Sensitivity of CERES Clear-sky ADM performance over ocean to the confidence of clear-sky scene identification

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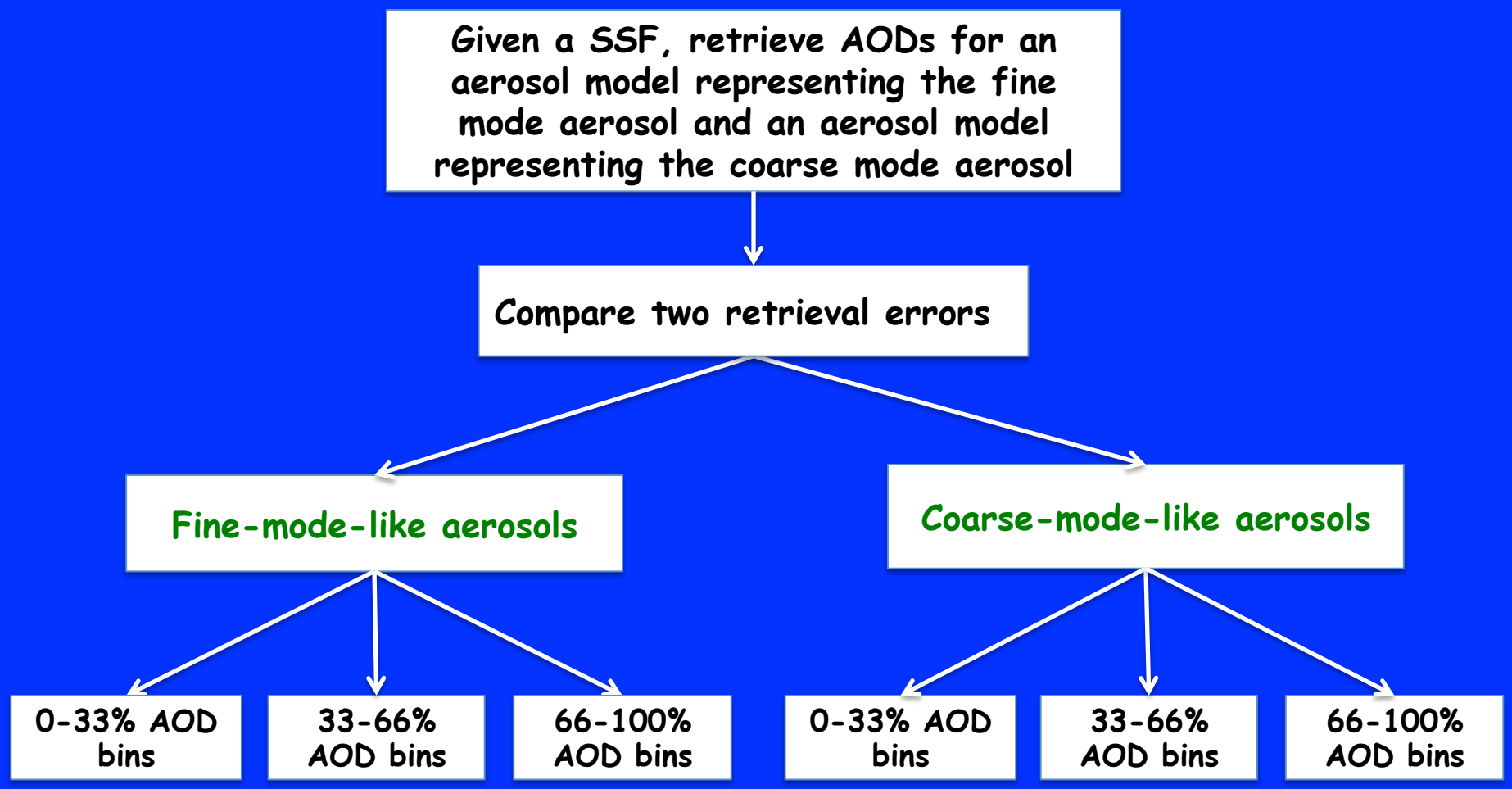
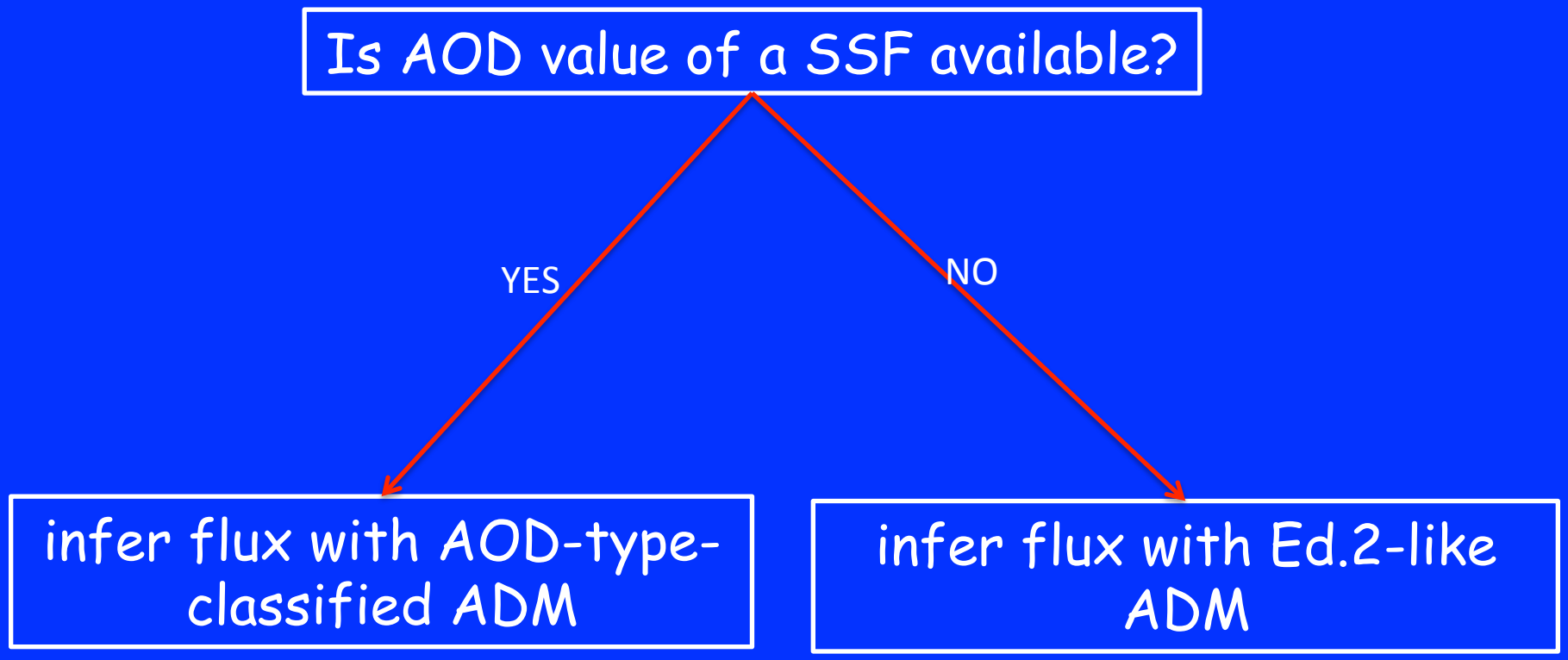
Ed4ADM: AOD-and-type classified ADM

two-model-minimal-retrieval-error approach



ED4ADM: flux inversion



How to quantify the performance of an ADM?

RMS of normalized radiance differences between ADM-prediction and observation

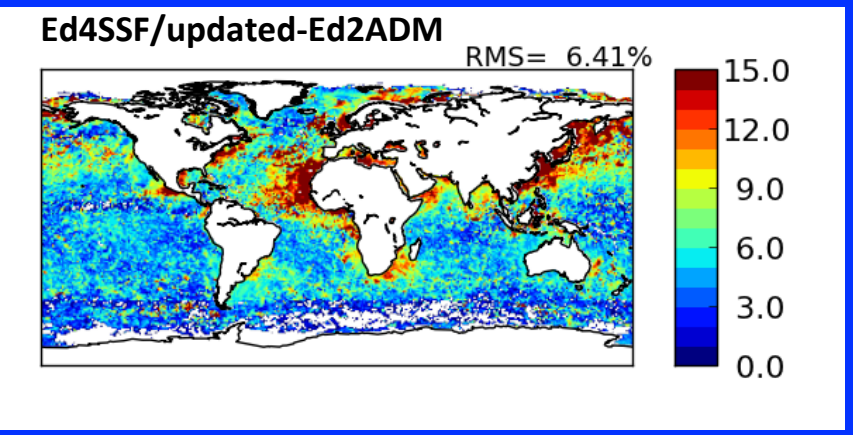
$$RMS = \sqrt{\frac{1}{n}\sum\left(\frac{\hat{I}^i}{\langle \hat{I} \rangle} - \frac{I_O^i}{\langle I_O \rangle}\right)^2}$$

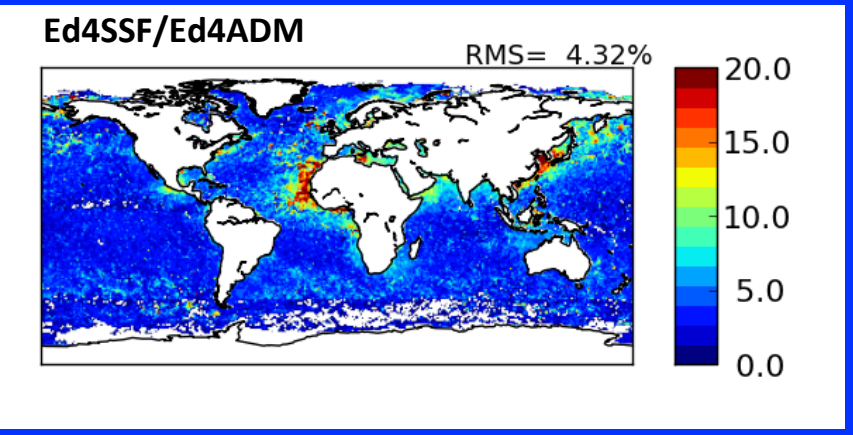
$\hat{I}^i$ is the radiance value of ADM at (w, θ_0, θ and ϕ),

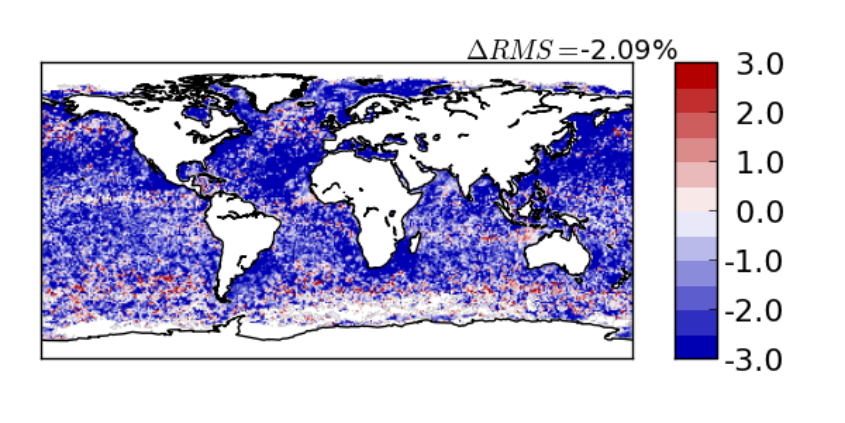
I_o^i is the radiance value of the theoretical model at (w, θ_0, θ and ϕ),

$\langle \ \rangle$ is the grid mean.

RMS of normalized radiance differences between ADM-prediction and observation



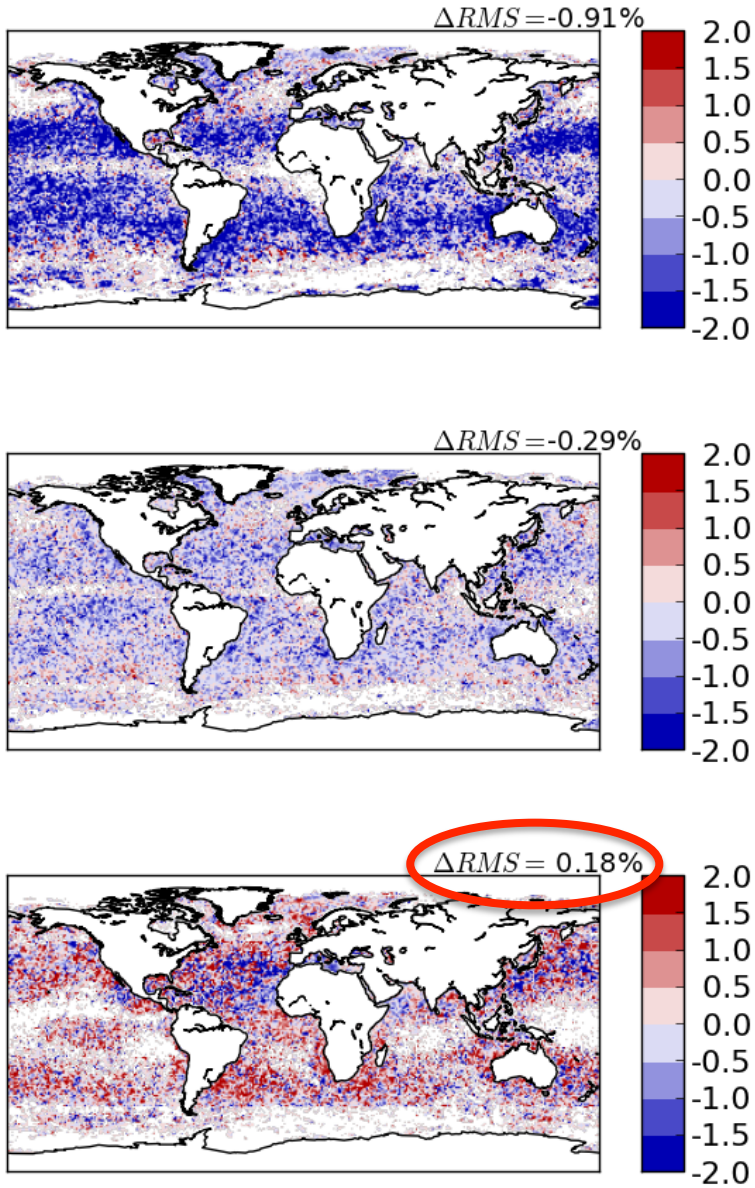




(Terra 2002 cross-track SSFs with AOD retrievals)

ΔRMS for **the each** aerosols **category bin**

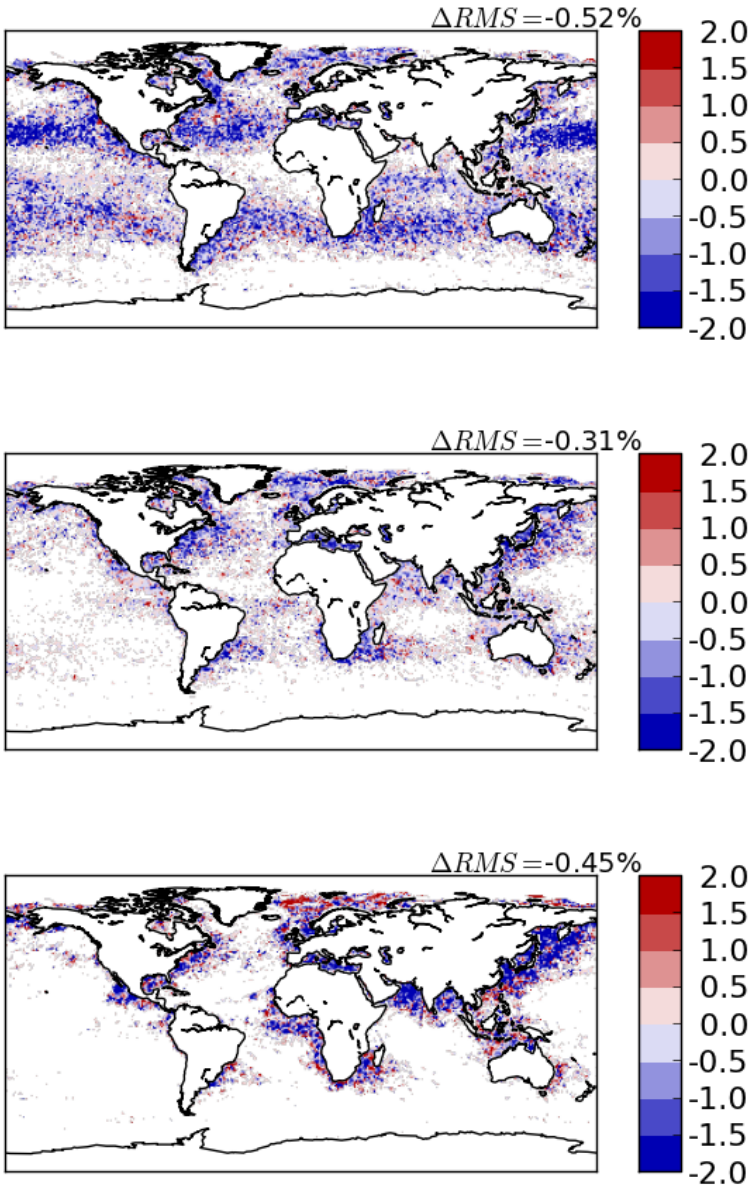
coarse-mode-like aerosol | fine-mode-like aerosol



0-33%

33-66%

66-100%



(Terra 2002 cross-track SSFs with AOD retrievals)

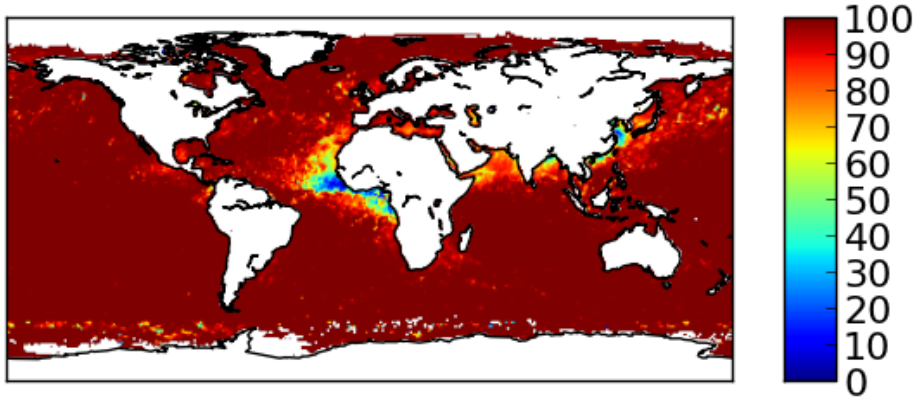
sensitivity of ADM performance to the confidence of clear-sky scene identification: clr_strong parameter

Retrieval confidence of clear-sky of SSF

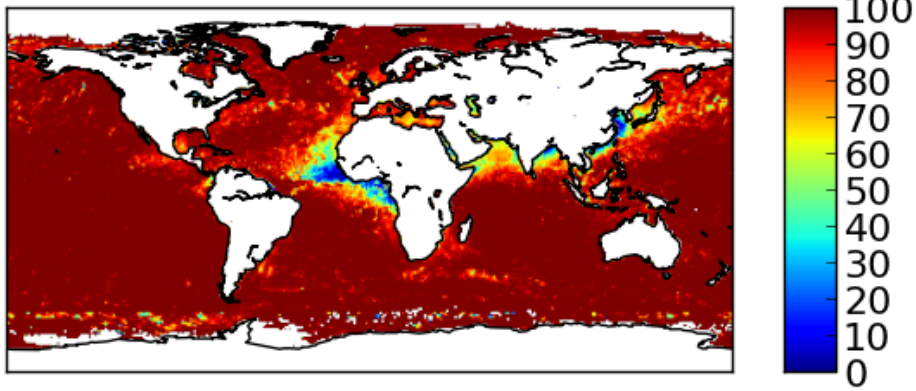
Clr-strong=0
no imager pixel is confidently clear

clr-strong=100
all imager pixels are confidently clear

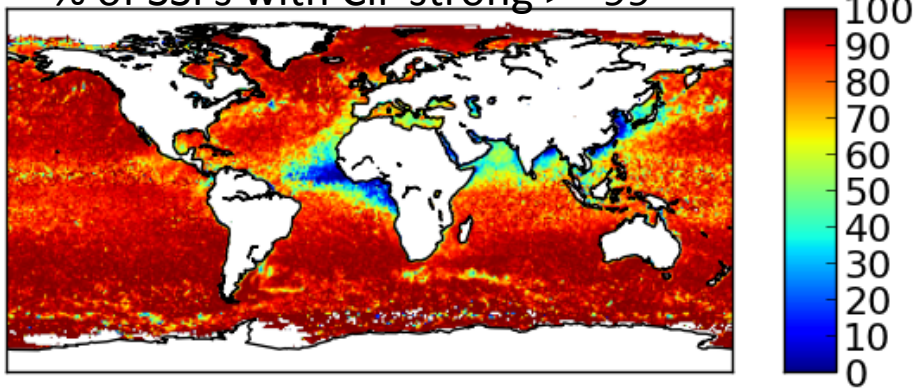
% of SSFs with Clr-strong >= 1



% of SSFs with Clr-strong >= 50



% of SSFs with Clr-strong >= 99

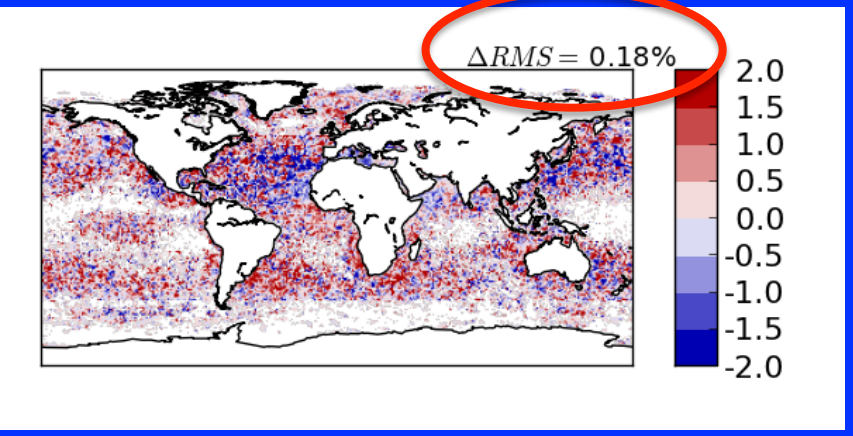


(Terra 2000-2005 RAP data)

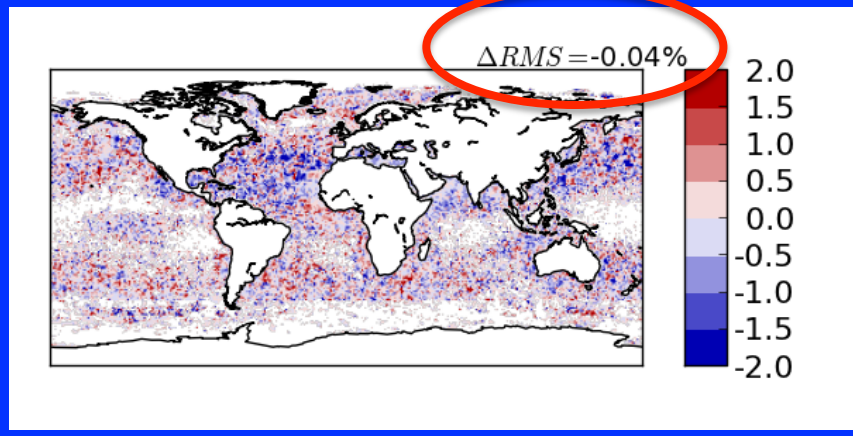
Sensitivity of radiance RMS error to clr_strong parameter

(coarse-mode-like aerosol in 66-100-percentile bin only)

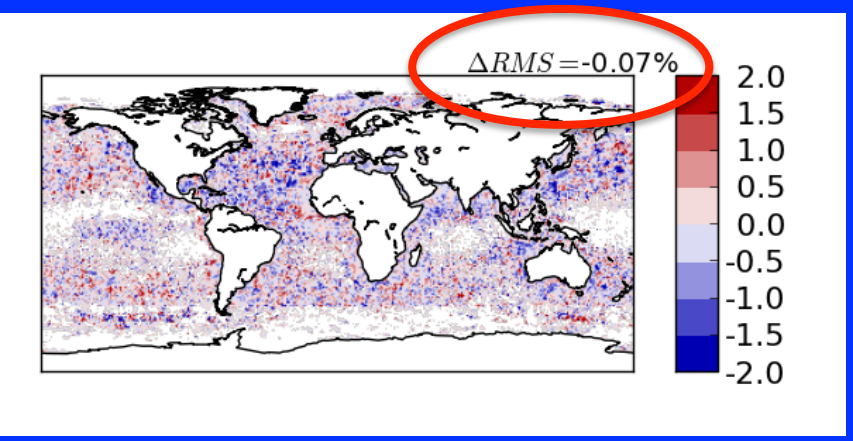
Control run



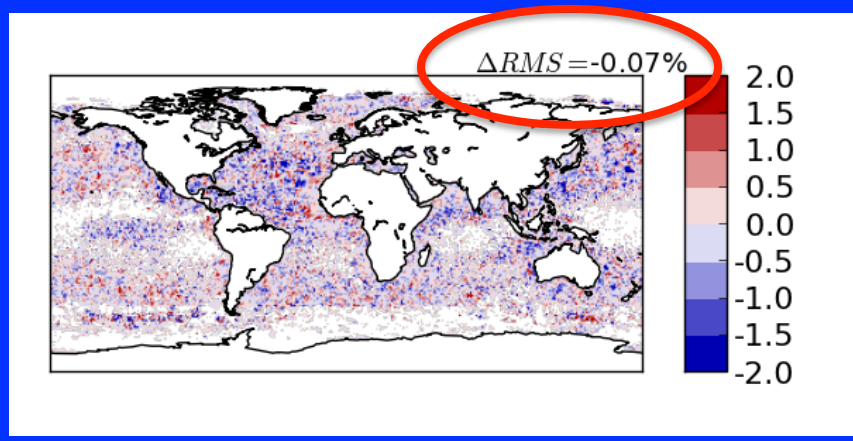
with SSFs with Clr-strong >= 1



with SSFs with Clr-strong >= 50



with SSFs with Clr-strong >= 99



(Terra 2002 cross-track with AOD retrievals)

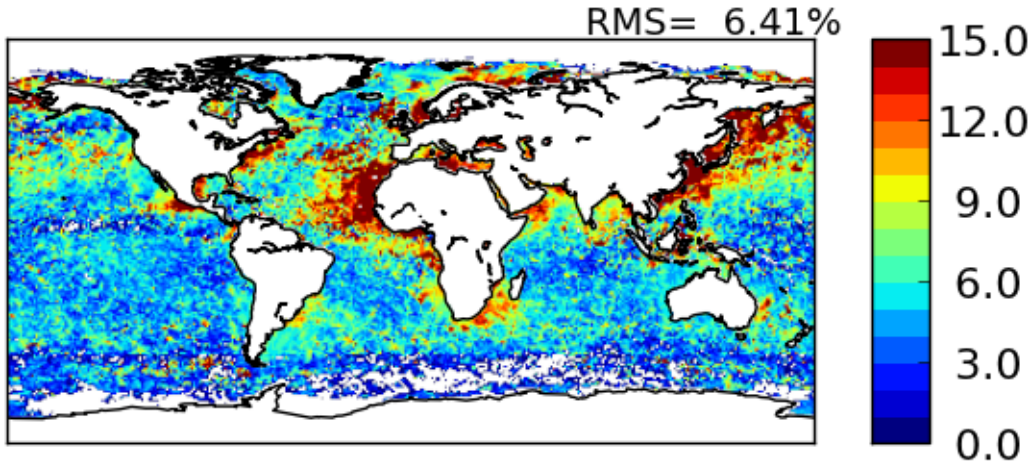
Sensitivity of ADM performance to clr_strong parameter

Terra 2002 cross-track SSFs with aerosol retrievals

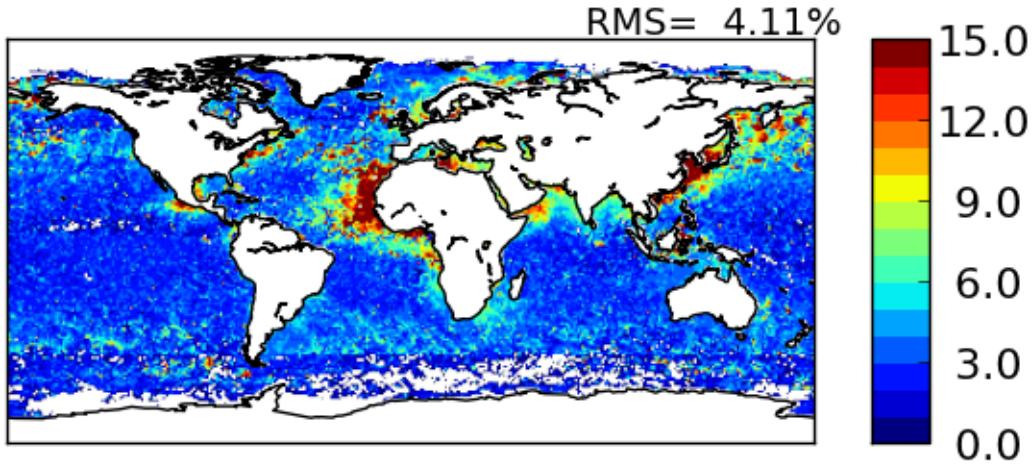
with SSF having clr-strong >=	RMS(%)		ΔRMS (%)	Iadm-Iobs (w/m²/sr)		ΔF(w/m²)
	Ed4SSF/ update-Ed2ADM	Ed4SSF/ Ed4ADM		Ed4SSF/ update-Ed2ADM	Ed4SSF/ Ed4ADM	
Control run	**6.41**	**4.32**	**-2.09**	**0.49**	**0.13**	**-0.15**
1	**6.41**	**4.11**	**-2.30**	**0.49**	**-0.01**	**-0.19**
50	6.41	4.13	-2.28	0.49	-0.07	-0.29
99	6.41	4.17	-2.24	0.49	-0.13	-0.34

ADM performance: RMS error
(clr_strong >= 1)

Ed4SSF/update-Ed2ADM



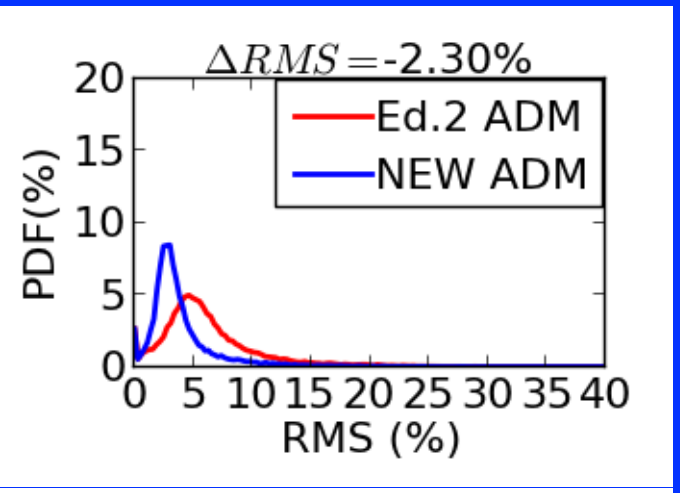
Ed4SSF/Ed4ADM

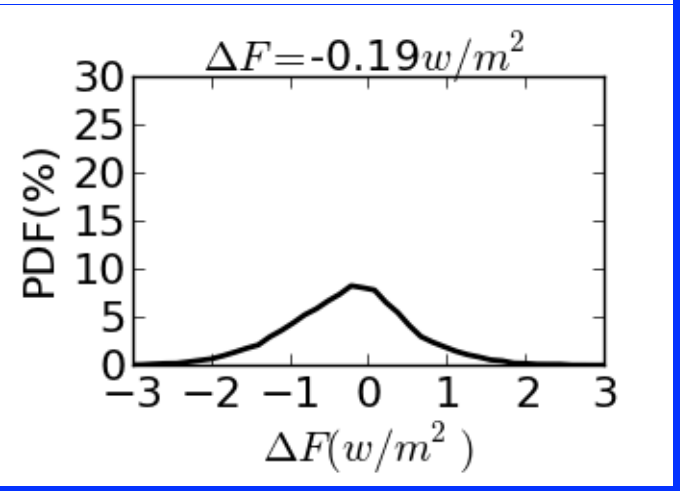


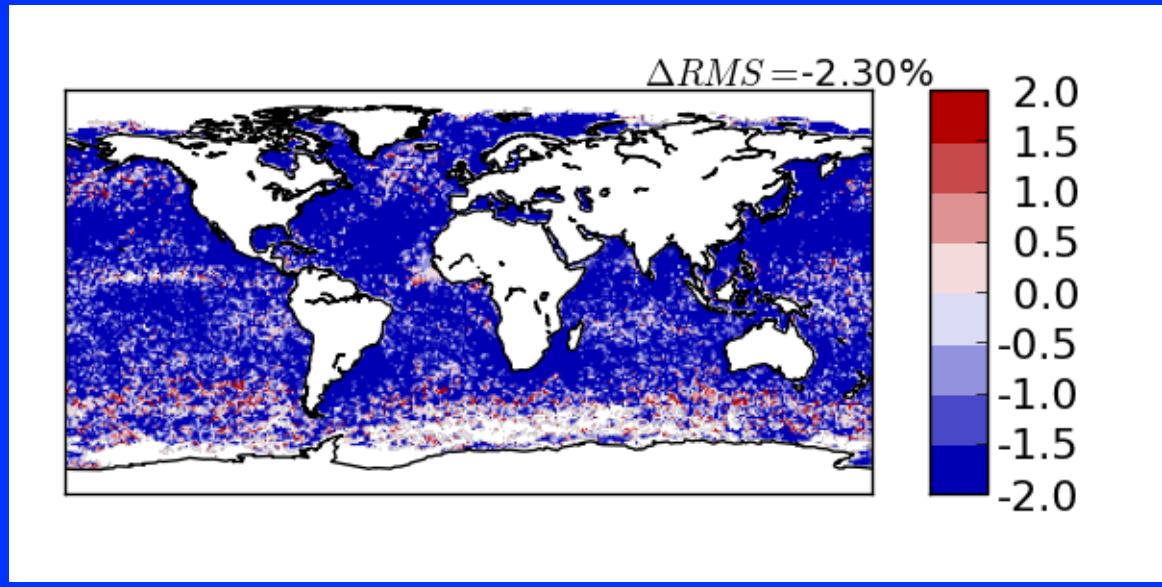
(2002, Terra cross-track mode and SSFs with AOD retrieval)

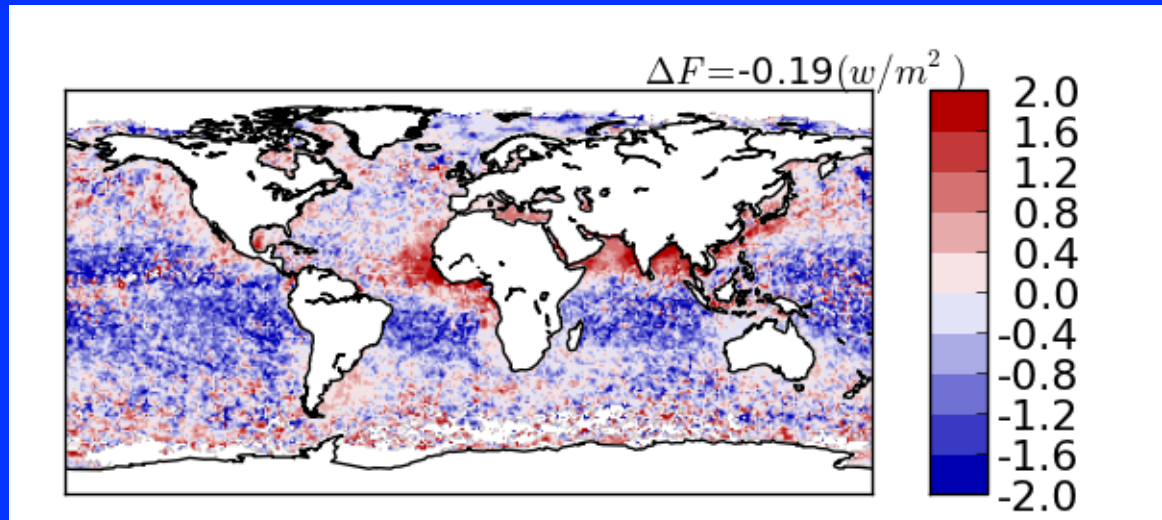
ADM performance: RMS error

(SSFs with AOD retrieval Ed4SSF/Ed4ADM clr_strong >= 1)



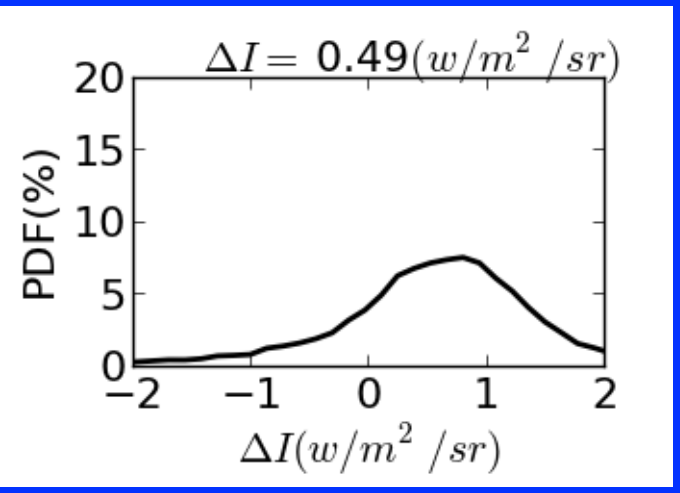




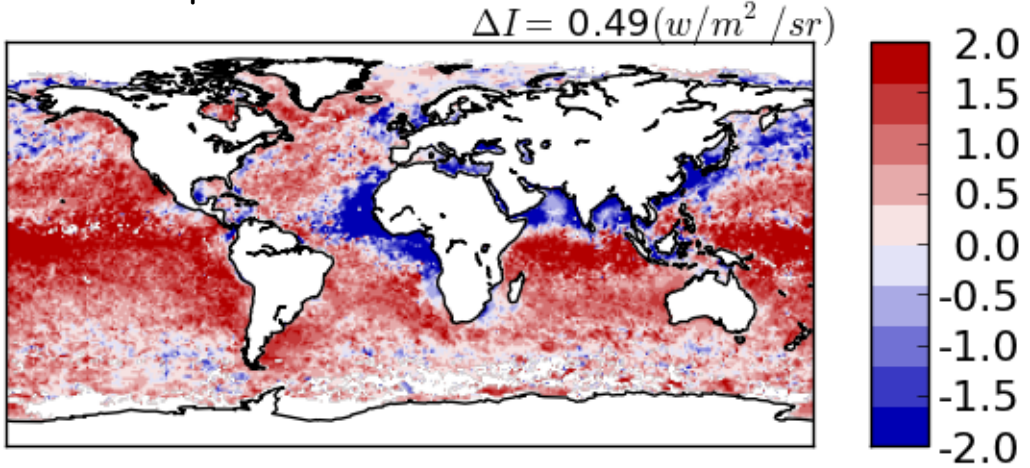


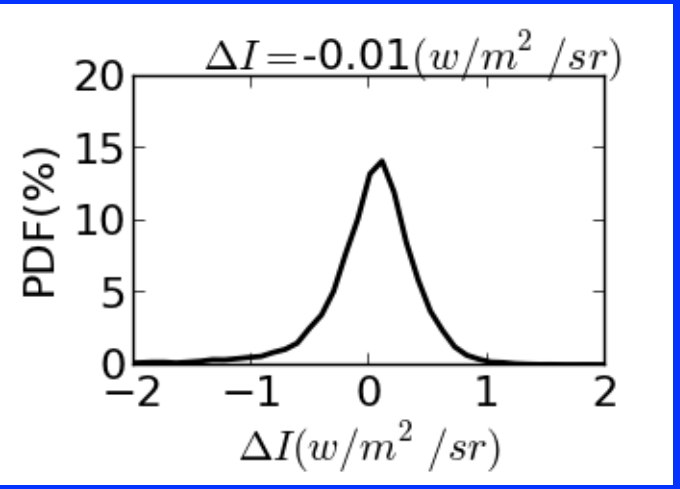
(2002, Terra cross-track mode and SSFs with AOD retrieval)

ADM performance: radiance bias
(clr_strong >= 1)

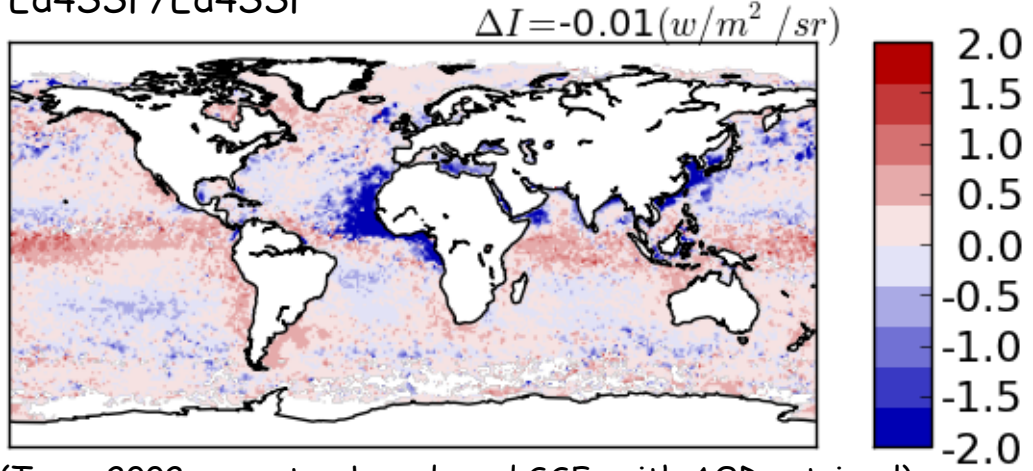


Ed4SSF/update-Ed2ADM





Ed4SSF/Ed4SSF

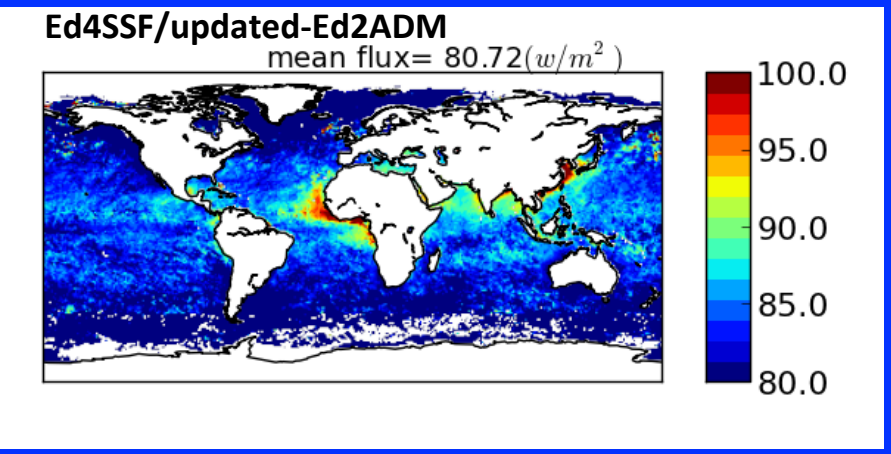


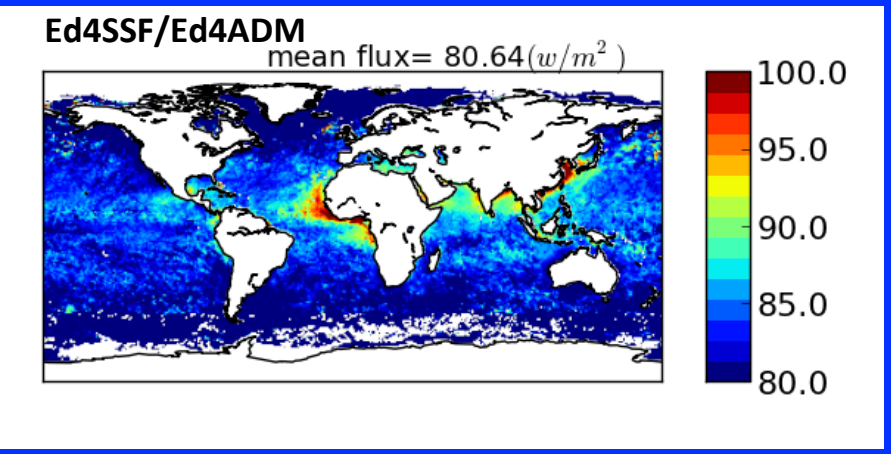
(Terra 2002 cross-track mode and SSFs with AOD retrieval)

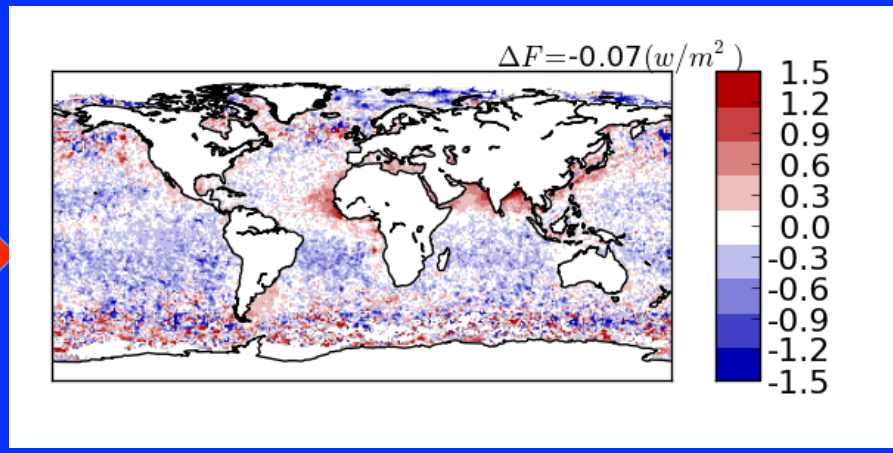
Fluxes and ADM performances calculated from all cross-track clear-sky SSFs over ocean

- Updated-Ed2ADM (built with ed2ADM approach and Ed4SSF)
- Ed4ADM

Change in flux from updated-Ed2ADM to Ed4ADM

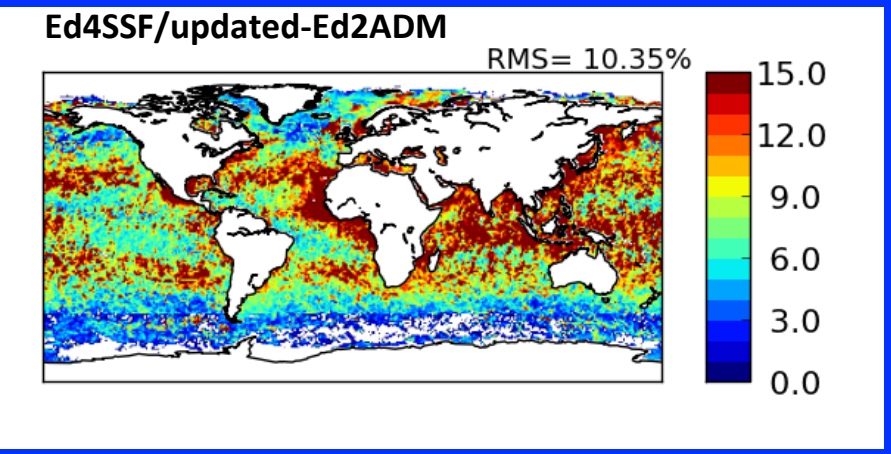


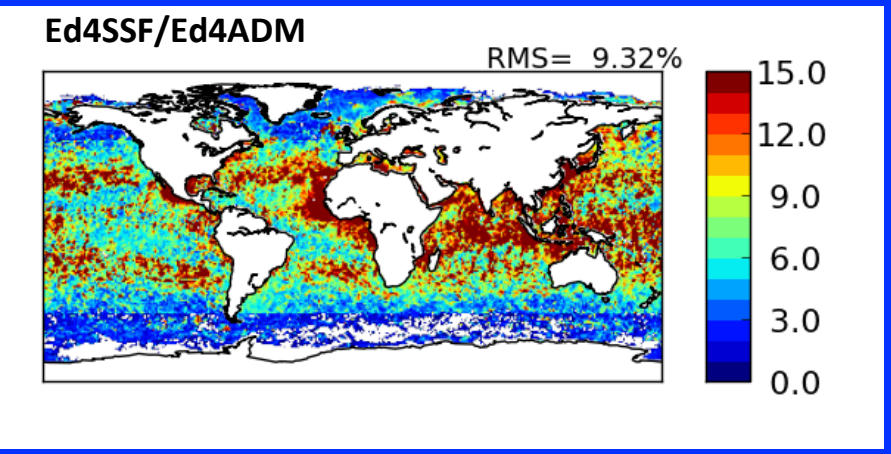


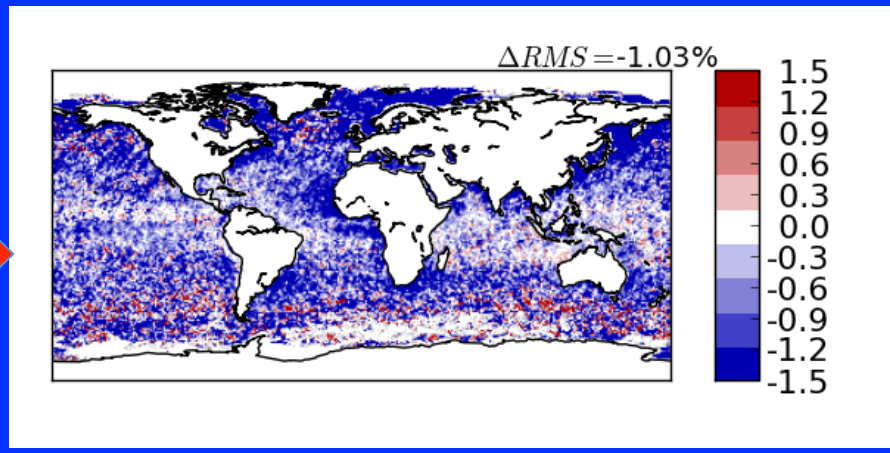


(Terra 2002 cross-track SSFs)

Change in radiance RMS error from updated-Ed2ADM to Ed4ADM

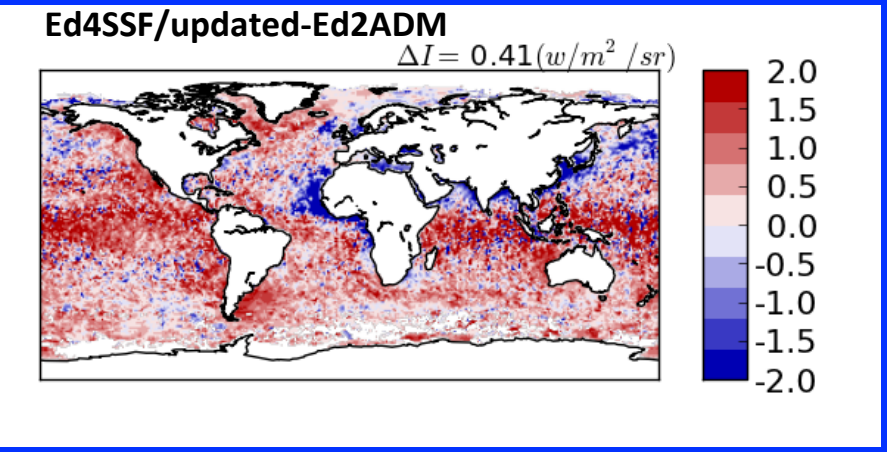


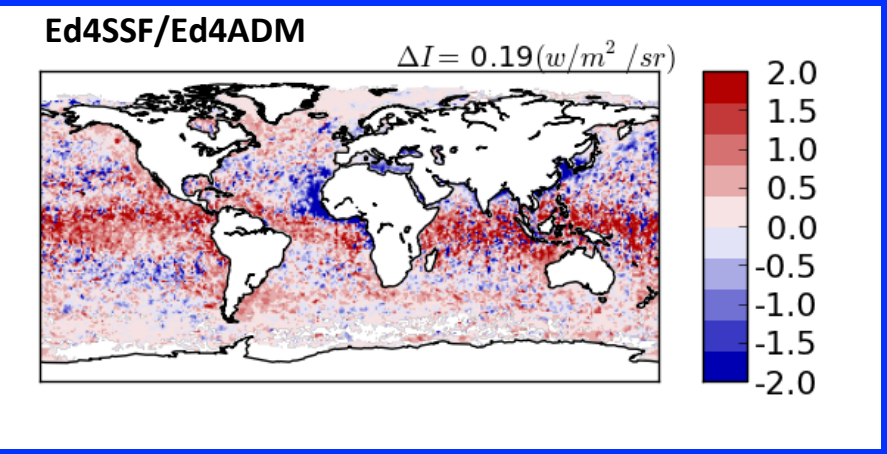




(Terra 2002 cross-track SSFs)

Change in radiance bias from updated-Ed2ADM to Ed4ADM





(Terra 2002 cross-track SSFs)

Summary

- Aerosols are retrieved with 6 MODIS bands of reflectances and classified to coarse-mode-like and fine-mode-like aerosols by a minimal-error-approach with two aerosol models (OPAC maritime-tropic and urban aerosol models). The Ed4ADMs are developed for coarse-mode-like and fine-mode-like aerosol, respectively, with 3 percentile AOD bins in each category.

- Applying SSF clr-strong parameter filtering to develop ADM substantially improves the ADM performance in the coarse-mode-like-aerosol 66-100%-AOD bin, and ADM developed with clr-strong >= 1 delivers the best performance.

- Comparing Ed4SSF/Ed4ADM to Ed4SSF/updted-Ed2ADM, the instantaneous global mean flux is changed by -0.07w/m^2, the global mean ADM RMS error is reduced by 1.03% and the global mean radiance bias error is reduced from 0.41 to 0.19 w/m^2/sr.