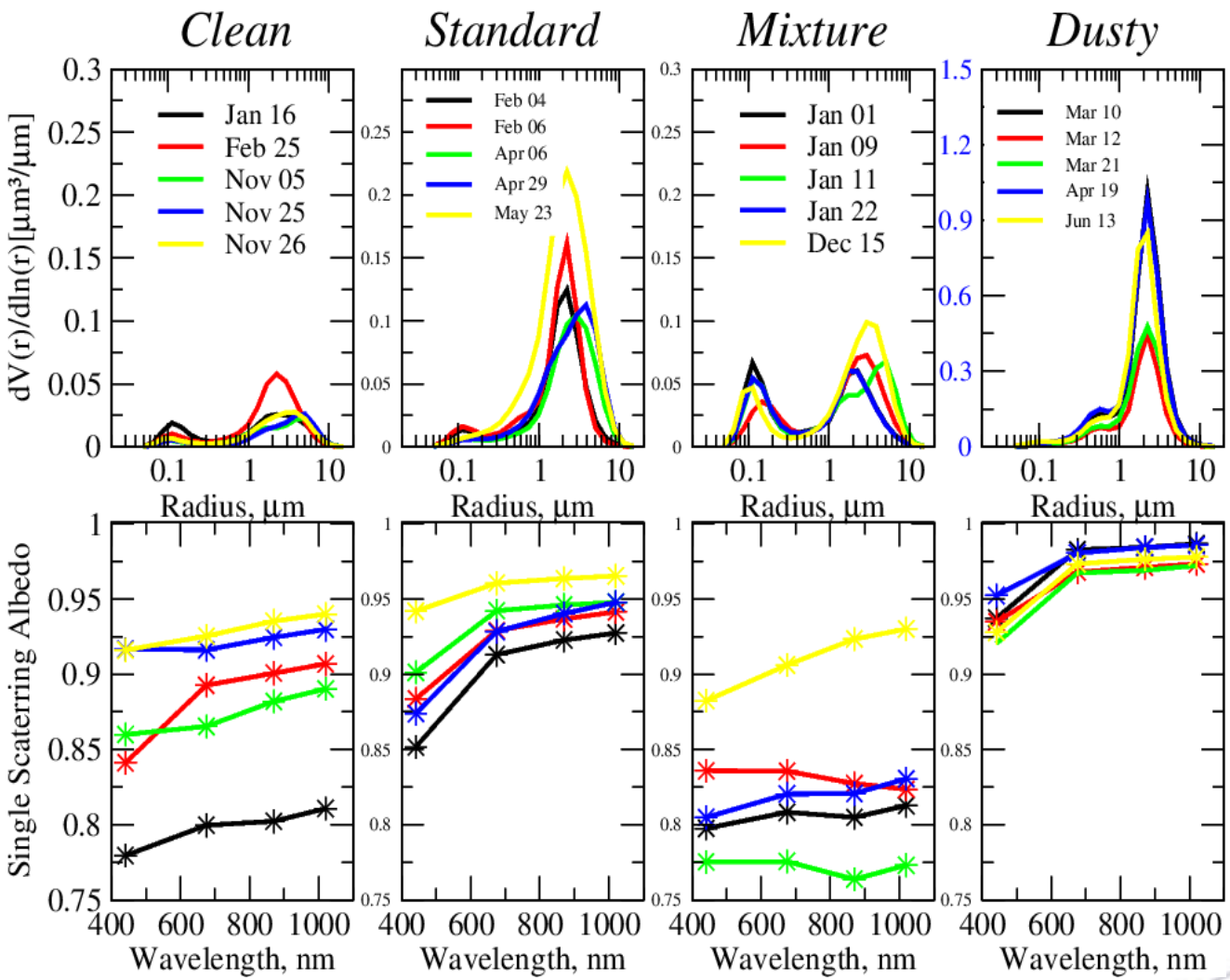
(2) Maximum of particle for dust events

(3) unlike the SOOT, the SSA increases for small ʎ for

(4) Spectral neutrality for dusty days: pure dust

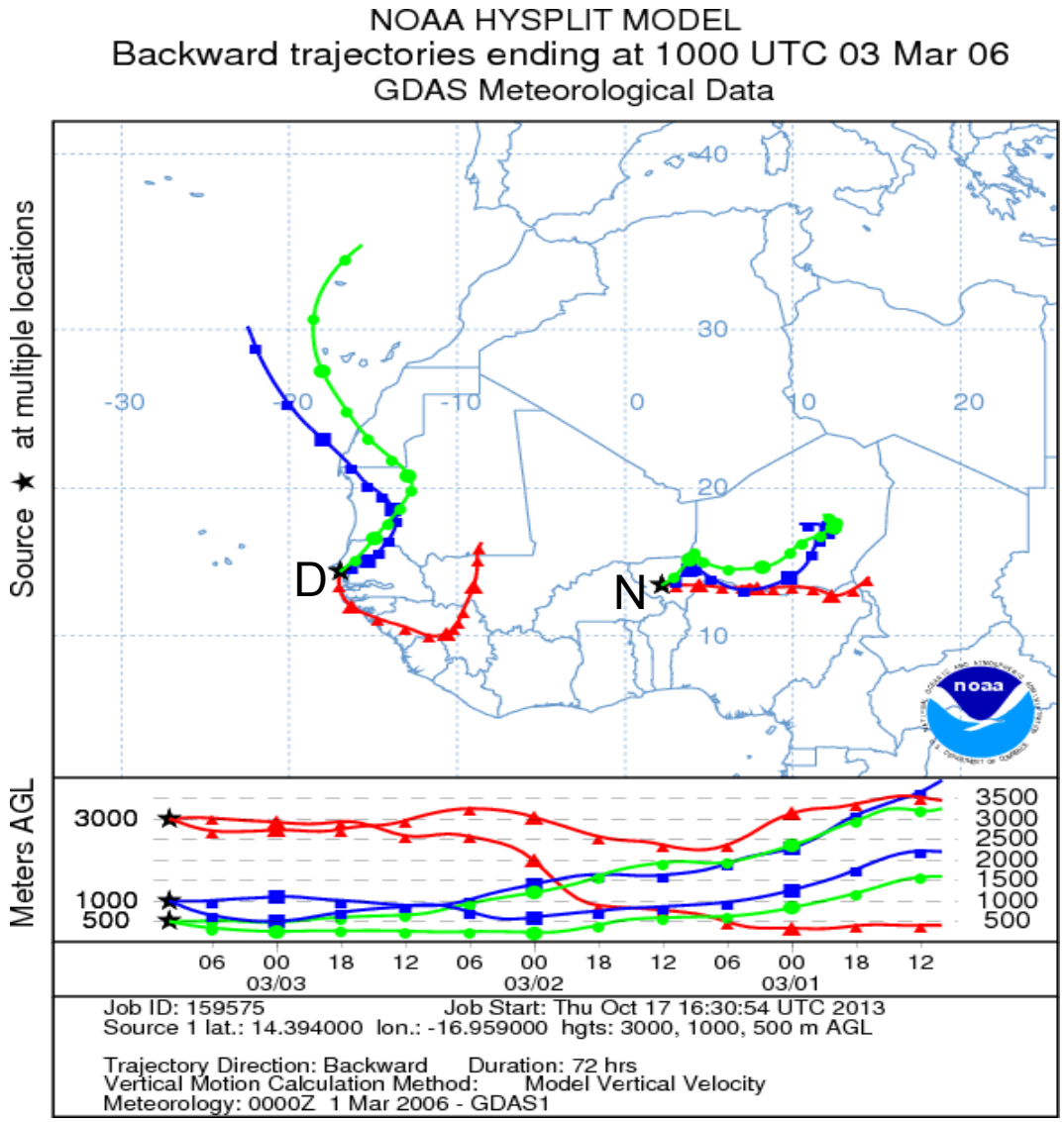
(5) Mixed day; not representative of either dust or soot (flat trend) then it is a mixture of 2

Optical properties of selected days : Niamey



Similar to Dakar

Source of air masses with Hysplit-4:
Clean days (no aerosol)

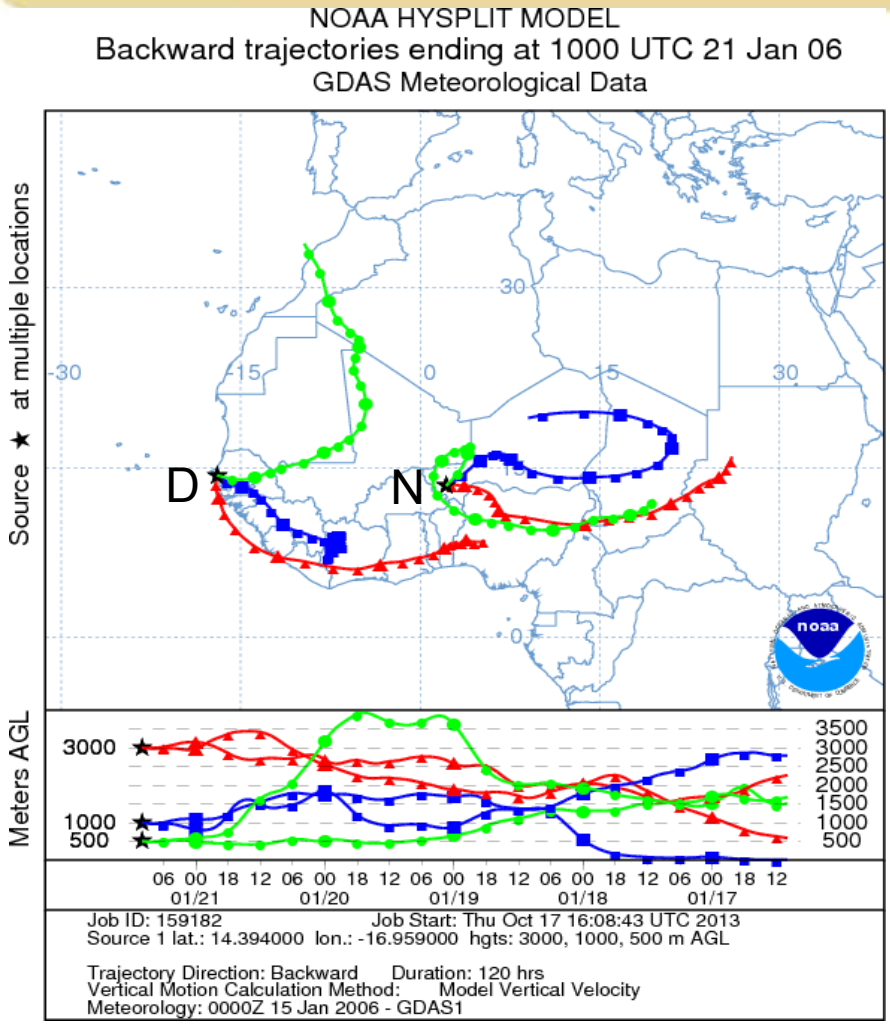


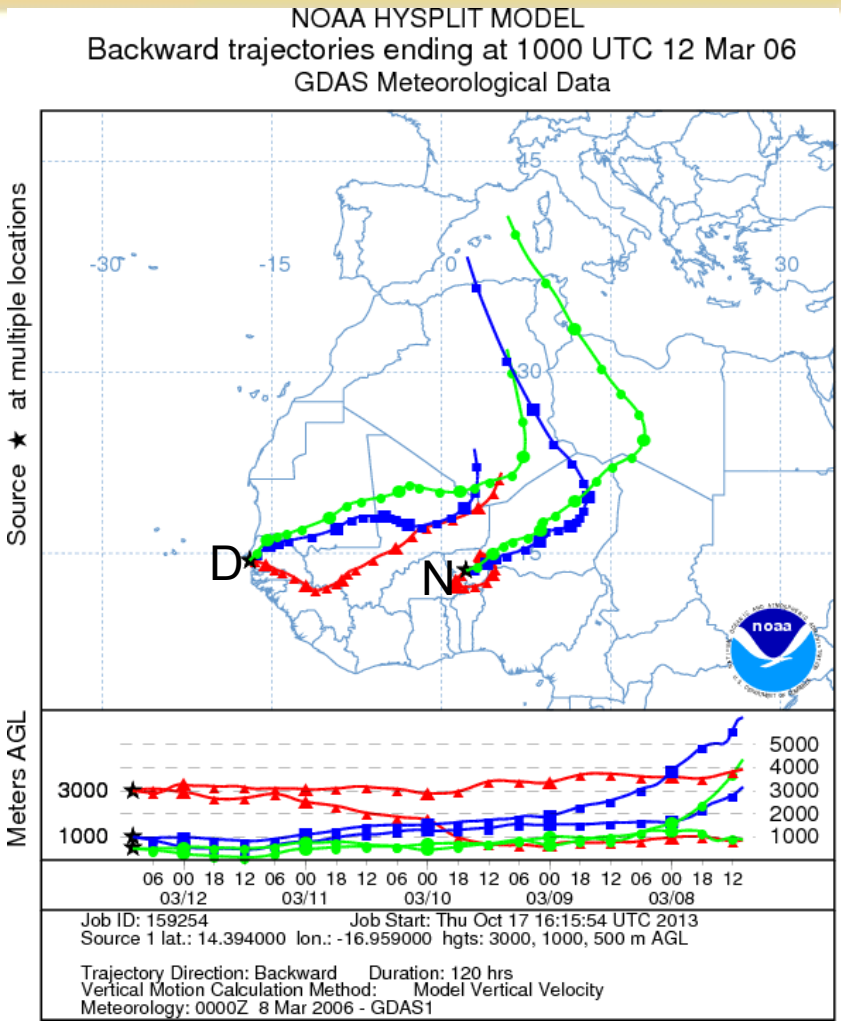
Source pour journée claire

Sea salt + dust in Dakar

Dust + Biomass burning in Niamey

Source of air masses for mixture and dust event days:

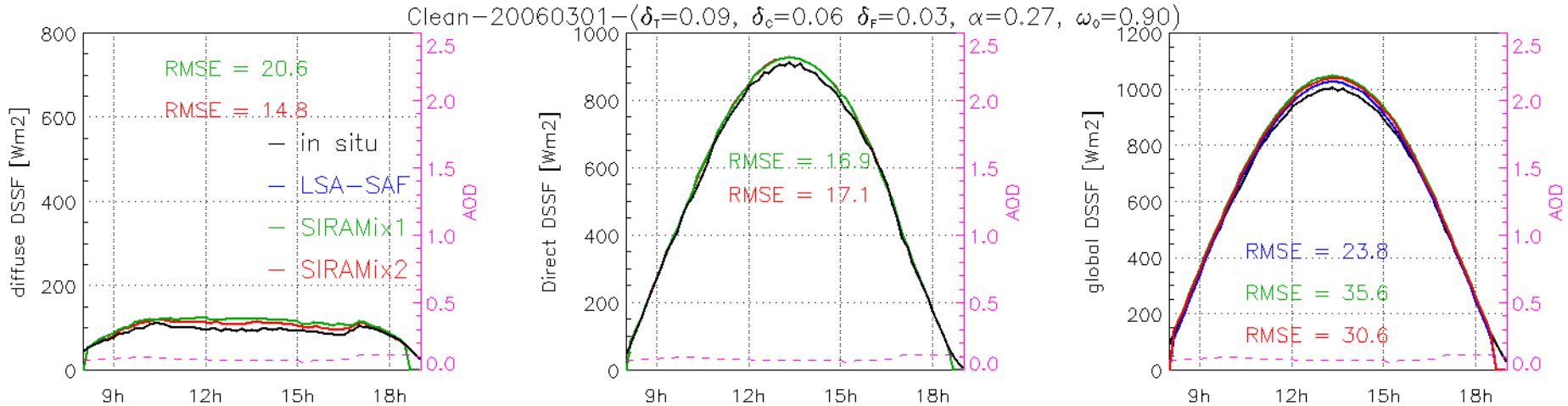


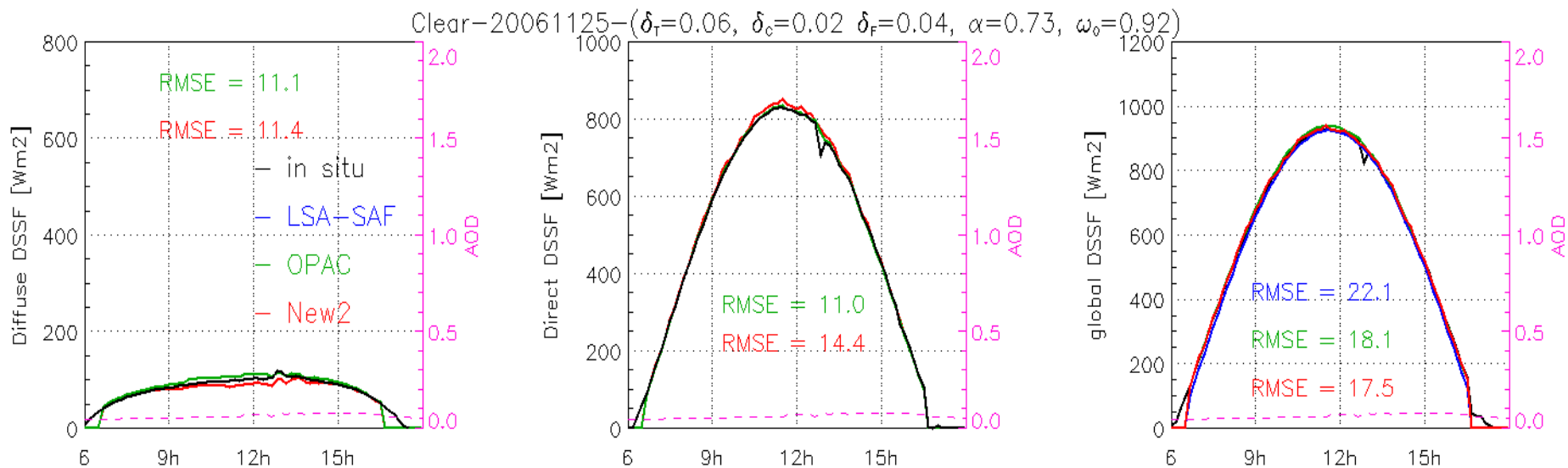


Mixture days: dust + soot for Dakar and Niamey

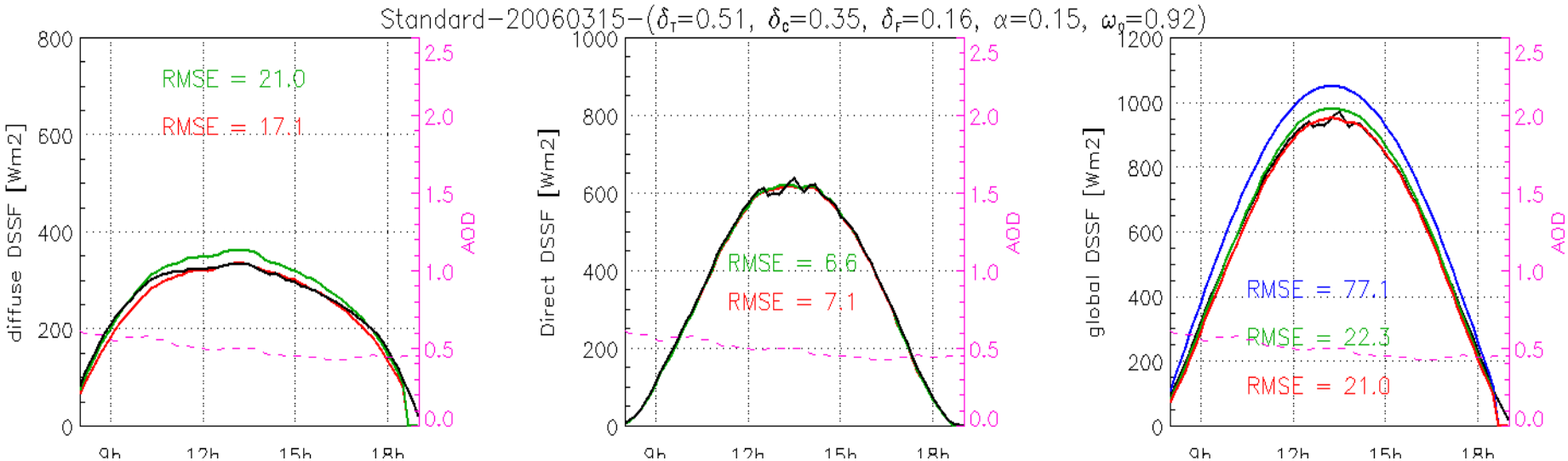
Dust event: fine dust + coarse dust for Dakar and Niamey

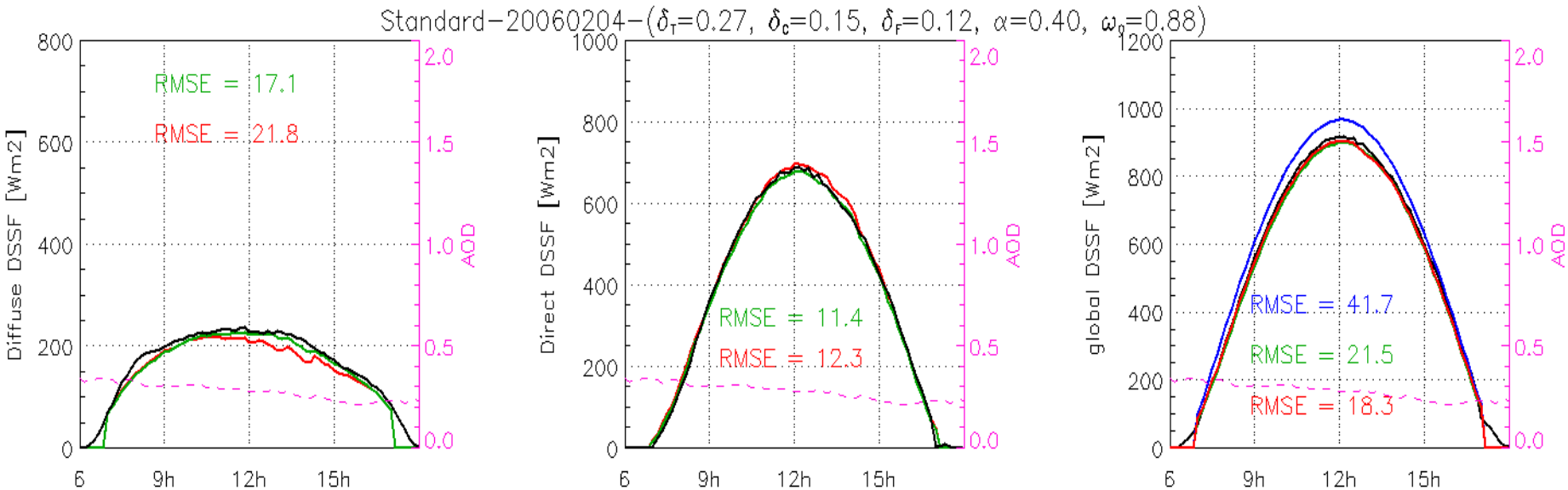
Dakar & Niamey: Clean days



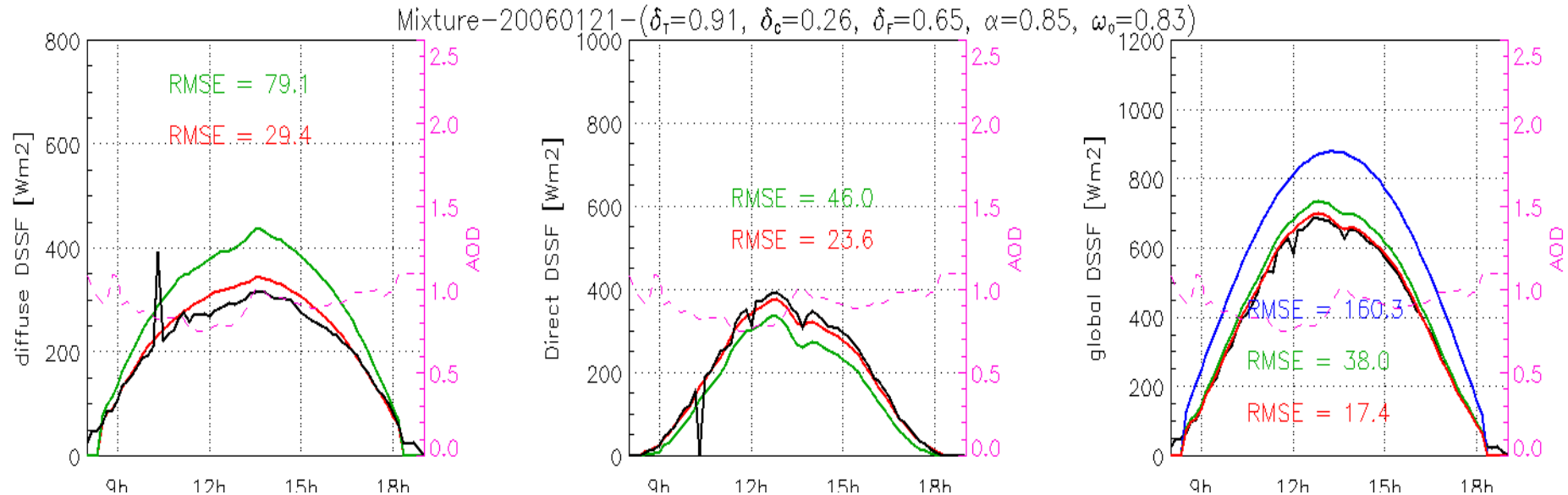


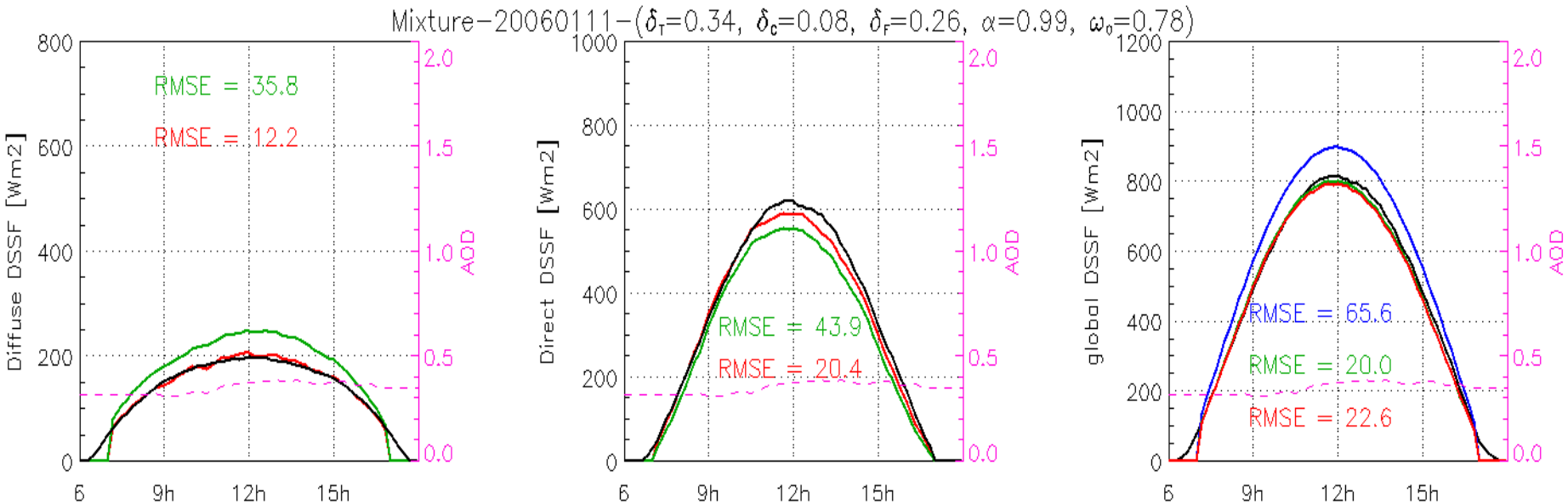
Dakar & Niamey: Standard days



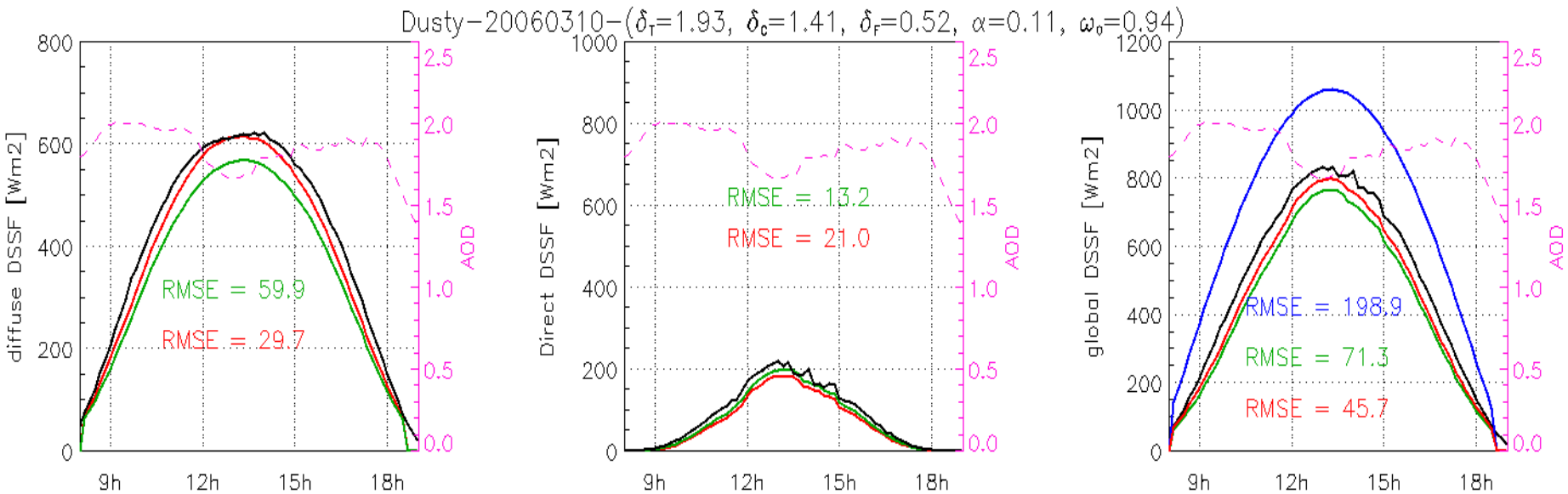


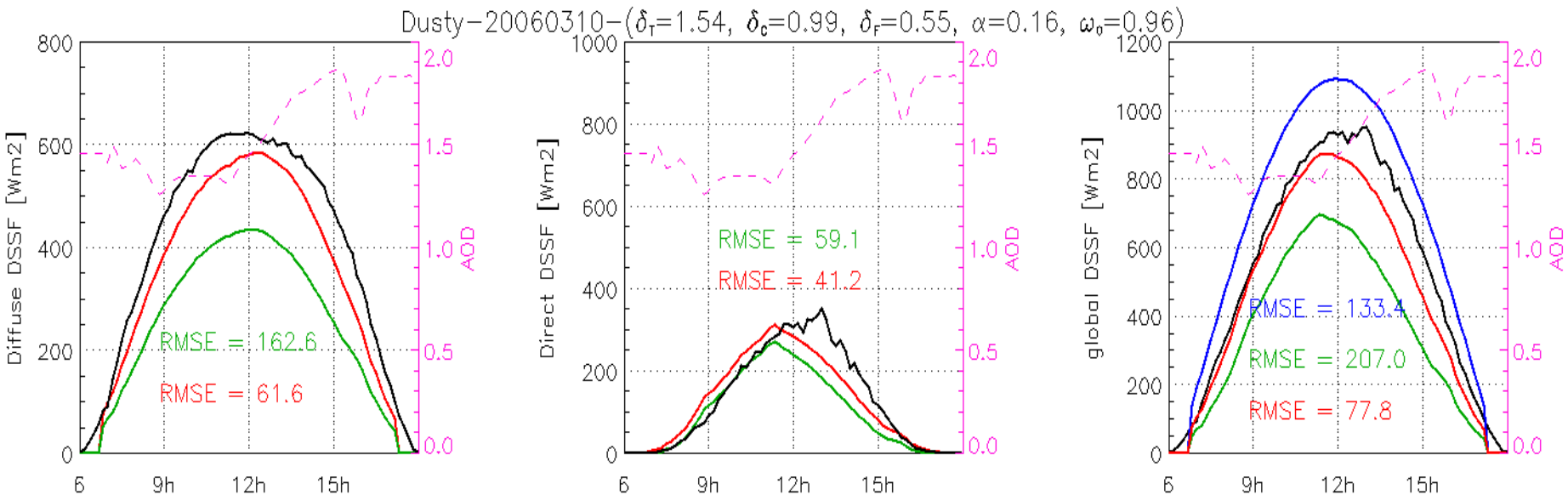
Dakar & Niamey: Mixture days



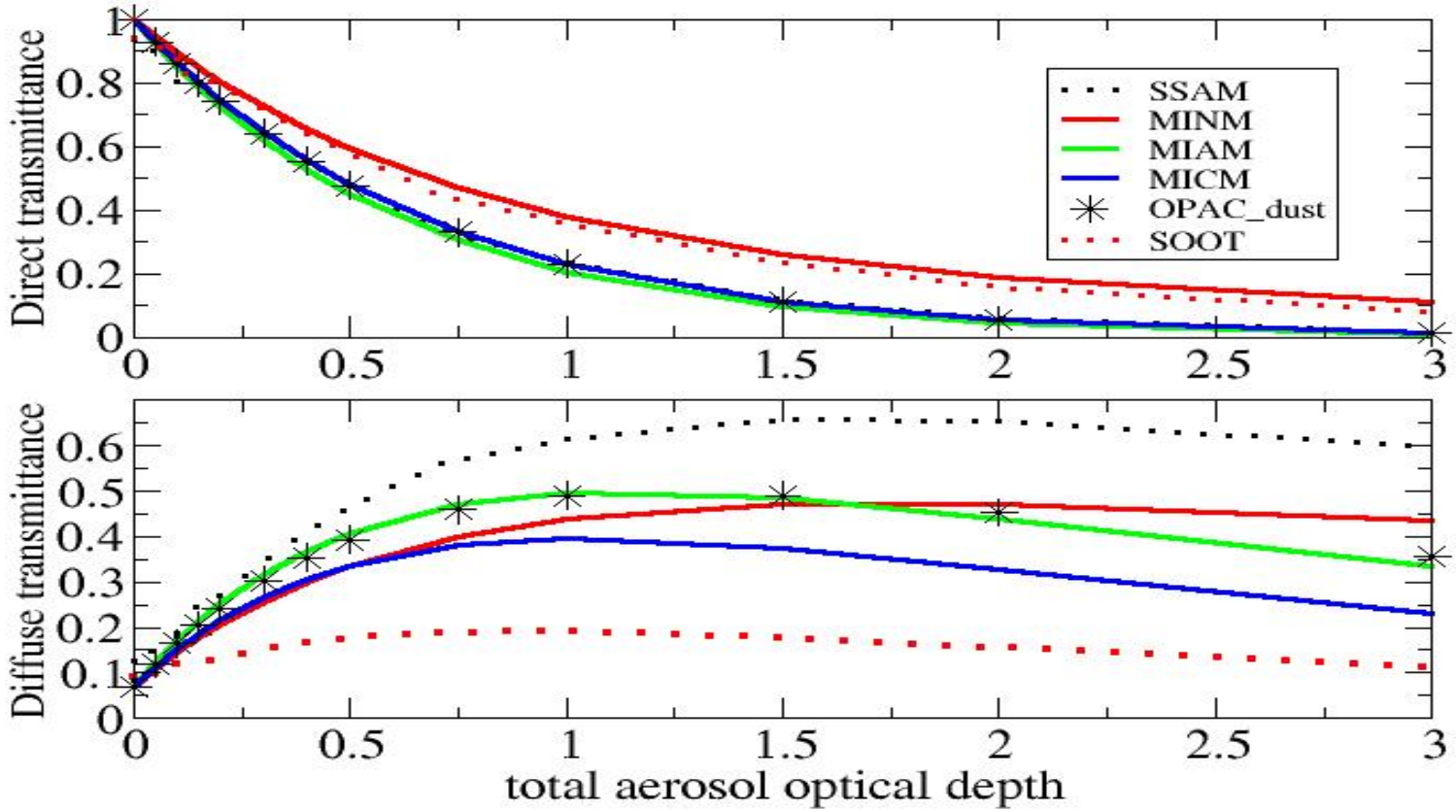


Dakar & Niamey: dusty days



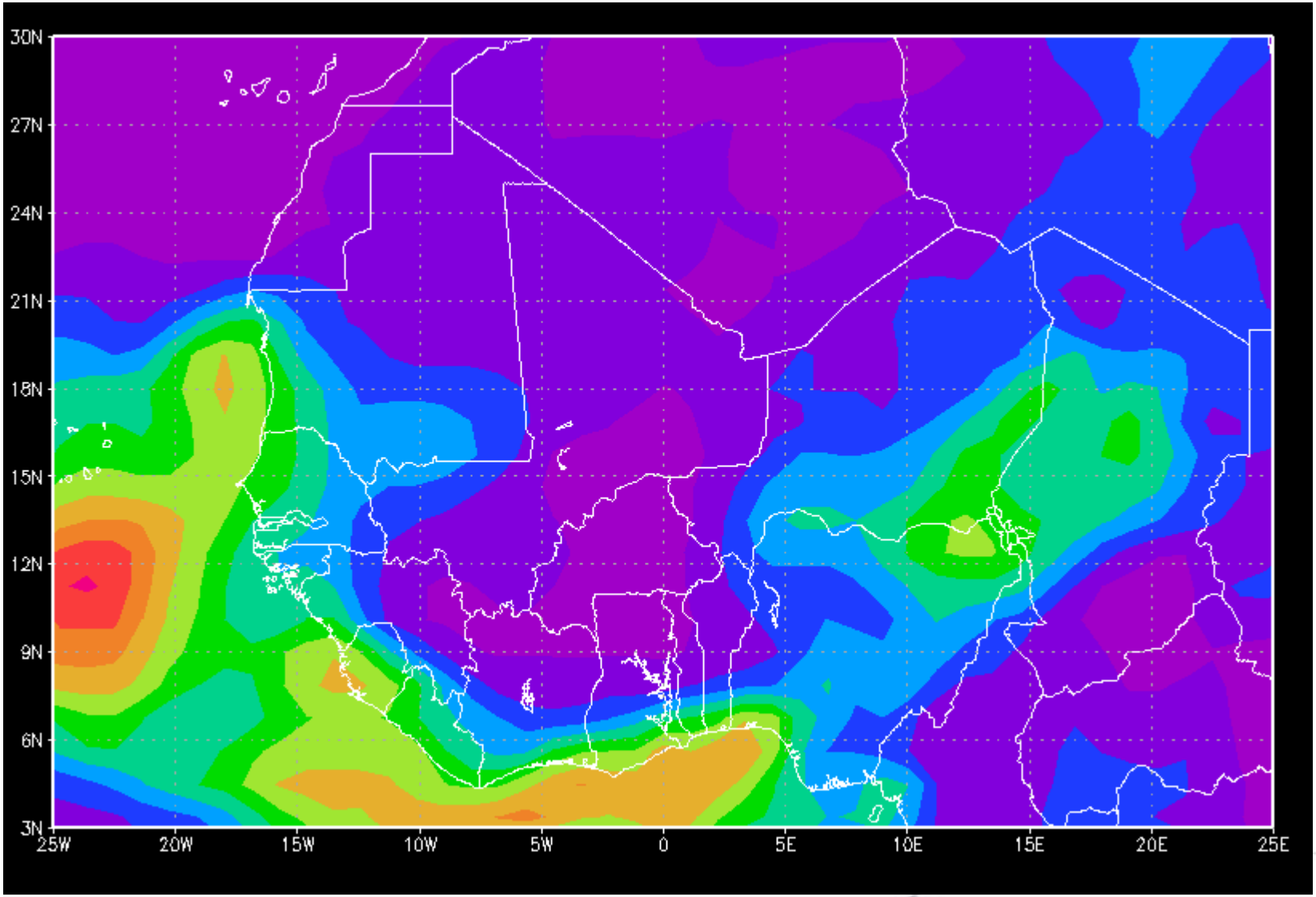


Transmittance des composantes du modèle désertique de la base de donnée OPAC

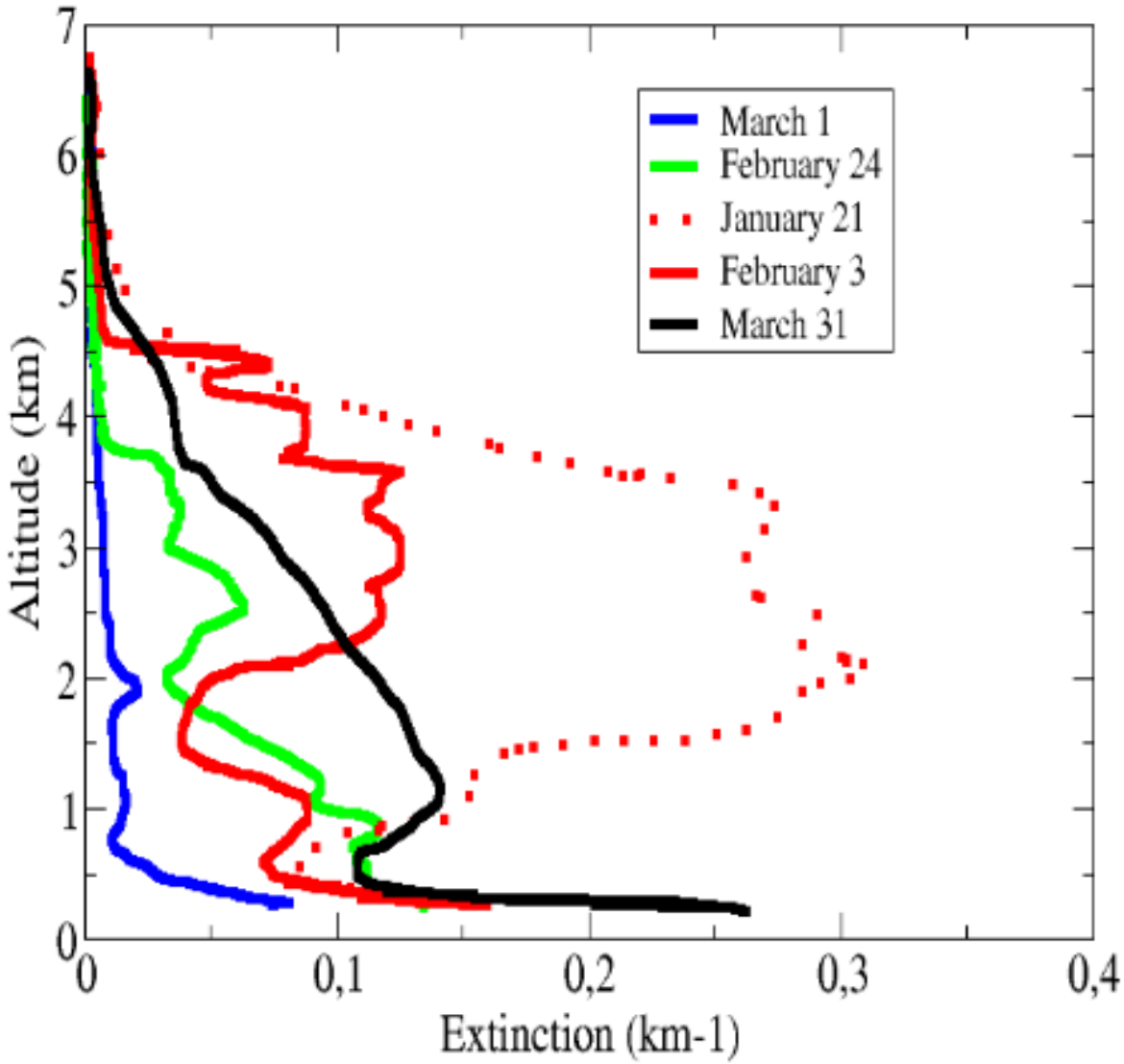


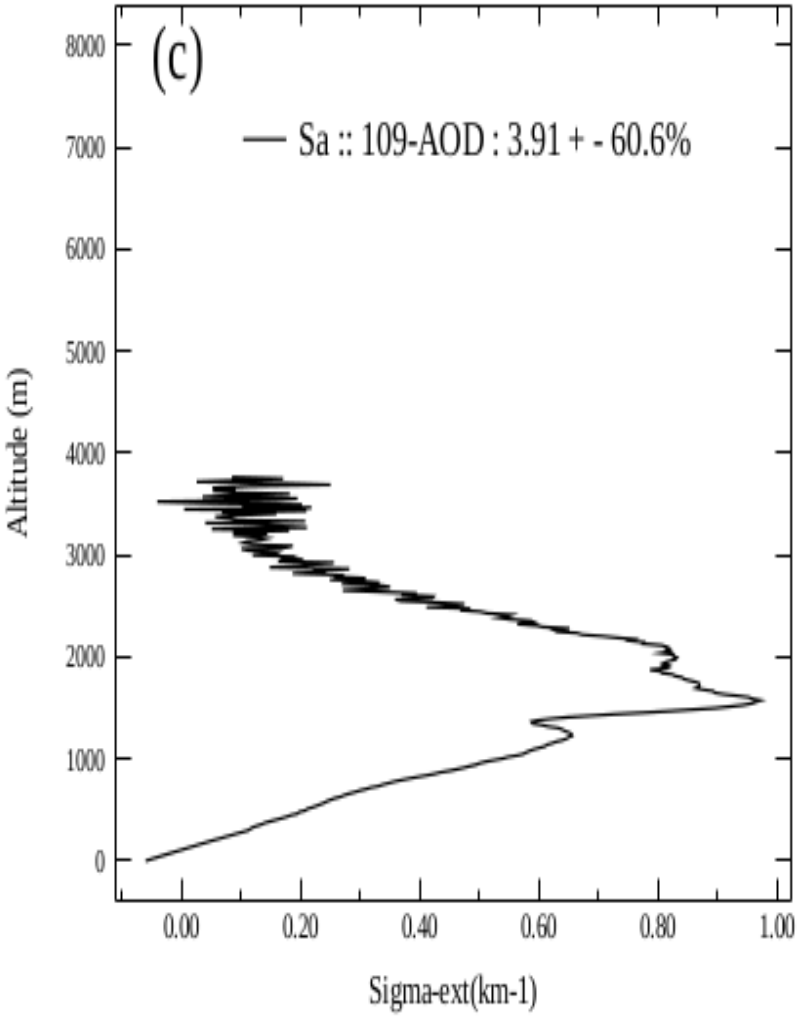
MIAM (Mineral Accumulate Mode) représente le mieux ce modèle.
Si AOD>1.5, MIAM transmittance diffuse est sous estimé par cette composante.

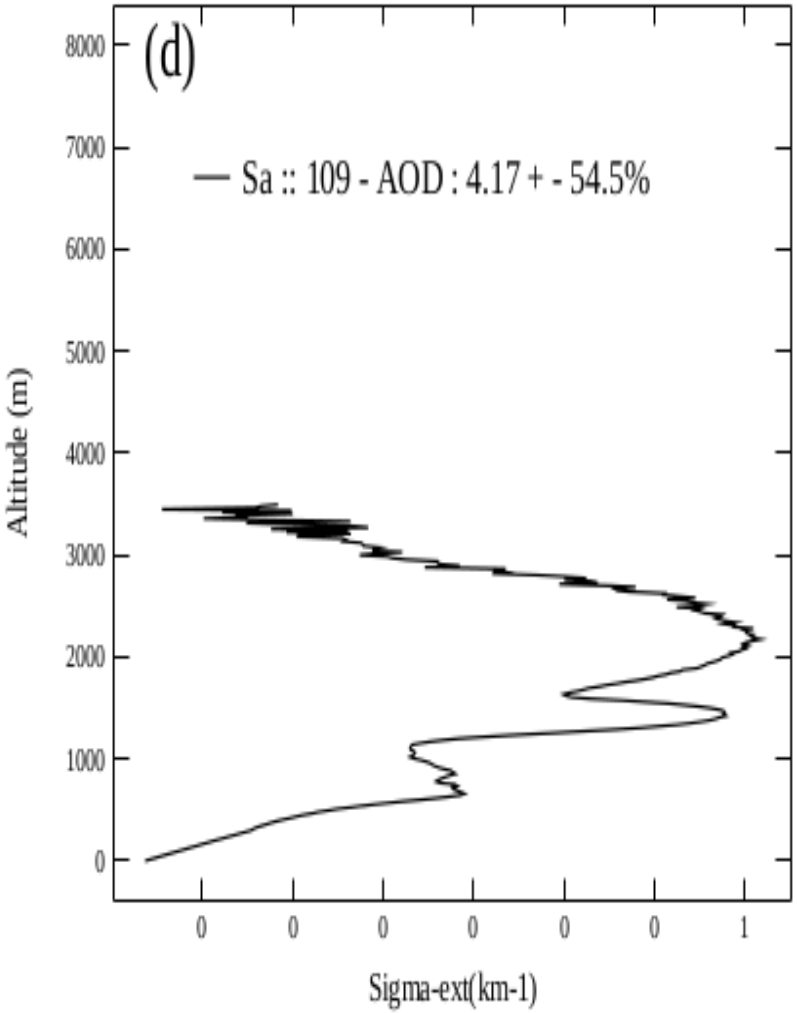
MACC II


30N
27N
24N
21N
18N
15N
12N
9N
6N
3N
25W
20W
15W
10W
5W
0
5E
10E
15E
20E
25E

Tests: profil vertical des aérosols à Dakar




(c)
— Sa :: 109-AOD : 3.91 + - 60.6%
Altitude (m)
Sigma-ext(km-1)
0
1000
2000
3000
4000
5000
6000
7000
8000
0.00
0.20
0.40
0.60
0.80
1.00


(d)
— Sa :: 109 - AOD : 4.17 + - 54.5%
Altitude (m)
Sigma-ext(km-1)
0
1000
2000
3000
4000
5000
6000
7000
8000
0
0
0
0
0
0
1