Supplementary Information

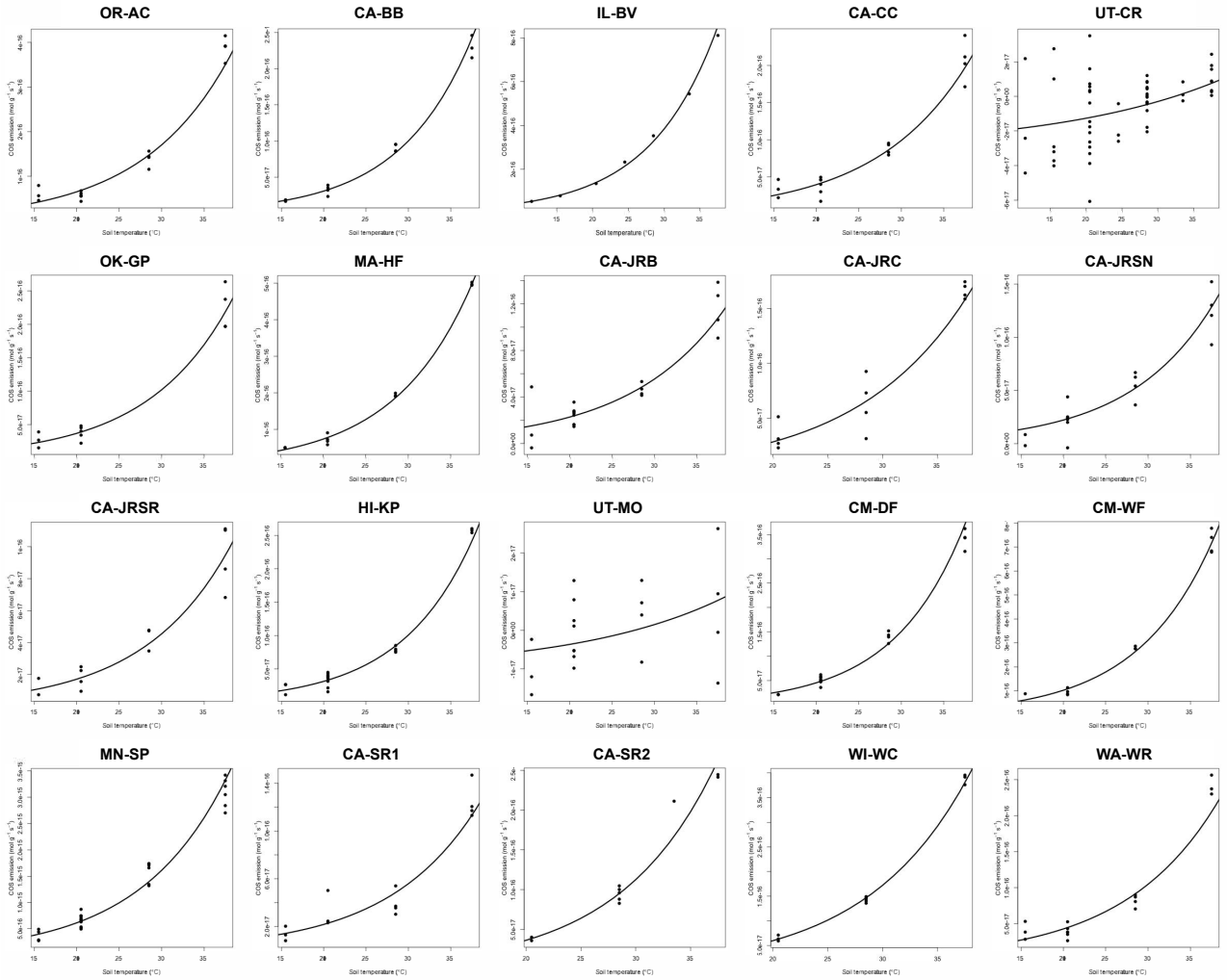

Figure S1. OCS soil air-gas exchange rates in soils as a function of incubation temperature with exponential fit.

Table S1. Extended site information including full GPS coordinates, management details, and related studies (organized alphabetically)

Survey 1						
Soil ID	**Name**	**Latitude**	**Longitude**	**Biome**	**Land Use**	**Details**
CA-BB	Big Basin, CA	37.19321	-122.22041	Temperate	Evergreen Forest	Old growth
CA-CC	Carnegie Cornfield, Stanford, CA	37.428906	-122.180033	Mediterranean	Cropland	Fertilized, corn
CA-JRB	Jasper Ridge, CA	37.404811	-122.225975	Mediterranean	Grassland	
CA-JRC	Jasper Ridge, CA	37.405017	-122.226964	Mediterranean	Grassland	
CA-JRSN	Jasper Ridge, CA	37.406842	-122.2278	Mediterranean	Grassland	
CA-JRSR	Jasper Ridge, CA	37.406028	-122.226967	Mediterranean	Grassland	
CA-SR1 [1–3]	Stunt Ranch Reserve, CA	34.093889	-118.657222	Mediterranean	Evergreen Forest	
CA-SR2 [1–3]	Stunt Ranch Reserve, CA	34.093889	-118.657222	Mediterranean	Evergreen Forest	
CM-DF	Snake Pointe P Mekong River Delta, Cambodia	11.505803	105.008758	Tropical	Cropland	Rice, grazing, flooding
CM-WF	Snake Pointe P Mekong River Delta, Cambodia	11.505803	105.008758	Tropical	Cropland	Rice, grazing, flooding
HI-KP	Kohala Peninsula, HI	20.14705	-155.834278	Tropical	Grassland	Grazing (low)
IL-BV [3,4]	Bondville Fluxnet, US-Bo1, IL	40.0062	-88.2904	Temperate	Cropland	No-till corn, soy
MA-HF [5,6]	Harvard Forest, MA	42.536667	-72.173333	Temperate	Deciduous Forest	Secondary mature
MN-SP	SPRUCE site, ORNL project, MN	47.50547	-93.45414	Boreal	Peatland	
OK-GP [3,4,7]	Southern Great Plains ARM site, OK	36.605	-97.485	Temperate	Cropland	Wheat
OR-AC	Arrastra Creek, OR	42.184775	-122.796061	Temperate	Evergreen Forest	Past thinning
UT-CR	Colorado River, UT	38.682778	-109.4225	Arid	Desert	
UT-MO	Moab, UT	38.867778	-109.813333	Arid	Desert	Grazing (low)
WA-WR	Wind River, WA	45.8205	-121.9519	Temperate	Evergreen Forest	Old growth
WI-WC [3,4]	Willow Creek Fluxnet, US-WCr, WI	45.80565	-90.07948	Temperate	Deciduous Forest	Secondary mature
Survey 2						
Soil ID	**Name**	**Latitude**	**Longitude**	**Biome**	**Land use**	**Details**
CH-Cha [8]	Chamou, Switzerland	47.2102	8.4104	Temperate	Grassland	
CH-Dav [8]	Davos, Switzerland	46.8147	9.8555	Temperate	Evergreen Forest	
CH-Fru [8]	Früebüel, Switzerland	47.1158	8.5378	Temperate	Grassland	
CH-Lag [8]	Lägeren, Switzerland	47.115	8.537	Temperate	Deciduous Forest	
CH-Oe2 [8]	Oensingen, Switzerland	47.2863	7.7343	Temperate	Cropland	
DE-Hai [8]	Hainich, Germany	51.0792	10.453	Temperate	Deciduous Forest	

DE-Lei [8]	Leinefelde, Germany	51.3282	10.3678	Temperate	Deciduous Forest	
DK-Sor [8]	Sorø, Denmark	55.4859	11.6446	Temperate	Deciduous Forest	
FI-Hyy [8]	Hyytiälä, Finland	61.8475	24.295	Boreal	Evergreen Forest	
FI-Var [8]	Värriö, Finland	67.7569	29.616	Boreal	Evergreen Forest	
FR_Rou	Rouffignac, France	45.01017	0.9727	Temperate	Deciduous Forest	
FR_TlsC6	Toulouse, France	43.5365	1.5067	Temperate	Cropland	Conventional
FR_TlsLA3	Toulouse, France	43.5344	1.4974	Temperate	Cropland	Organic
FR-AucB4	Auch, France	43.6227	0.5707	Temperate	Cropland	Conventional
FR-AucLH8	Auch, France	43.6381	0.6026	Temperate	Cropland	Organic
FR-Gra	Gradignan, France	44.7633	0.5972	Temperate	Evergreen Forest	
FR-Hes [8]	Hesse, France	48.6742	7.0656	Temperate	Deciduous Forest	
FR-Laq1 [8]	Laqueuille, France	45.6431	2.7358	Temperate	Grassland	Int
FR-Laq2 [8]	Laqueuille, France	45.6431	2.7358	Temperate	Grassland	Ext
FR-LeB	Le Bray, France	44.7167	0.7658	Temperate	Evergreen Forest	
FR-Lou	Lourdes, France	43.0795	-0.0406	Temperate	Deciduous Forest	
FR-Pue	Puechabon, France	43.7416	3.596	Mediterranean	Evergreen Forest	
FR-TlsCL	Toulouse, France	43.5308	1.5078	Temperate	Cropland	Conventional
IS-Reh [8]	Rehovot, Israel	31.9091	34.8124	Mediterranean	Orchard	
IS-Yat [8]	Yatir, Israel	31.3468	35.051	Arid	Evergreen Forest	
PT-Cor [8]	Coruche, Portugal	39.1384	-8.3327	Mediterranean	Evergreen Forest	
PT-Mit-amb	Mitra, Portugal	38.5406	-8.0001	Mediterranean	Evergreen Forest	
PT-Mit-b9 [8]	Mitra, Portugal	38.5406	-8.0001	Mediterranean	Evergreen Forest	
PT-Mit-mid	Mitra, Portugal	38.5406	-8.0001	Mediterranean	Evergreen Forest	
SE-Abi	Abisko, Sweden	68.3567	19.0514	Boreal	Peatland	
SE-Hyl [8]	Hyltemossa, Sweden	56.1	13.4167	Boreal	Peatland	
SE-Nor [8]	Norunda, Sweden	60.0881	17.4669	Boreal	Evergreen Forest	
SE-Ros_Cont [8]	Rosinedal, Sweden	64.1705	19.748	Boreal	Evergreen Forest	Control

SE-Ros_Fert [8]	Rosinedal, Sweden	64.1705	19.748	Boreal	Evergreen Forest	Fertilized
SE-Sva [8]	Svartberget, Sweden	64.1666	19.783	Boreal	Evergreen Forest	
SP-Amo [8]	Amoladeras, Spain	36.834	-2.2503	Arid	Grassland	
SP-Bal [8]	Balsablanca, Spain	39.9417	-2.0328	Arid	Grassland	
SP-Cha	Chapinera, Spain	40.6508	0.2089	Mediterranean	Evergreen Forest	
SP-Peg	Peguerinos, Spain	40.3836	4.1942	Mediterranean	Evergreen Forest	
SP-Ube_NOVeg [8]	Ubeda, Spain	37.915	-3.2269	Mediterranean	Orchard	Inter-row
SP-Ube_Veg [8]	Ubeda, Spain	37.9109	-3.2284	Mediterranean	Orchard	In-row

References to related OCS studies

1. Sun, W.; Maseyk, K.; Lett, C.; Seibt, U. Litter dominates surface fluxes of carbonyl sulfide in a Californian oak woodland. *J. Geophys. Res. Biogeosciences* **2016**, *121*, 438–450, doi:10.1002/2015JG003149.
2. Sun, W.; Maseyk, K.; Lett, C.; Seibt, U. A soil diffusion–reaction model for surface COS flux: COSSM v1. *Geosci. Model Dev.* **2015**, *8*, 3055–3070, doi:10.5194/gmd-8-3055-2015.
3. Whelan, M. E.; Hilton, T. W.; Berry, J. a.; Berkelhammer, M.; Desai, A. R.; Campbell, J. E. Carbonyl sulfide exchange in soils for better estimates of ecosystem carbon uptake. *Atmos. Chem. Phys.* **2016**, *16*, 3711–3726, doi:10.5194/acp-16-3711-2016.
4. Montzka, S. a.; Calvert, P.; Hall, B. D.; Elkins, J. W.; Conway, T. J.; Tans, P. P.; Sweeney, C. S. On the global distribution, seasonality, and budget of atmospheric carbonyl sulfide (COS) and some similarities to CO2. *J. Geophys. Res. Atmos.* **2007**, *112*, 1–15, doi:10.1029/2006JD007665.
5. Commane, R.; Meredith, L. K.; Baker, I. T.; Berry, J. A.; Munger, J. W.; Montzka, S. A.; Templer, P. H.; Juice, S. M.; Zahniser, M. S.; Wofsy, S. C. Seasonal fluxes of carbonyl sulfide in a midlatitude forest. *Proc. Natl. Acad. Sci.* **2015**, *112*, 14162–14167, doi:10.1073/pnas.1504131112.
6. Mellillo, J. M.; Steudler, P. A. The effect of nitrogen fertilization on the COS and CS_2 emissions from temperature forest soils. *J. Atmos. Chem.* **1989**, *9*, 411–417.
7. Maseyk, K.; Berry, J. a; Billesbach, D.; Campbell, J. E.; Torn, M. S.; Zahniser, M.; Seibt, U. Sources and sinks of carbonyl sulfide in an agricultural field in the Southern Great Plains. *Proc. Natl. Acad. Sci.* **2014**, *111*, 9064–9069, doi:10.1073/pnas.1319132111.
8. Kaisermann, A.; Ogée, J.; Sauze, J.; Wohl, S.; Jones, S. P.; Gutierrez, A.; Wingate, L. Disentangling the rates of carbonyl sulphide (COS) production and consumption and their dependency with soil properties across biomes and land use types. *Atmos. Chem. Phys. Discuss.* **2018**, 1–27, doi:10.5194/acp-2017-1229.