CRS Edition 2a & 2b

1. Aerosols – Optical properties for “dust” changed to newer Tegen & Lacis(2004)

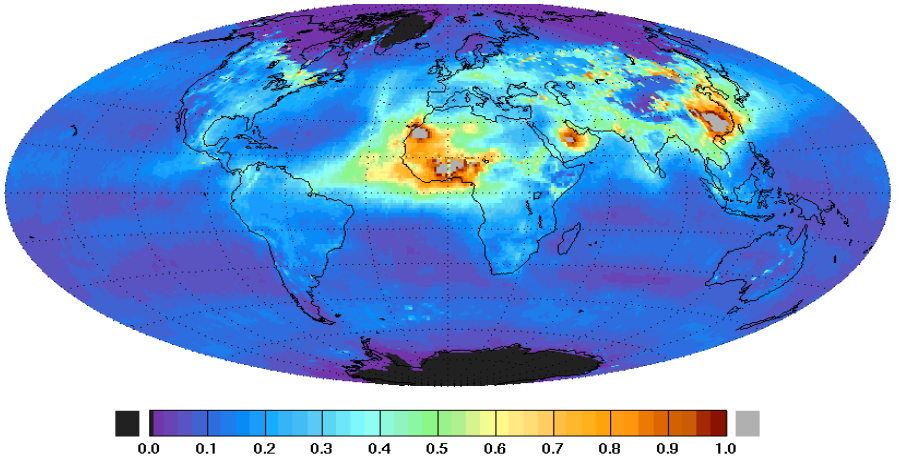
2. Aerosols – No scale heights. Instead a variable vertical distribution advected within Model for Atmospheric and Chemical transport (MATCH) with constituent.

3. Aerosols – Definition of “dust” in better agreement between MATCH and SARB.

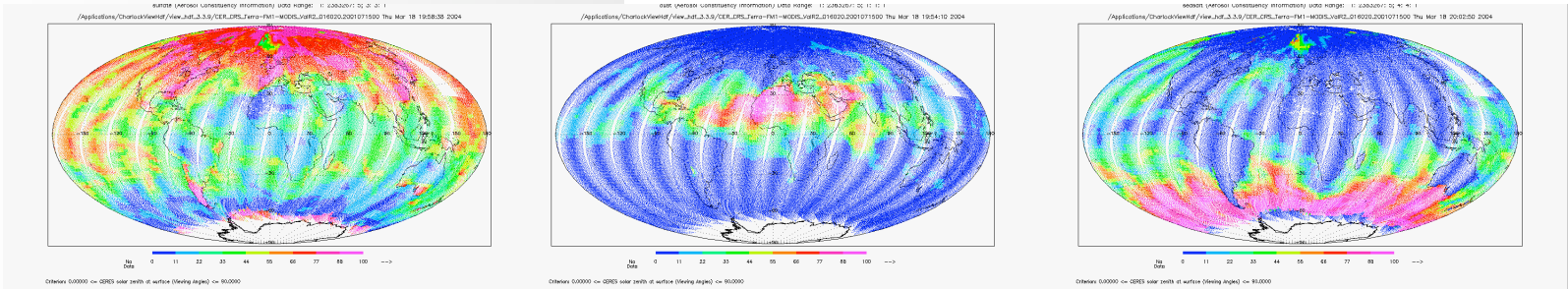
SARB Aerosol Inputs

- **MODIS τ:**
  1. **Instantaneous**
  2. **Gridded**
     cloud-free ocean
     Some land
  3. **Stowe & Ignatov if no MODIS over ocean**
  4. **MATCH τ rest of globe**

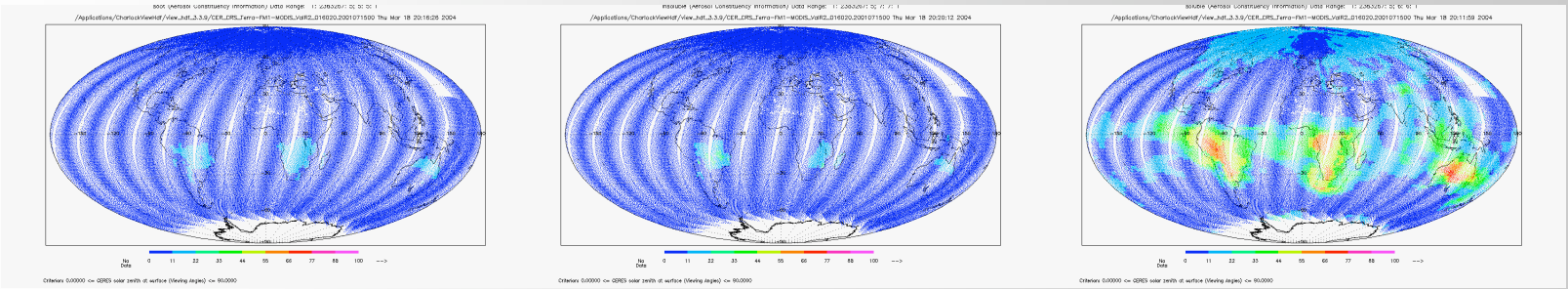
Initial Optical Depth τ



Constituents from MATCH (Fillmore and Collins) 15 July 2001



Sulfate (%) **Dust (%)** **Sea Salt (%)**



Soot (%) **Insoluble organic (%)** **Soluble organic (%)**

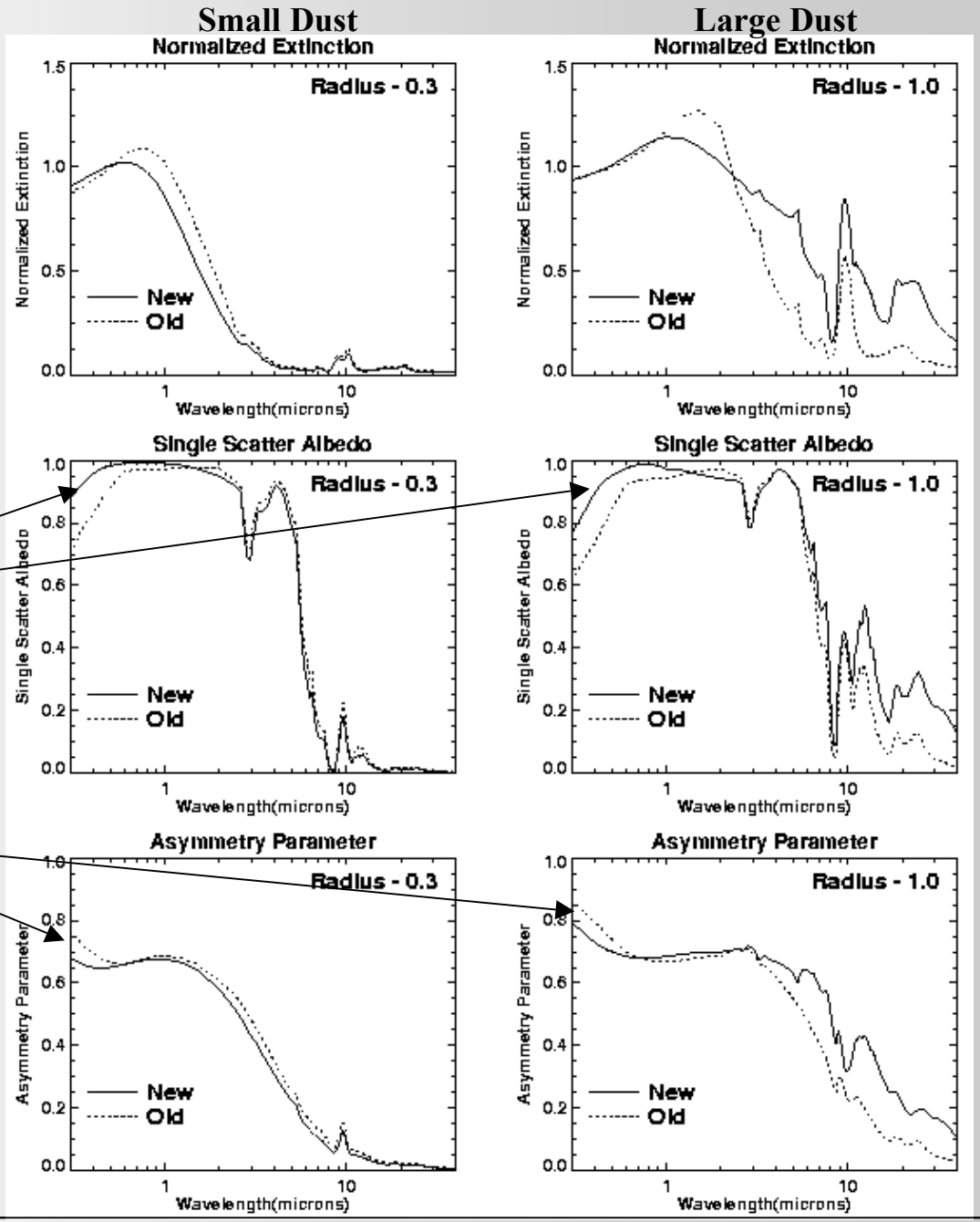
Assignment of MATCH Aerosol Properties

CRS Aerosol ID Number	MATCH aerosol type	CRS aerosol optics		Vertical Distribution	
		Ed2A	Ed2B	Ed2A Scale Height	Ed2B f(z)
1	Small dust particles	Dust < 1.0 μm given by particle re =0.5μm Tegen -Lacis (1998)	Dust < 0.5 μm given by particle re = 0.3 μm Tegen-Lacis(2004)	3.0 km	Variable (Moves with MATCH particle.)
2	Large dust particles	Dust > 1.0 μm given by particle re =2.0 μm Tegen-Lacis(1998)	Dust > 0.5 μm given by particle re = 1.0 μm Tegen-Lacis(2004)	1.0 km	Variable
3	Black carbon	Soot (OPAC)	Soot (OPAC)	3.5 km	Variable
4	Hydrophilic organic carbon	Soluble organic (OPAC)	Soluble organic (OPAC)	3.8 km	Variable
5	Hydrophobic organic carbon	Insoluble organic (OPAC)	Insoluble organic (OPAC)	3.8 km	Variable
6	Sulfate	Sulfate (OPAC)	Sulfate (OPAC)	3.5 km	Variable
7	Sea salt	Sea salt (OPAC)	Sea salt (OPAC)	0.5 km	Variable

Change in Tegen and Lacis dust properties

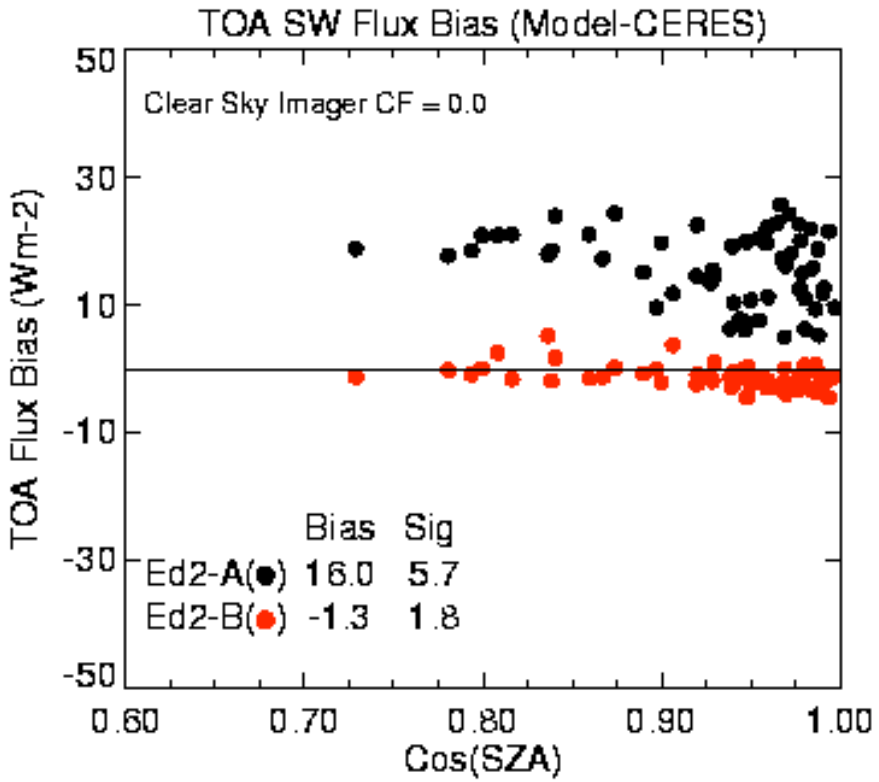
- Significantly less absorption

- More backward scatter in SW.

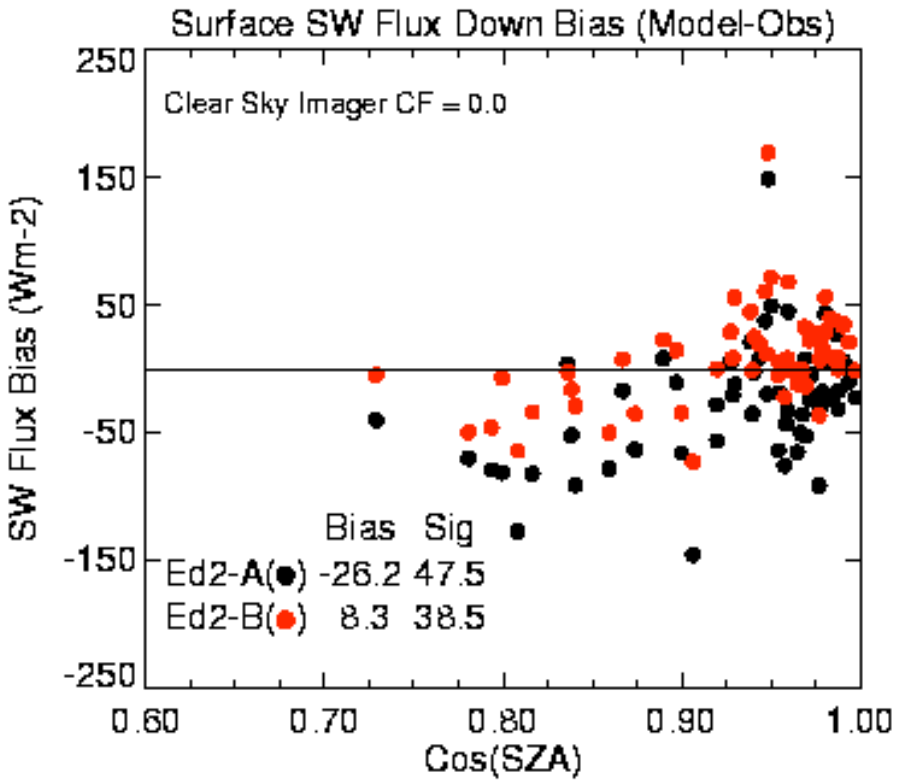


Ed2A, Ed2B Untuned TOA & Surface Instantaneous Bias' at Saudi Solar Village (SSV) Mar-Jun 2000.

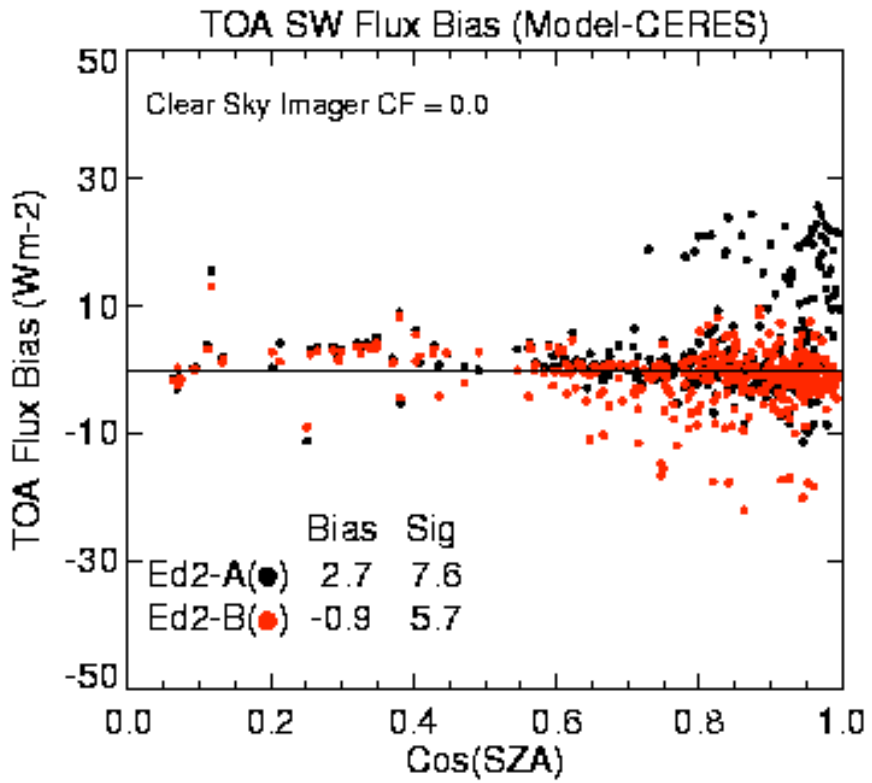
TOA

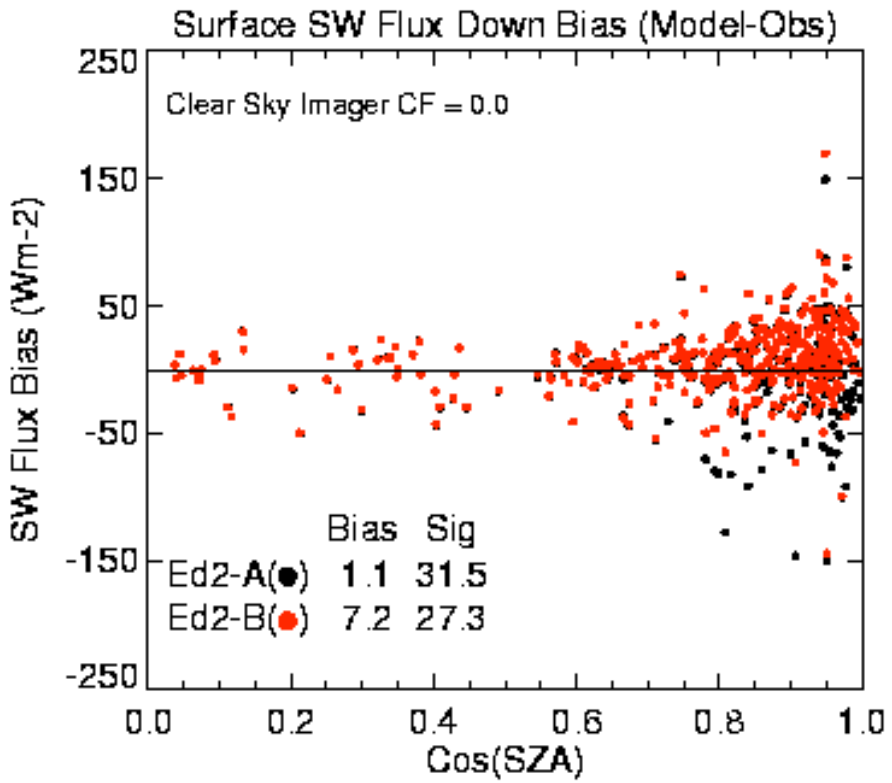


Surface

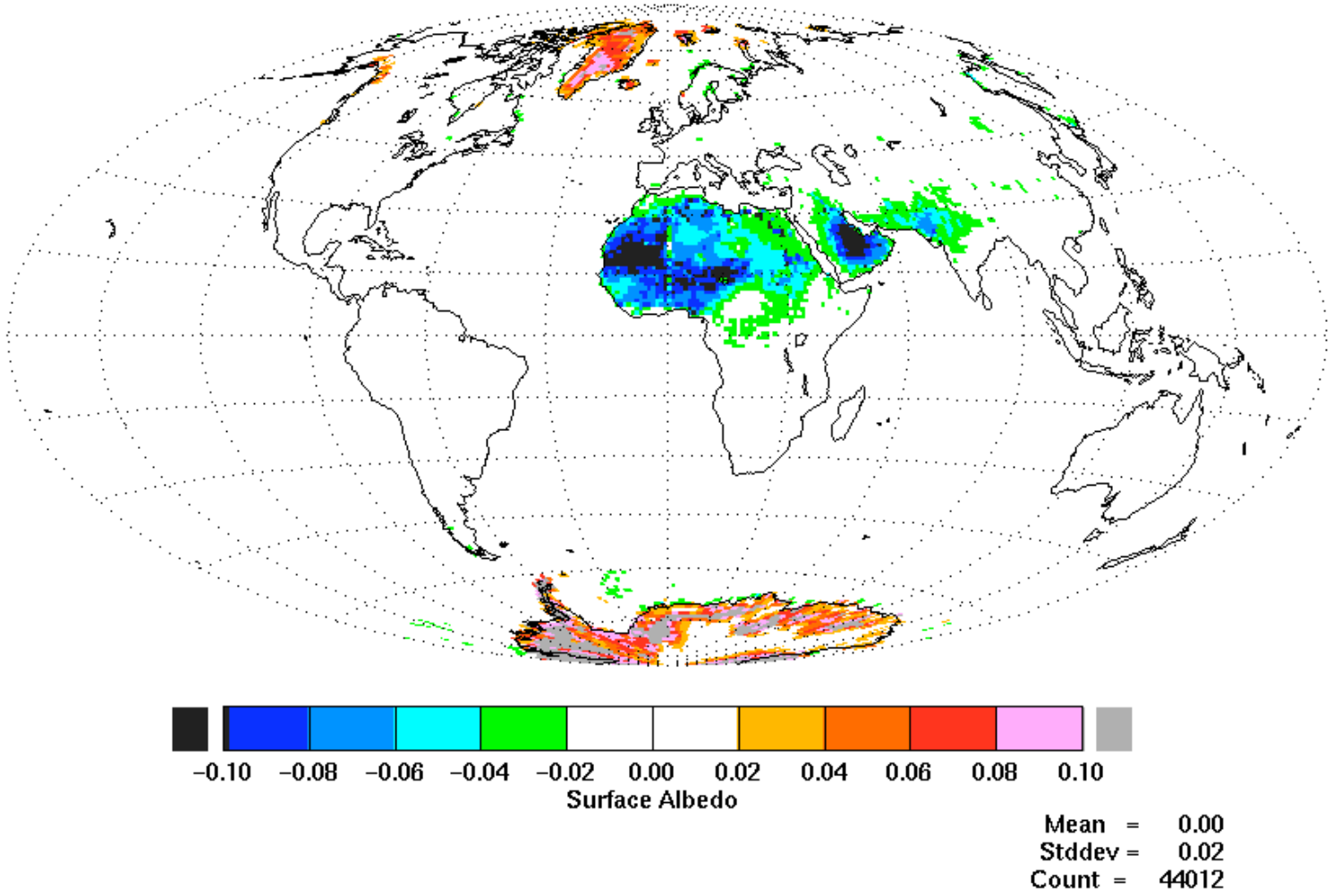


Ed2A, Ed2B Untuned TOA & Surface Bias
CAVE Validation Sites (CVS), Mar-Jun 2000

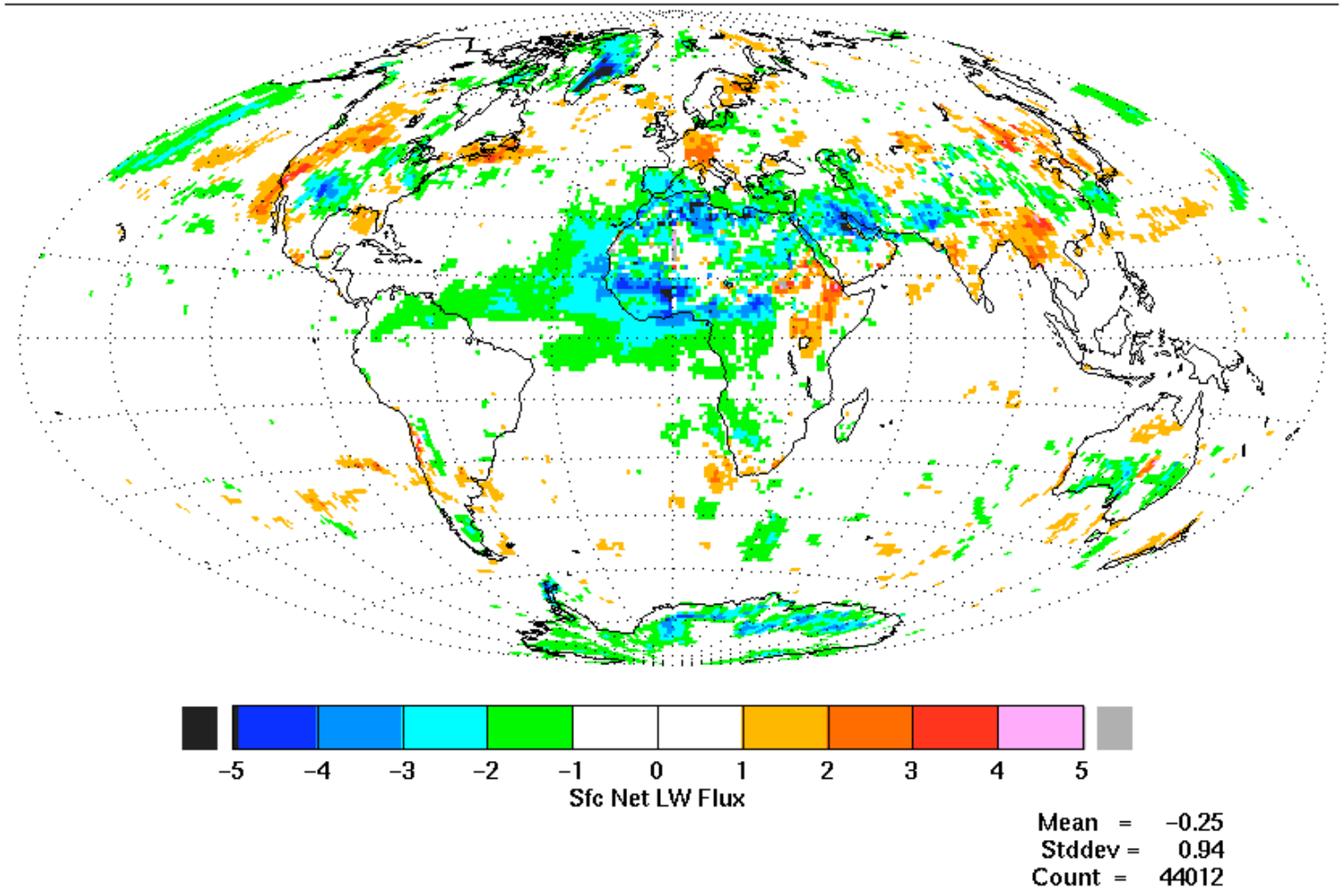




Surface Albedo Difference (Tuned, Calculated) Mar 2000 Edition 2B-Edition 2A

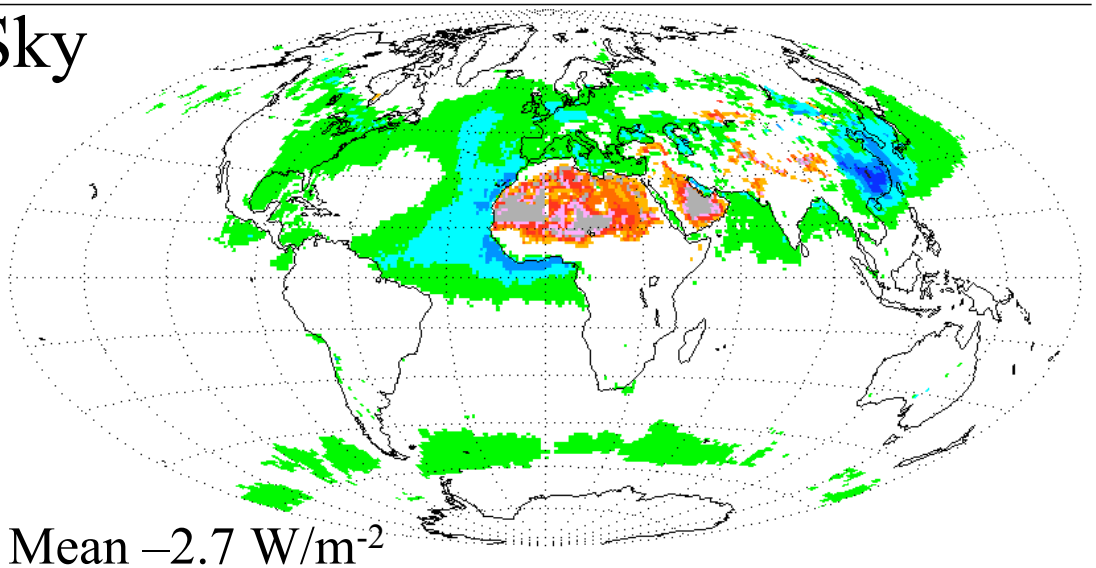


Change in NET LW Flux at Surface



TOA SW Net Clear Sky Aerosol Forcing

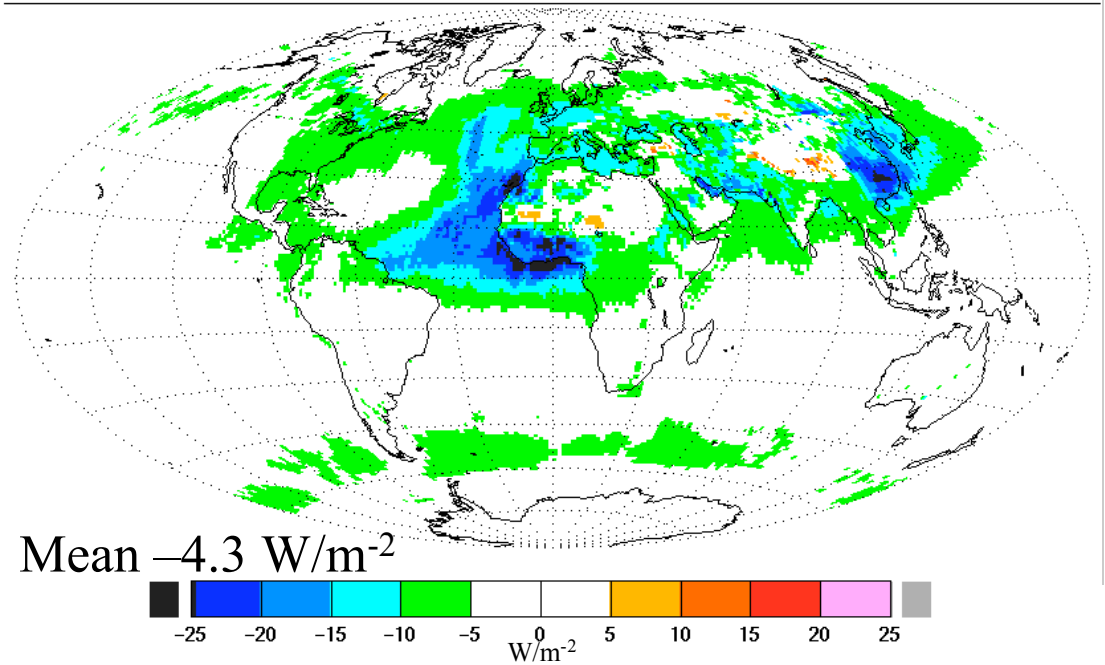
FSW March 2000 Edition 2A



Net TOA Aerosol Forcing =

$$(SW^{\downarrow}_{clr} - SW^{\uparrow}_{clr}) - (SW^{\downarrow}_{prs} - SW^{\uparrow}_{prs})$$

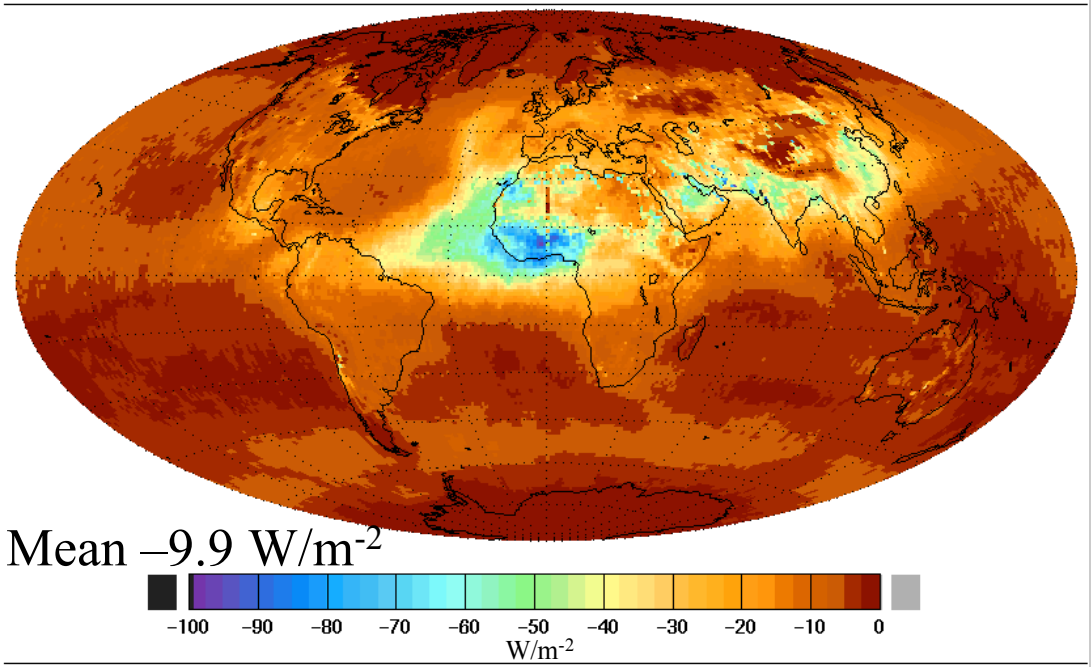
FSW March 2000 Edition 2B



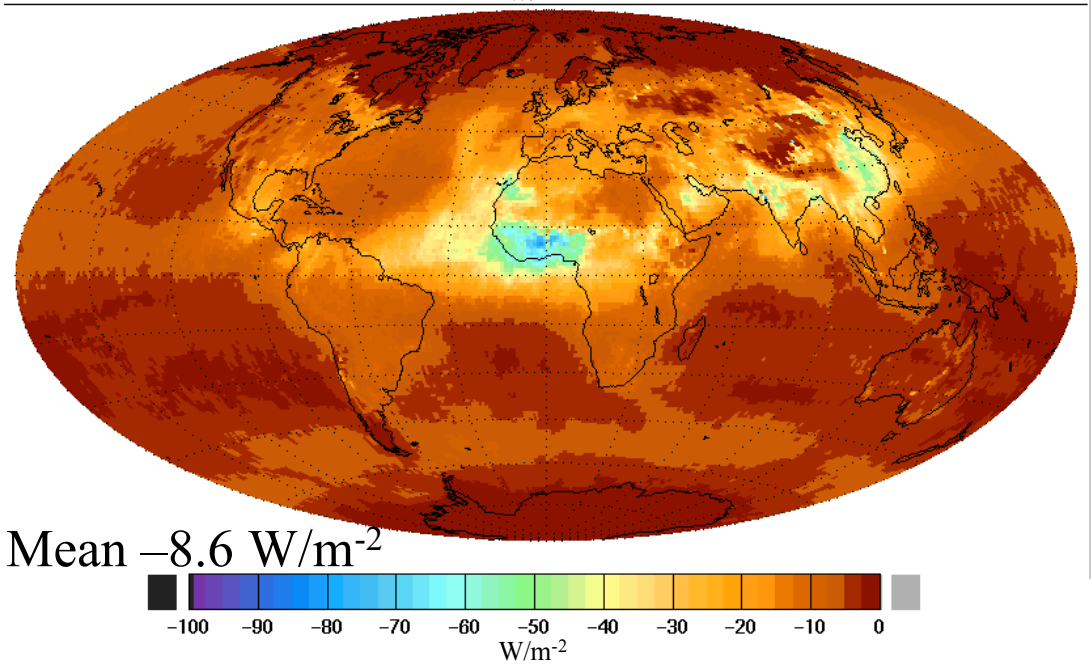
Surface SW Net Clear Sky Aerosol Forcing

FSW March 2000
Edition 2A

Net Sfc Aerosol Forcing =
$(SW^{\downarrow}_{clr} - SW^{\uparrow}_{clr}) - (SW^{\downarrow}_{prs} - SW^{\uparrow}_{prs})$



FSW March 2000
Edition 2B



CAVE Validation, Edition 2a, 2b Summary

Instantaneous All Sky Mean(RMS) All Wm $^{-2}$

	LW Up TOA		SW Up TOA		LW Down Sfc		SW Down Sfc		LW Up Sfc		SW Up Sfc	
	Untuned	Tuned	Untuned	Tuned	Untuned	Tuned	Untuned	Tuned	Untuned	Tuned	Untuned	Tuned
Edition 2A	+1(8)	+1(5)	+4(22)	+2(9)	-4(25)	-4(25)	+12(85)	+13(87)	-0(26)	-0(25)	-12(45)	-12(45)
Edition 2B	+1(8)	+1(5)	+6(22)	+2(8)	-4(25)	-5(25)	+13(85)	+17(87)	-4(34)	-4(33)	-13(45)	-13(45)

Instantaneous Clear Sky Mean(RMS) All Wm $^{-2}$ [clear - imager CF = 0.0]

	LW Up TOA		SW Up TOA		LW Down Sfc		SW Down Sfc		LW Up Sfc		SW Up Sfc	
	Untuned	Tuned	Untuned	Tuned	Untuned	Tuned	Untuned	Tuned	Untuned	Tuned	Untuned	Tuned
Edition 2A	-1(6)	-1(3)	+3(8)	+1(3)	-9(19)	-9(19)	+1(32)	+1(31)	+0(22)	+1(24)	-11(24)	-10(24)
Edition 2B	-1(5)	-1(3)	-1(6)	-0(2)	-10(19)	-10(19)	+7(27)	+8(27)	+0(23)	+1(24)	-13(25)	-13(24)

Instantaneous Overcast Sky Mean(RMS) All Wm $^{-2}$ [overcast - imager CF = 1.0]

	LW Up TOA		SW Up TOA		LW Down Sfc		SW Down Sfc		LW Up Sfc		SW Up Sfc	
	Untuned	Tuned	Untuned	Tuned	Untuned	Tuned	Untuned	Tuned	Untuned	Tuned	Untuned	Tuned
Edition 2A	+0(9)	+1(4)	+10(31)	+1(12)	-5(24)	-6(25)	+15(90)	+25(97)	+6(24)	+6(24)	-11(40)	-9(40)
Edition 2B	+1(9)	+1(4)	+12(29)	+2(9)	-5(24)	-6(25)	+17(90)	+30(96)	+1(39)	+1(39)	-10(41)	-8(41)

LW – Day and night footprints.
SW – Day time only (not a 24 hour average).