Mineral Dust Search Criteria

In the present work, ATOFMS search criteria for detecting mineral dust in ambient particles are based on recent findings from an ATOFMS single-particle source characterization study of suspended soil samples commonly found in the Southern California region [1]. The mineral dust search criteria are defined precisely in Table S1. A particle spectrum that meets at least one of the eight criteria listed in Table S1 is classified as a dust-containing particle in the present study. Ninety percent of the positive ion mass spectra obtained from suspended soil samples in the source characterization study satisfy these search criteria. This represents a marked improvement in the source classification of Southern California ambient particles, in comparison to previous studies [2]. Because these search criteria were developed by manual inspection of single-particle spectra from Southern California soil and ambient samples, they should not be used to categorize ambient ATOFMS data collected in other regions.

Multi-Component Model Evaluation

Table S2 provides a numerical representation of the color-coded display found in Figure 3. The values listed in Table S2 correspond to the number of dots in Figure 3, that represent particles of the given chemical class. For example, Table S2 indicates that 34% of the counting efficiency corrected ATOFMS measurements in the 1.00 - 1.80 μm particle size range at Long Beach contain nitrate, ammonium, and carbon. The corresponding subplot of Figure 3 includes 34 dots with red, yellow, and orange stripes.

Table S 1: Criteria for finding mineral dust in positive ion mass spectra of ambient particles.

Criterion #	Ion	m/z range[a]	Peak List Search Criteria[b]
1	Al^+	[27]	Height ≥ 200 AND
	$Fe^+/CaOH^+$	[54,58]	Height ≥ 200
2	H^+	[0.5,2.5]	Height ≥ 100 AND
	C^+	[12]	Height < 100
3	Metals	[40,50]	Area ≥ 50000
4	Ti^+	[47,49]	Height ≥ 200 AND
	TiO^+	[63,65]	Height ≥ 200
5	Na^+	[22,24]	(Height ≥ 100 OR Relative Area[c] ≥ 0.5) AND
	K^+	[38,39.5]	Height < 50 AND
	Na_2Cl^+	[81]	Height < 10 AND
	$Na_2NO_3^+$	[107,109]	Height < 10 AND
	$Na_3SO_4^+$	[164,166]	Height < 10 AND
	C^+	[12]	Height < 50 AND
	C_3^+	[36]	Height < 50 AND
	$C_2H_3O^+$	[43]	Height < 50
6	K^+	[38,39.5]	(Height ≥ 100 OR Relative Area[c] ≥ 0.5) AND
	C^+	[12]	Height < 50 AND
	C_3^+	[36]	Height < 50 AND
	$C_2H_3O^+$	[43]	Height < 50 AND
			not sea salt[d]
7	Ca^+	[40]	Height ≥ 200 AND
	$CaO^+/CaOH^+$	[55,58]	Height ≥ 20 AND
	Ca_2O^+	[95,97]	Height ≥ 20 AND
	C^+	[12]	Height < 50 AND
	C_3^+	[36]	Height < 50 AND
			not sea salt[d]
8	Al^+	[27]	Height ≥ 20 AND
	$Fe^+/CaOH^+$	[54,58]	Height ≥ 100 AND
	V^+	[51]	Height < 50 AND
			not sea salt[d]

[a] Unless otherwise specified, m/z range is ±0.5 Daltons

[b] Height and area thresholds are listed in arbitrary units

[c] Relative area is the ratio of the area of a given peak to the total area under the mass spectrum

[d] Sea salt particle spectra contain a peak in the m/z range [22,24] with Height ≥ 50 arbitrary units (indicative of Na^+) and meet at least one of the four criteria listed below

1	Na_2Cl^+	[81]	Height ≥ 30
2	$Na_2NO_3^+$	[107,109]	Height ≥ 30
3	$Na_3SO_4^+$	[164,166]	Height ≥ 10 AND
	Na_2Cl^+	[81]	Height ≥ 10
4	$Na_3SO_4^+$	[164,166]	Height ≥ 10 AND
	$Na_2NO_3^+$	[107,109]	Height ≥ 10

Table S 2: Numerical Representation of Figure 3.

	Long Beach 0700–1100 PDT, Sept. 24, 1996		Riverside 1500–1900 PDT, Sept. 25, 1996	
	ATOFMS	Model	ATOFMS	Model
	1.80–3.50 μm		1.80–3.50 μm	
Sodium	4%	2%	4%	2%
Sodium & Nitrate	41%	67%	33%	44%
Sodium & Ammonium			1%	
Sodium & Carbon	2%	2%	3%	1%
Sodium, Nitrate, & Ammonium	4%		2%	15%
Sodium, Nitrate, & Carbon	16%		9%	
Sodium, Ammonium, & Carbon	2%			
Sodium, Nitrate, Ammonium, & Carbon	18%		11%	2%
Nitrate, Ammonium, & Carbon	1%	17%	4%	12%
Carbon			2%	
Dust	10%	11%	28%	23%
Many Types	1%	1%	1%	1%
Unclassified	1%		2%	
	1.00–1.80 μm		1.00–1.80 μm	
Sodium	2%	1%	1%	1%
Sodium & Nitrate	9%	9%	10%	2%
Sodium & Carbon	4%	2%	4%	1%
Sodium, Nitrate, & Ammonium	1%		1%	
Sodium, Nitrate, & Carbon	8%		5%	
Sodium, Ammonium, & Carbon	5%		2%	
Sodium, Nitrate, Ammonium, & Carbon	21%	20%	14%	4%
Nitrate, Ammonium, & Carbon	34%	57%	22%	82%
Nitrate & Carbon	1%		5%	
Ammonium & Carbon	5%		3%	
Carbon	1%	2%	13%	1%
Dust	9%	9%	17%	8%
Many Types			1%	1%
Unclassified			2%	
	0.56–1.00 μm		0.56–1.00 μm	
Sodium		1%		
Sodium & Nitrate	2%		1%	
Sodium & Carbon	1%	2%	1%	1%
Sodium, Nitrate, & Carbon	1%		2%	1%
Sodium, Ammonium, & Carbon	1%			
Sodium, Nitrate, Ammonium, & Carbon	8%	13%	6%	11%
Nitrate, Ammonium, & Carbon	53%	67%	41%	69%
Nitrate & Carbon	2%		10%	
Ammonium & Carbon	17%		6%	
Carbon	10%	4%	23%	1%
Dust	4%	12%	5%	16%
Many Types	1%		1%	1%
Unclassified		1%	4%	
			0.32–0.56 μm	
Sodium & Nitrate			1%	
Sodium & Carbon			3%	1%
Sodium, Nitrate, & Carbon			2%	7%
Sodium, Ammonium, & Carbon			1%	
Sodium, Nitrate, Ammonium, & Carbon			4%	33%
Nitrate, Ammonium, & Carbon			33%	49%
Nitrate & Carbon			9%	
Nitrate			1%	
Ammonium & Carbon			9%	
Carbon			26%	1%
Dust			4%	8%
Many Types			1%	1%
Unclassified			6%	

References

[1] Silva, P. J.; Carlin, R. A.; Prather, K. A. *Atmos. Environ.* **2000**, *34*, 1811–1820.

[2] Hughes, L. S.; Allen, J. O.; Bhave, P. V.; Kleeman, M. J.; Cass, G. R.; Liu, D.-Y.; Fergenson, D. P.; Morrical, B. D.; Prather, K. A. *Environ. Sci. Technol.* **2000**, *34*, 3058–3068.