

Table 1. Contrasting features between Systems 1 and 2

Feature	System 1	System 2
Objective	Feasibility of probe-TILDAS integration	Versatility of soil gas probe sampling
Location	Biosphere 2, University of Arizona, Tucson, AZ	Aerodyne Research Inc., Billerica, MA
Analyzer 1	Dual-laser TILDAS for H ₂ O and CO ₂ isotopes	Novel dual-laser TILDAS for N ₂ O and CH ₄ isotopes
Analyzer 2	Mini TILDAS for OCS, CO, CO ₂ , and H ₂ O	Vocus PTR-T OF-MS for VOCs
Control Gas (bulk)	Ultra-Zero Air	Ultra-Zero Air; Ultra-High Purity N ₂
Control Gas (trace)	5% CO ₂ in air	49.1 ppm N ₂ O in air; 54.6 ppm CH ₄ in air
Flow Control	0.6 to 1 SLPM per column	0.65 SLPM per column
Matrix	Silica	Silica, Soil

Table 2. Experiments under controlled conditions using Systems 1 and 2

Experiment	Type of soil	Columns	Probe Pore Size (µm)	Total flow (sccm); Probe Flow (sccm); Dilution (%)	Control gas (ppm)	System	Figures
1. Effect of probe sampling (silica) ^a	Silica	1	P8 (8 µm)	total (10-600); probe (5-300); dilution (50%)	CO ₂ 1000	1	Figure 4
2. Flow and dilution ^a	Silica	1	P8 (8 µm)	total (50:50:300); probe (0-300); dilution (90:15:0%)	CO ₂ 1000	1, 2	Figure 6, 7, 8
3. Multi-probe evaluation ^a	Silica	1	P8 (8 µm)	total (20-400); probe (5-100); dilution (75%)	CO ₂ 2000	1	Figure 10
	Silica	2	P10 (10 µm)				
	Silica	3	P5 (5 µm)				
	Silica	4	P8 (8 µm)	total (250); probe (25); dilution (90%)	N ₂ O 3ppm CH ₄ 7 ppm	2	Figure 9
4. Soil vs. silica: multi-probe flow rate dependence	Soil 1	4	P8 (8 µm)	total (235); probe (60); dilution (74%)	N ₂ O 3 ppm; CH ₄ 7 ppm	Field moisture	Figure 11
	Silica	5	P10 (10 µm)			Dry	
	Silica	6	P25 (25 µm)			Dry	
5. Soil wetting ^a	Soil 1	4	P8 (8 µm)	total (50-100); probe (25); dilution (50-75%)		Dry to wet	Figure 12
6. Soil redox: anaerobic (N ₂) to aerobic (UZA) ^{ab}	Soil 3	5	P10 (10 µm)	total (185); probe (53); dilution (71%)		Wet	Figure 13