

Table S1. Supplementary information on the MISR components from Research Aerosol (RA) retrieval results, using the algorithm version summarized in Sect. 2.1 in the main text, with a 774-mixture climatology.

Particle Size, Shape, Light-Absorption ^a	Imaginary Refractive Index ($\times 10^2$) ^b				Real Refractive Index ^b				r_0 ^c	r_e ^c	r_1 ^c	σ ^c
	446	558	672	866	446	558	672	866				
Very small, spherical, strongly absorbing (flat)	2.19	2.19	2.19	2.19	1.6	1.6	1.6	1.6	0.001	0.06	0.40	0.28
Very small, spherical, strongly absorbing (steep)	3.07	1.80	1.04	0.930	1.55	1.55	1.55	1.55	0.001	0.06	0.40	0.28
Very small, spherical, moderately absorbing (flat)	0.693	0.693	0.693	0.693	1.5	1.5	1.5	1.5	0.001	0.06	0.40	0.28
Very small, spherical, moderately absorbing (steep)	1.03	0.608	0.429	0.31	1.475	1.475	1.475	1.475	0.001	0.06	0.40	0.28
Small, spherical, strongly absorbing (flat)	4.66	4.66	4.66	4.66	1.6	1.6	1.6	1.6	0.001	0.12	0.75	0.32
Small, spherical, strongly absorbing (steep)	6.99	4.11	2.23	2.11	1.55	1.55	1.55	1.55	0.001	0.12	0.75	0.32
Small, spherical, moderately absorbing (flat)	1.69	1.69	1.69	1.69	1.5	1.5	1.5	1.5	0.001	0.12	0.75	0.32
Small, spherical, moderately absorbing (steep)	2.62	1.54	0.910	0.794	1.475	1.475	1.475	1.475	0.001	0.12	0.75	0.32
Medium, spherical, strongly absorbing (flat)	4.58	4.58	4.58	4.58	1.6	1.6	1.6	1.6	0.001	0.26	1.5	0.35
Medium, spherical, strongly absorbing (steep)	7.41	4.36	2.36	2.24	1.55	1.55	1.55	1.55	0.001	0.26	1.5	0.35
Medium, spherical, moderately absorbing (flat)	1.85	1.85	1.85	1.85	1.5	1.5	1.5	1.5	0.001	0.26	1.5	0.35
Medium, spherical, moderately absorbing (steep)	3.00	1.76	1.02	0.911	1.475	1.475	1.475	1.475	0.001	0.26	1.5	0.35
Very small, spherical, non- absorbing	0	0	0	0	1.4	1.4	1.4	1.4	0.001	0.06	0.40	0.28
Small, spherical, non-absorbing	0	0	0	0	1.4	1.4	1.4	1.4	0.001	0.12	0.75	0.32

Medium, spherical, non-absorbing	0	0	0	0	1.4	1.4	1.4	1.4	0.001	0.28	1.5	0.35
Large, spherical, non-absorbing	0	0	0	0	1.4	1.4	1.4	1.4	0.1	1.28	10	0.45
Large, non-spherical, weakly absorbing	0.219	0.209	0.198	0.180	1.542	1.537	1.532	1.524	N/A	1.21	N/A	N/A

^a Particle type includes four elements: size—very small (VSm), small (Sm), medium (Me), and large (La); shape—spherical (Sph) or non-spherical (Nsph); light-absorption—non-absorbing (Nab), weakly absorbing (Wab), moderately absorbing (Mab), and strongly absorbing (Sab); spectral light-absorption profile—equal in all spectral bands (flat), or varying between spectral bands (steep).

^b Refractive indices are given across all four spectral bands (μm)

^c Each spherical component has a designated effective radius (r_e), ranging between a minimum (r_0) and maximum (r_1) particle size. Particle size is normally distributed within these bounds with variance σ . Particle size is given in μm .

Table S2. Land cover type legend for the MODIS International Geosphere-Biosphere Programme (IGBP) classification method (* = observed in this study and can be found in Table 3 in the main text)

Land Cover Type	Description
Evergreen Needleleaf Forests *	Dominated by evergreen conifer trees (canopy >2m). Tree cover >60%.
Evergreen Broadleaf Forests *	Dominated by evergreen broadleaf and palmate trees (canopy >2m). Tree cover >60%.
Deciduous Needleleaf Forests *	Dominated by deciduous needleleaf (larch) trees (canopy >2m). Tree cover >60%.
Deciduous Broadleaf Forests *	Dominated by deciduous broadleaf trees (canopy >2m). Tree cover >60%.
Mixed Forests *	Dominated by neither deciduous nor evergreen (40-60% of each) tree type (canopy >2m). Tree cover >60%.
Closed Shrublands	Dominated by woody perennials (1-2m height) >60% cover.
Open Shrublands *	Dominated by woody perennials (1-2m height) 10-60% cover.
Woody Savannas *	Tree cover 30-60% (canopy >2m).
Savannas *	Tree cover 10-30% (canopy >2m).
Grasslands *	Dominated by herbaceous annuals (<2m).
Permanent Wetlands	Permanently inundated lands with 30-60% water cover and >10% vegetated cover.
Croplands	At least 60% of area is cultivated cropland.
Urban and Built-up Lands	At least 30% impervious surface area including building materials, asphalt, and vehicles.
Cropland/Natural Vegetation Mosaics	Mosaics of small-scale cultivation 40-60% with natural tree, shrub, or herbaceous vegetation.
Permanent Snow and Ice	At least 60% of area is covered by snow and ice for at least 10 months of the year.
Barren	At least 60% of area is non-vegetated barren (sand, rock, soil) areas with less than 10% vegetation.
Water Bodies	At least 60% of area is covered by permanent water bodies

Table S3. Land cover type legend for the FAO-Land Cover Classification System (LCCS) surface hydrology classification method.

Land Cover Type	Description
Dense Forests	Tree cover >60% (canopy >2m).
Open Forests	Tree cover 10-60% (canopy >2m).
Shrublands	Shrub cover >60% (1-2m).
Grasslands	Dominated by herbaceous annuals (<2m) >10% cover.
Woody Wetlands	Shrub and tree cover (>1m) >10% cover. Permanently or seasonally inundated.
Herbaceous Wetlands	Dominated by herbaceous annuals (<2m) >10% cover. Permanently or seasonally inundated.
Tundra	Tree cover <10%. Snow-covered for at least 8 months of the year.
Permanent Snow and Ice	At least 60% of area is covered by snow and ice for at least 10 months of the year.
Barren	At least 60% of area is non-vegetated barren (sand, rock, soil) or permanent snow/ice with less than 10% vegetation.
Water Bodies	At least 60% of area is covered by permanent water bodies.

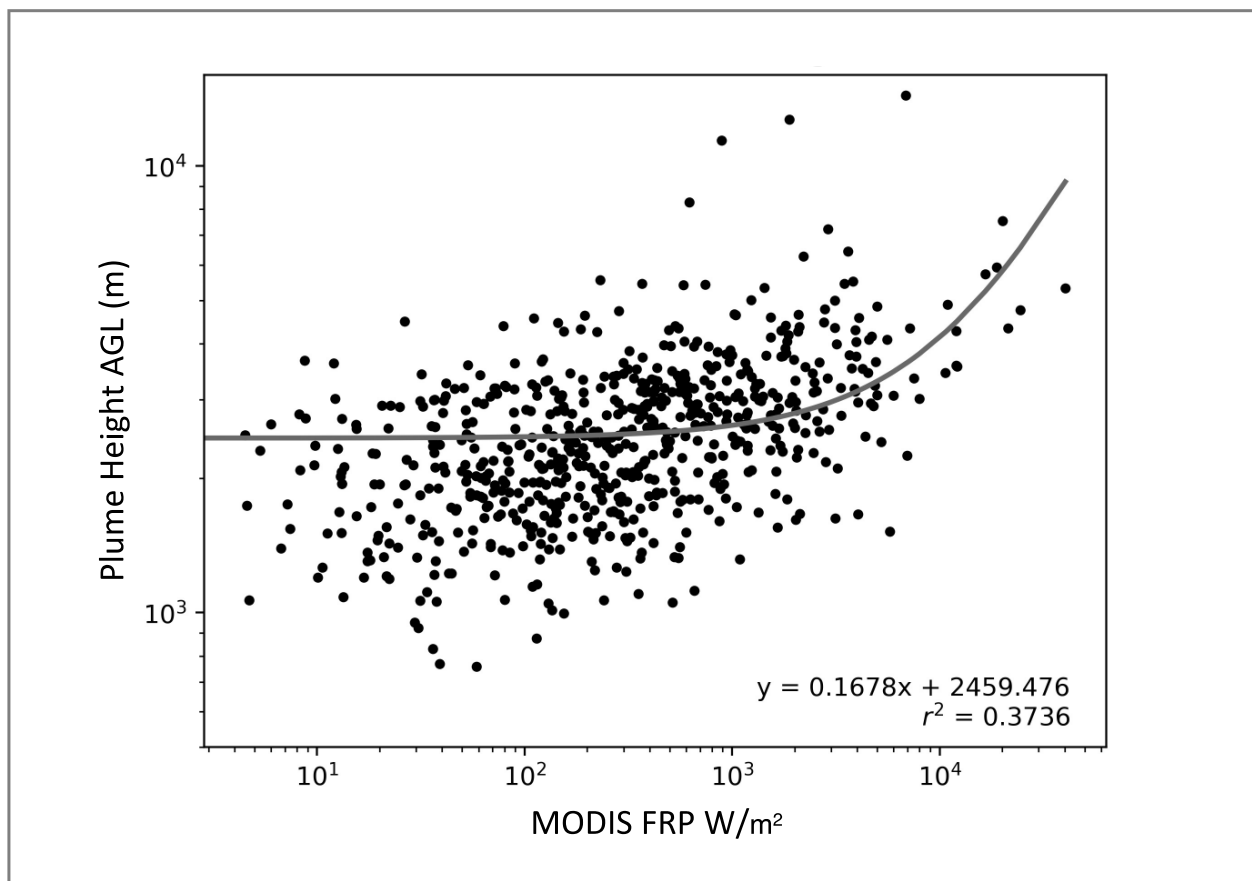


Figure S1. MISR-MINX maximum plume stereo heights vs. cumulative plume FRP from MODIS.

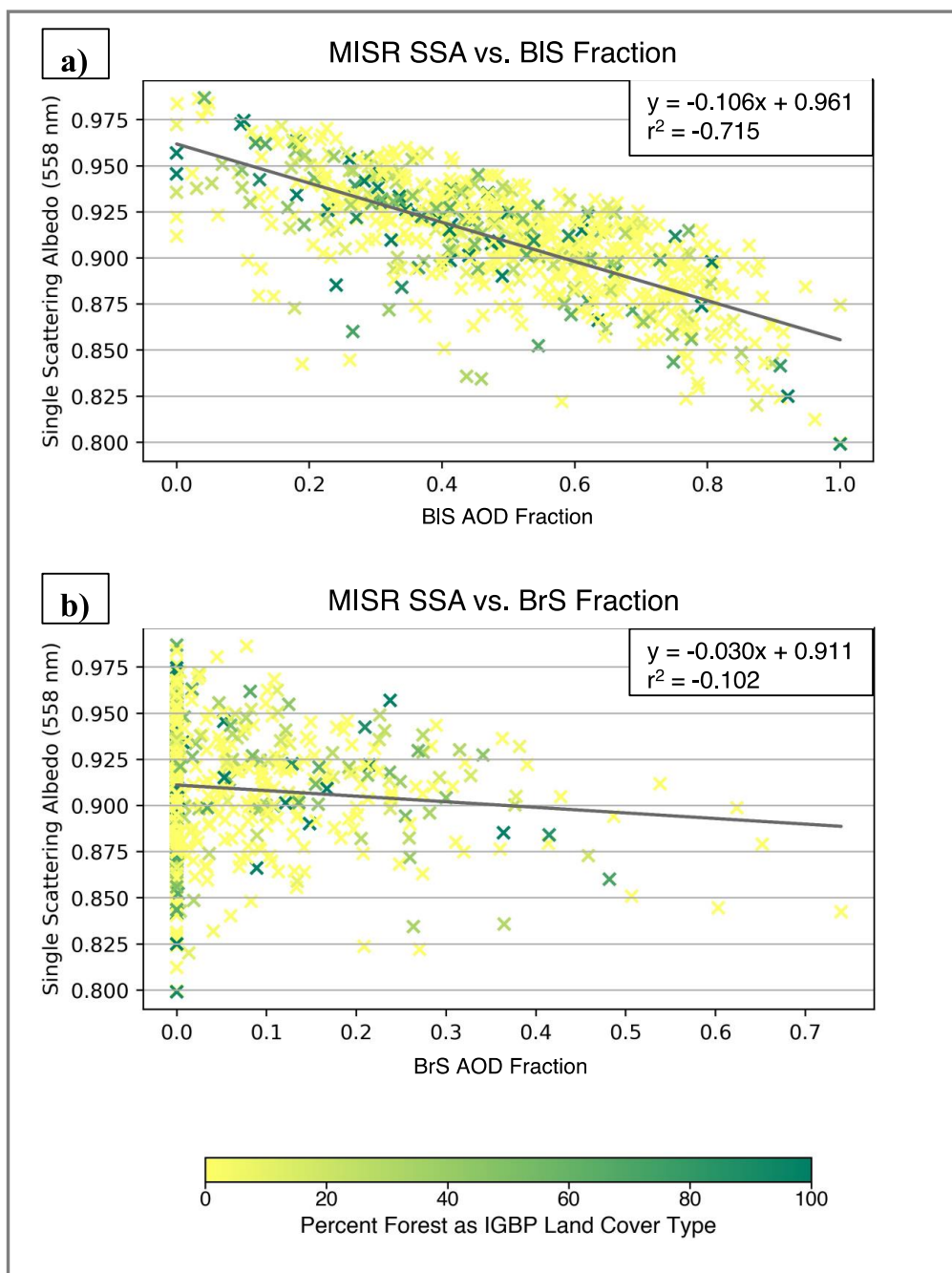


Figure S2. Relationship between MISR SSA and the interpreted amount of **(a)** black smoke (BIS) and **(b)** brown smoke (BrS).