

Monitoring greenhouse gases (GHGs) in China: status and perspective

Youwen Sun^{1,2}, Hao Yin^{1,2}, Wei Wang^{1,2}, Changgong Shan^{1,2}, Justus Notholt³,
Mathias Palm³, Zhenyi Chen^{4*}, and Cheng Liu^{1,2,5,6,7*}

1. Key Laboratory of Environmental Optics and Technology, Anhui Institute of Optics and Fine Mechanics, HFIPS, Chinese Academy of Sciences, Hefei 230031, China
2. Department of Precision Machinery and Precision Instrumentation, University of Science and Technology of China, Hefei, 230026, China
3. University of Bremen, Institute of Environmental Physics, P. O. Box 330440, 28334 Bremen, Germany
4. School of Ecology and Environment, Beijing Technology and Business University, 100048, Beijing, China
5. Center for Excellence in Regional Atmospheric Environment, Institute of Urban Environment, Chinese Academy of Sciences, Xiamen, 361021, China
6. Key Laboratory of Precision Scientific Instrumentation of Anhui Higher Education Institutes, University of Science and Technology of China, Hefei, 230026, China
7. Anhui Province Key Laboratory of Polar Environment and Global Change, University of Science and Technology of China, Hefei, 230026, China

*Correspondence: Cheng Liu (chliu81@ustc.edu.cn) and Zhenyi Chen (zychen@btbu.edu.cn)

Table S1. Geolocations of global GHGs monitoring network coordinated by NOAA and WMO

Site	Latitude (° N)	Longitude (° E)	Project
Alert, Nunavut	82.45	-62.51	Surface Flasks
Argyle, Maine	45.04	-68.68	Surface Flasks
Anmyeon-do	36.54	126.33	Surface Flasks
Ascension Island	-7.97	-14.40	Surface Flasks
Assekrem	23.26	5.63	Surface Flasks
Terceira Island, Azores	38.77	-27.38	Surface Flasks
Baring Head Station	-41.41	174.87	Surface Flasks
Bukit Kototabang	-0.20	100.32	Surface Flasks
Tudor Hill, Bermuda	32.27	-64.89	Surface Flasks
Barrow Atmospheric Baseline Observatory	71.32	-156.61	Surface Flasks
Brentwood, Maryland	38.93	-76.96	Surface Flasks
Cold Bay, Alaska	55.21	-162.72	Surface Flasks
Cape Grim, Tasmania	-40.68	144.69	Surface Flasks
Christmas Island	1.70	-157.15	Surface Flasks
Centro de Investigacion de la Baja Atmosfera	41.81	-4.93	Surface Flasks
Cape Point	-34.35	18.49	Surface Flasks
Carbon in Arctic Reservoirs Vulnerability Experiment	64.99	-147.60	Surface Flasks
Crozet Island	-46.43	51.85	Surface Flasks
Drake Passage	-59.00	-64.69	Surface Flasks
Dongsha Island	20.70	116.73	Surface Flasks
Easter Island	-27.16	-109.43	Surface Flasks
Mariana Islands	13.39	144.67	Surface Flasks
Halley Station, Antarctica	-75.61	-26.21	Surface Flasks
Hohenpeissenberg	47.80	11.02	Surface Flasks
Hegyhatsal	46.95	16.65	Surface Flasks
Storhofdi, Vestmannaeyjar	63.40	-20.29	Surface Flasks
Indianapolis Flux Experiment	39.58	-86.42	Surface Flasks
Izana, Tenerife, Canary Islands	28.31	-16.50	Surface Flasks
Key Biscayne, Florida	25.67	-80.16	Surface Flasks
Cape Kumukahi, Hawaii	19.56	-154.89	Surface Flasks
Park Falls, Wisconsin	45.95	-90.27	Surface Flasks
Lewisburg, Pennsylvania	40.95	-76.88	Surface Flasks
Lulin	23.47	120.87	Surface Flasks
Lampedusa	35.52	12.63	Surface Flasks
Mt. Bachelor Observatory	43.98	-121.69	Surface Flasks
High Altitude Global Climate Observation Center	18.98	-97.31	Surface Flasks

Mace Head, County Galway	53.33	-9.90	Surface Flasks
Sand Island, Midway	28.22	-177.37	Surface Flasks
Mauna Loa, Hawaii	19.54	-155.58	Surface Flasks
Marcellus Pennsylvania	41.47	-76.41	Surface Flasks
Mashpee, Massachusetts	41.66	-70.50	Surface Flasks
Mt. Wilson Observatory	34.23	-118.06	Surface Flasks
Farol De Mae Luiza Lighthouse	-5.80	-35.19	Surface Flasks
NE Baltimore, Maryland	39.32	-76.58	Surface Flasks
Gobabeb	-23.58	15.03	Surface Flasks
NW Baltimore	39.34	-76.69	Surface Flasks
Niwot Ridge, Colorado	40.05	-105.59	Surface Flasks
Ochsenkopf	50.03	11.81	Surface Flasks
Pallas-Sammaltunturi, GAW Station	67.97	24.12	Surface Flasks
Palmer Station, Antarctica	-64.77	-64.05	Surface Flasks
Ragged Point	13.17	-59.43	Surface Flasks
Beech Island, South Carolina	33.41	-81.83	Surface Flasks
Mahe Island	-4.68	55.53	Surface Flasks
Southern Great Plains, Oklahoma	36.61	-97.49	Surface Flasks
Shemya Island, Alaska	52.71	174.13	Surface Flasks
Tutuila	-14.247	-170.56	Surface Flasks
South Pole, Antarctica	-89.98	-24.80	Surface Flasks
Sutro Tower, San Francisco, California	37.76	-122.45	Surface Flasks
Summit	72.60	-38.42	Surface Flasks
Syowa Station, Antarctica	-69.01	39.59	Surface Flasks
Tae-ahn Peninsula	36.79	126.13	Surface Flasks
Hydrometeorological Observatory of Tiksi	71.60	128.89	Surface Flasks
Thurmont, Maryland	39.58	-77.49	Surface Flasks
Taiping Island	10.38	114.37	Surface Flasks
Ushuaia	-54.85	-68.31	Surface Flasks
Wendover, Utah	39.90	-113.72	Surface Flasks
Ulaan Uul	44.45	111.10	Surface Flasks
West Branch, Iowa	41.73	-91.35	Surface Flasks
Walnut Grove, California	38.26	-121.49	Surface Flasks
Weizmann Institute of Science	29.97	35.06	Surface Flasks
Moody, Texas	31.32	-97.33	Surface Flasks
Mt. Waliguan	36.29	100.90	Surface Flasks
Ny-Alesund, Svalbard	78.91	11.89	Surface Flasks
Alaska Coast Guard	57.74	-152.50	Airborne Flasks
Briggsdale, Colorado	40.64	-104.33	Airborne Flasks
Offshore Cape May, New Jersey	38.83	-74.32	Airborne Flasks
Estevan Point, British Columbia	49.38	-126.54	Airborne Flasks
East Trout Lake, Saskatchewan	54.35	-104.99	Airborne Flasks
Homer, Illinois	40.07	-87.91	Airborne Flasks

Indianapolis Flux Experiment	39.58	-86.42	Airborne Flasks
Park Falls, Wisconsin	45.95	-90.27	Airborne Flasks
Offshore Portsmouth, New Hampshire	42.95	-70.63	Airborne Flasks
Poker Flat, Alaska	64.90	-148.76	Airborne Flasks
Rarotonga	-21.25	-159.83	Airborne Flasks
Offshore Charleston, South Carolina	32.77	-79.55	Airborne Flasks
Southern Great Plains, Oklahoma	36.61	-97.49	Airborne Flasks
Offshore Corpus Christi, Texas	27.73	-96.86	Airborne Flasks
Trinidad Head, California	41.05	-124.15	Airborne Flasks
West Branch, Iowa	41.73	-91.35	Airborne Flasks
Argyle, Maine	45.04	-68.68	In Situ Tall Tower
Carbon in Arctic Reservoirs Vulnerability Experiment	64.99	-147.60	In Situ Tall Tower
Park Falls, Wisconsin	45.95	-90.27	In Situ Tall Tower
Beech Island, South Carolina	33.41	-81.83	In Situ Tall Tower
West Branch, Iowa	41.73	-91.35	In Situ Tall Tower
Walnut Grove, California	38.26	-121.49	In Situ Tall Tower
Moody, Texas	31.32	-97.33	In Situ Tall Tower
Barrow Atmospheric Baseline Observatory	71.32	-156.61	In Situ Observatory
Mauna Loa, Hawaii	19.54	-155.58	In Situ Observatory
Tutuila	-14.25	-170.56	In Situ Observatory
South Pole, Antarctica	-89.98	-24.80	In Situ Observatory
Tambopata	-12.82	-69.29	Surface In Situ
Shenandoah National Park	38.62	-78.35	Surface In Situ
Mt. Bachelor Observatory	43.98	-121.69	Surface In Situ

Table S2 Geolocations of global FTIR observation networks, including TCCON, NDACC-IRWG, and COCCON networks.

Site	Latitude (° N)	Longitude (° E)	Network
Anmyeondo, Korea	36.54	126.33	TCCON
Ascension Island	-7.92	-14.33	TCCON
Bremen, Germany	53.10	8.85	TCCON
Burgos, Philippines	18.53	120.65	TCCON
Caltech, USA	34.14	-118.13	TCCON
Darwin, Australia	-12.42	130.89	TCCON
Darwin, Australia	-12.46	130.93	TCCON
Dryden, USA	34.96	-117.88	TCCON
East Trout Lake, Canada	54.35	-104.99	TCCON
Eureka, Canada	80.05	-86.42	TCCON
Garmisch, Germany	47.48	11.06	TCCON
Harwell, Oxfordshire, UK	51.57	-1.31	TCCON
Hefei, China	31.91	117.17	TCCON
Izaña, Tenerife	28.30	-16.50	TCCON
Karlsruhe, Germany	49.10	8.44	TCCON
Lamont, OK (USA)	36.60	-97.49	TCCON
Lauder, New Zealand	-45.04	169.68	TCCON
Nicosia, Cyprus	35.14	33.38	TCCON
Ny-Ålesund, Spitsbergen	78.90	11.90	TCCON
Orléans, France	47.97	2.11	TCCON
Paris, France	48.85	2.36	TCCON
Park Falls, WI (USA)	45.95	-90.27	TCCON
Reunion Island	-20.90	55.49	TCCON
Rikubetsu, Japan	43.46	143.77	TCCON
Saga, Japan	33.24	130.29	TCCON
Sodankylä, Finland	67.37	26.63	TCCON
Tsukuba, Japan	36.05	140.12	TCCON
Wollongong, Australia	-34.41	150.88	TCCON
Xianghe, China	39.80	116.96	TCCON
Zugspitze, Germany	47.42	10.98	TCCON
Boulder	39.99	-105.26	COCCON
Paris, France	48.85	2.36	COCCON
Lanzhou	36.03	103.40	COCCON
Leicester	52.63	-1.14	COCCON
Heidelberg	49.41	8.72	COCCON
Xianghe, China	39.80	116.96	COCCON
München	48.14	11.58	COCCON

Oklahoma	35.50	-97.50	COCCON
Wollongong, Australia	-34.41	150.88	COCCON
Romania	44.38	26.02	COCCON
Harvard University	42.37	-71.12	COCCON
Meteorological State Agency of Spain	40.35	3.75	COCCON
University of Reims	49.25	4.05	COCCON
Universidad Nacional Autónoma de México	19.32	-99.18	COCCON
Vrije University Amsterdam	52.33	4.87	COCCON
University of Alaska Fairbanks	64.83	147.72	COCCON
Seoul	37.46	126.95	COCCON
Finland	60.10	24.83	COCCON
Universidade de São Paulo	-23.56	-46.73	COCCON
Moshiri	44.40	142.30	COCCON
Edinburgh	55.95	-3.22	COCCON
National Remote Sensing Centre	17.47	78.45	COCCON
Lauder, New Zealand	-45.04	169.68	COCCON
Kiruna	67.84	20.41	COCCON
Brussels	50.91	4.43	COCCON
Hefei, China	31.91	117.17	COCCON
Botswana	-24.60	25.90	COCCON
Environment and Climate Change Canada	45.20	-73.58	COCCON
Tokyo	35.71	139.76	COCCON
Shanghai	31.32	121.39	COCCON
Toronto	43.66	-79.40	COCCON
Beijing	39.90	116.40	COCCON
Eureka	80.05	-86.42	NDACC
Ny Alesund	78.92	11.30	NDACC
Thule	76.53	-68.74	NDACC
Kiruna	67.84	20.41	NDACC
Søndre Strømfjord	66.99	-50.95	NDACC
Harestua	60.20	10.80	NDACC
Petersburg	59.90	29.80	NDACC
Bremen	53.10	8.80	NDACC
Zugspitze	47.42	10.98	NDACC
Jungfraujoch	46.55	7.98	NDACC
Moshiri	44.40	142.30	NDACC
Toronto	43.66	-79.40	NDACC
Rikubetsu	43.46	143.77	NDACC
Boulder	39.99	-105.26	NDACC
Barcroft	37.58	-118.25	NDACC
Kitt Peak	31.90	-111.60	NDACC
Izaña	28.30	-16.48	NDACC
Mauna Loa	19.54	-155.58	NDACC

Altzomoni	19.12	-98.66	NDACC
Paramaribo	5.75	-55.20	NDACC
Reunion Island	-20.90	55.50	NDACC
Reunion Island	-21.10	55.40	NDACC
Wollongong	-34.41	150.88	NDACC
Lauder	-45.04	-169.68	NDACC
Arrival Heights	-77.83	166.67	NDACC