Empa
Materials Science and Technology

GGMT-2017

Greenhouse Gases & Measurement Techniques

WMO GAW IAEA

GGMT 2017

19th WMO/IAEA Meeting on

Carbon Dioxide, Other Greenhouse Gases,

and Related Measurement Techniques

Empa, Dübendorf, Switzerland
August 27th – 31st, 2017

Final Program

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WELCOME

We are very delighted to have you here at Empa in Dübendorf to participate in the 19th WMO/IAEA Meeting on Carbon Dioxide, other Greenhouse Gases and Related Measurement Techniques (GGMT-2017). The GGMT conferences, a follow-up of the CO_2 experts meetings initiated in 1975 by Dr Dave Keeling and a few experts, are today cornerstone events of the international greenhouse gas monitoring programmes. This year, we are pleased to welcome more than 150 experts from all over the world to discuss relevant issues regarding long-term and consistent observation of greenhouse gases in the atmosphere. This includes recent developments in measurement techniques for GHGs, their isotopic composition, calibration procedures and quality control as well as data utilization, integrated products, observational network design and future strategies. Over the years, GGMT has become a key event of the Global Atmosphere Watch programme (GAW) of the World Meteorological Organization (WMO) to elaborate the scientific backbone of GAW's quality management framework for greenhouse gases. WMO has provided support for all GGMT meetings since the beginning and the International Atomic Energy Agency (IAEA) joined in 1997 in recognition of the increased benefit of carbon isotope observations in understanding the carbon cycle.

Empa, an interdisciplinary research institute of the ETH domain, contributes to the WMO GAW programme since many years. We started the first in-situ trace gas observations at the global GAW station Jungfraujoch in 1973 and we are proud that today we run one of the most comprehensive measurement programs at a mountain site station world-wide. Since 1996, two central facilities are operated by Empa to support the GAW programme. We initiated the World Calibration Centre for Carbon Monoxide (CO), Methane (CH_4), Carbon Dioxide (CO_2) and Surface Ozone (WCC-Empa), which conducted more than 80 system- and performance audits over the past 20 years and together with the Quality Assurance/ Science Activity Centre (QA/SAC) Switzerland supports international activities within and related to the GAW programme.

We look forward to an interesting conference with many exciting contributions and fruitful discussions, advancing the scientific basis for a successful Global Atmosphere Watch programme in the future.

Dr Brigitte Buchmann	Member of the Board of Directors Head of Depertment Mobility, Energy and Environment
Dr Christoph Zellweger	World Calibration Centre (WCC-Empa)
Dr Martin Steinbacher	Quality Assurance/Science Activity Centre (QA/SAC) Switzerland

ORGANISATION COMMITTEE
ADVISORY COMMITTEE

GGMT-2017
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WMO GAW IAEA

ORGANISATION COMMITTEE

Martin Steinbacher (Chair)

Brigitte Buchmann

Carole Delemont

Andrea Fischer

Christoph Zellweger

ADVISORY COMMITTEE

Sergey Assonov, International Atomic Energy Agency (IAEA), Austria

Gordon Brailsford, National Institute for Water and Atmospheric Research, New Zealand

Christoph Gerbig, Max-Planck-Institut für Biogeochemie, Germany

Brad Hall, NOAA ESRL Global Monitoring Division, USA

Armin Jordan, Max Planck Institute for Biogeochemistry, Germany

Ralph Keeling, Scripps Institution of Oceanography, USA

Paul Krummel, Commonwealth Scientific and Industrial Research Organization (CSIRO), Australia

Casper Labuschagne, South African Weather Service (SAWS), South Africa

Haeyoung Lee, Korea Meteorological Administration (KMA), Republic of Korea

Markus Leuenberger, University of Bern, Switzerland

Andrew Manning, University of East Anglia, UK

Heiko Moossen, Max Planck Institute for Biogeochemistry, Germany

Pieter Tans, NOAA ESRL Global Monitoring Division, USA

Alex Vermeulen, Lund University, Sweden

Christoph Zellweger, Empa, Swiss Federal Laboratories for Materials Science and Technology, Switzerland

GGMT 2017 – FINAL PROGRAM

SOCIAL EVENTS

GGMT-2017
Greenhouse Gases & Measurement Techniques
WMO GAW IAEA

ICEBREAKER (& REGISTRATION)

SUNDAY, AUGUST 27, 18:00 - 20:00

Empa NEST

CITY TOUR OF HISTORICAL ZURICH

WEDNESDAY, AUGUST 30, 17:00 - 18:30

Meeting point: Next to the fountain at the opera square (see map)

Use public transport to Zurich Stadelhofen, followed by a 2-minute walk.

CONFERENCE DINNER

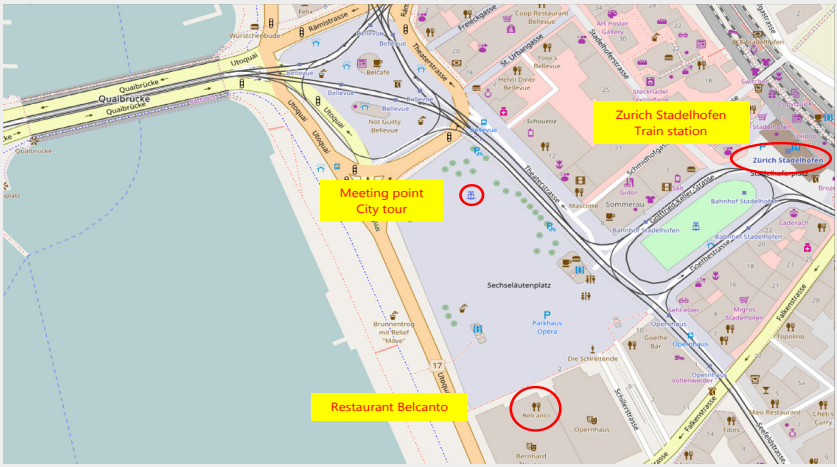
WEDNESDAY, AUGUST 30, 19:00

Restaurant Belcanto

Sechseläutenplatz 1

8001 Zurich

Use public transport to Zurich Stadelhofen. Restaurant Belcanto is a 2-minute walk just next to the opera (see map and photo on page 13).



GGMT 2017 – FINAL PROGRAM

MONDAY, AUGUST 28, 2017

GGMT-2017
Greenhouse Gases & Measurement Techniques

WMO GAW IAEA

08:00	**Registration**
09:00	Welcome and Opening Remarks, *Brigitte Buchmann
09:10	News from the GAW secretariat, *Oksana Tarasova
	Quality Assurance, GHG Standards & Comparison Activities **Chair: Paul Krummel**
09:30	T01- Uncertainties of NOAA GHG measurements from discrete air samples and zonal means, *Ed Dlugokencky
09:50	T02- Efforts to separately report random and systematic measurement uncertainty for continuous measurements in the NOAA Global Greenhouse Gas Reference Network, *Arlyn Andrews
10:10	**Photo and Coffee Break**
	Quality Assurance, GHG Standards & Comparison Activities **Chair: Martin Steinbacher**
10:40	T03- An update of comparisons of non-CO_2 trace gas measurements between AGAGE and NOAA at common sites, *Paul Krummel
11:00	T04- Revision of the WMO CO_2 calibration scale, *Brad Hall
11:20	T05- An update on the WMO CO X2014A scale, *Andrew Crotwell
11:40	T06- The result of the first SF_6 inter-comparison Experiment (SICE) 2016-2017, *Haeyoung Lee
12:00	T07- A new method to produce SI-traceable, primary calibration standards for halogenated greenhouse gases, *Myriam Guillevic
12:20	**Lunch Break**

	Quality Assurance, GHG Standards & Comparison Activities **Chair: Paul Krummel**
13:40	T08- Quality assurance and quality control of the upcoming ICOS-RI atmospheric dataset, *Michel Ramonet
14:00	T09- QA/QC of IAGOS NRT GHG data, *Christoph Gerbig
14:20	T10- WCC-Empa – Activities and Achievements, *Christoph Zellweger
14:40	**Recommendations A: QA/QC, Standards and Comparisons, Chapters 1, 2, 6, 9:** **Calibration of GAW Measurements, CO, CH_4 and CO_2 Calibration** **Lead: Andrew Crotwell, Rapporteur: Christoph Zellweger**
15:10	**Coffee Break**
15:40	Speed talks for Posters "Site and Network Updates"
16:40	**Poster Session (until 18:30)**

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TUESDAY, AUGUST 29, 2017

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Greenhouse Gases & Measurement Techniques
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	Isotope Measurements - Chair: Joachim Mohn
08:30	T11- Introduction: Data Quality Objectives for stable isotopes in greenhouse gases: current status and future needs, *Sergey Assonov
08:50	T12- Delta-^{13}C scale realisation based on the primary Reference Materials in the form of carbonates, *Sergey Assonov
09:10	T13- JRAS-06: Keeping up with changing internationally-distributed, light- element stable isotopic reference materials, *Heiko Moossen
09:30	T14- Maintaining quality with quantity: lessons learned in the corrections and calibrations of INSTAARs large isotopic dataset, *Sylvia E. Michel
09:50	T15- Measurement and Calibration Uncertainty in the CSIRO atmospheric CO_2 Stable Isotope Program, *Colin Allison
10:10	**Coffee Break**
	Isotope Measurements - Chair: Sergey Assonov
10:40	T16- On the calibration of isotopologue-specific optical trace gas analysers, *David Griffith
11:00	T17- Calibration strategies for FTIR and other IRIS instruments for accurate $\delta^{13}C$ and $\delta^{18}O$ measurements of CO_2 in air, *Edgar Flores
11:20	T18- Gaseous reference materials to underpin measurements of amount fraction and isotopic composition of greenhouse gases, *Paul Brewer
11:40	T19- Using Isotopic Fingerprints to Trace Nitrous Oxide in the Atmosphere, *Joachim Mohn
12:00	T20- Methane isotopes – clues to the budget changes: and the need for independent isotopic measurement programs, *Euan Nisbet
12:20	**Lunch Break (including vendor presentations)**
13:00	Air Liquide
13:15	Decent Lab
13:30	Mirico
13:45	LosGatos

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14:00	***Side event: -Metrology for Stable Isotope Reference Standards (SIRS) stakeholder meeting (until 17:30)***
	Urban Networks and Megacities - Chair: Jooil Kim
14:00	T21- Integrated urban Greenhouse Gas Information System (IG^3IS): Advances in the urban GHG monitoring implementation plan and results of previous and current city-scale studies, *Felix Vogel
14:20	T22- Detection of trends in urban CO_2 emissions: Results from the INFLUX tower network, *Natasha Miles
14:40	T23- The North-East Corridor: Baltimore-Washington DC Urban Greenhouse Gas Network, *Anna Karion
15:00	**Coffee Break**
	Site and Network Updates - Chair: Lingxi Zhou
15:30	T24- Amazon Greenhouse Gas Measurement Program, *Luciana V. Gatti
15:50	T25- CO_2, CH_4, and CO with CRDS technique at the Izaña Global GAW station: instrumental tests, developments and first measurement results, *Angel J. Gomez-Pelaez
16:10	T26- Atmospheric CO_2 and other greenhouse gases monitoring in India, *Yogesh K. Tiwari
16:30	**Recommendations C: Urban Networks, Site and Network Updates, Chapters 11 & 12 - Lead: Felix Vogel, Rapporteur: Casper Labuschagne**
17:00	**Poster Session (until 18:00)**
18:00	***Side event: -Discussion on Stable Isotopes Recommendations (until 19:00)***
18:00	***Side event: -Discussion on Shipboard Atmospheric CO_2 Measurement Recommendations (until 19:00)***

SCIENTIFIC PROGRAM OVERVIEW

GGMT-2017
Greenhouse Gases & Measurement Techniques

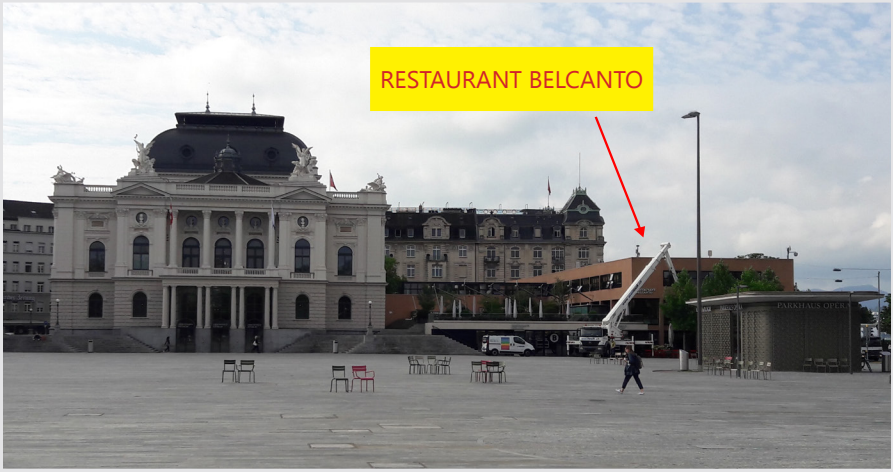
WMO GAW IAEA

	August 27, 2017	August 28, 2017	August 29, 2017	
time	**Sunday**	**Monday**	**Tuesday**	
7-8				
8-9		registration		
9-10	SAG GHG (on invitation only)	plenary session	plenary session	
10-11				
11-12				
12-13		lunch	lunch	
13-14		plenary session	lunch	vendor talks
14-15			plenary session	side event
15-16				
16-17		poster session	poster session	
17-18				
18-19	icebreaker (& registration)		side events	
19-20				
20-21				
21-22				

August 30, 2017	August 31, 2017	September 01, 2017
Wednesday	**Thursday**	**Friday**
		trip to Jungfraujoch (limited availabilities only) or visit to METAS, the Swiss National Metrology Institute
plenary session	plenary session	
lunch	lunch	
lunch / vendor talks		
plenary session	plenary session	
social event	GGMT 2017 closing and Coffee	
conference dinner		

08:10	**Recommendations B: Isotope Measurements, Chapters 3, 4: Stable isotopes and radiocarbon - Lead: Sergey Assonov, Rapporteur: Bruce Vaughn**
	Measurement Techniques & Calibration - Chair: Zoe Loh
08:40	T27- Fractionation of O_2/N_2, Ar/N_2, and CO_2 at Aircraft Sampling Inlets, *Britton Stephens
09:00	T28- Comparison of interferometric and mass spectrometric measurements of O_2/N_2 by the Scripps O_2 program, *Ralph Keeling
09:20	T29- Preparation of high precision standards (with ± 1 ppm) using a gravimetric method for measuring atmospheric oxygen, *Nobuyuki Aoki
09:40	T30- Towards the Unifying of the Detection Systems for the Measurement of the Major Greenhouse Gases and Related Tracers, *Blagoj Mitrevski
10:00	**Coffee Break**
	Measurement Techniques & Calibration - Chair: Arlyn Andrews
10:30	T31- Calibration and Field Testing of Cavity Ring-Down Laser Spectrometers Measuring Methane Mole Fraction and Isotopic Ratio Deployed on Towers in the Marcellus Shale Region, *Natasha Miles
10:50	T32- Adaptation of a commercial greenhouse gas analyser for airborne measurements with expanded altitude range and application on the ORCAS and ATom campaigns, *Kathryn McKain
11:10	T33- A new lightweight active stratospheric air sampler, *Joram Hooghiem
11:30	**Recommendations D: Measurement Techniques & Calibration, Chapters 5, 7, 8, 10: Calibration of O_2/N_2, N_2O, SF_6 and H_2 Measurements Co-Lead/Rapporteur: Britton Stephens and Brad Hall**
	Emerging Techniques - Chair: Christoph Gerbig
12:00	T34- Low-cost sensors for CO_2 monitoring: calibration, characterization and assessment, *Lukas Emmenegger
12:20	**Lunch Break (including vendor presentations)**
13:15	Picarro
13:30	Aerodyne
13:45	Ecotech

14:00	T35- Measurements of atmospheric oxygen using a newly built CRDS analyzer and comparison with a paramagnetic cell and an IRMS, *Markus Leuenberger
14:20	T36- Microwave sensing column oxygen amounts for surface air pressure and greenhouse gas mixing ratio estimates, *Bing Lin
14:40	T37- The AirCore atmospheric profiler: methods, challenges, applications, and updates, *Jonathan Bent
15:00	T38- A UAV-based active AirCore system for accurate measurements of green house gases, *Truls Andersen
15:20	**Coffee Break (until 15:50)**
17:00	**City tour of historical Zurich (until 18:30)** Meeting point: Next to the fountain at the opera square (see map page 5)
19:00	**Conference Dinner (Restaurant Belcanto, Zurich, see map page 5)**



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THURSDAY, AUGUST 31, 2017

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	Emerging Techniques - Chair: Michel Ramonet
08:30	T39- Stratospheric measurements of ozone-depleting substances and greenhouse gases using AirCores, *E. Leedham Elvidge
08:50	T40- APRECON-TOF-MS: A new state-of-the art instrument for the analysis of halogenated greenhouse gases, *Martin K. Vollmer
09:10	**Recommendations E: Emerging Techniques** **Lead: David Griffith, Rapporteur: Huilin Chen**
	Ocean Measurements, Chapter 13 - Chair: Martin Vollmer
09:40	T41- Medusa-Aqua System: Development of Analytical Techniques for Novel Halogenated Transient Tracers in the Ocean, *Pingyang Li
10:00	T42- Fifteen years of surface water CO_2 measurements from cruise ships in the Caribbean Sea, *Rik Wanninkhof
10:20	**Coffee Break**
10:50	T43- Towards including atmospheric CO_2 data from the oceanic community into the global high-accuracy atmospheric CO_2 network, *Penelope A. Pickers
11:10	T44- The PGGM measurements of atmospheric carbon dioxide concentrations over the Asia-Pacific and the Asia-Europe commercial shipping routes: The 2009- 2017 results, *Kuo-Ying Wang
11:30	T45- Atmospheric CO_2, CH_4 and N_2O mixing ratios in the China sea-shelf boundary layer during the spring 2017 campaign, *Lingxi Zhou
11:50	**Recommendations F: Ocean Measurements** **Lead: Rik Wanninkhof, Rapporteur: Hideki Nara**
12:20	**Lunch Break**

THURSDAY, AUGUST 31, 2017

	Data Products and Policy - Chair: Alex Vermeulen
13:20	T46- Updated Guidelines for Atmospheric Trace Gas Data Management, *John Mund
13:40	T47- Introduction of new WDCGG website, *Seiji Miyauchi
14:00	**Expert group recommendations** **Lead: to be assigned, Rapporteur: to be assigned**
16:00	**GGMT 2017 closing and Coffee**

Posters Quality Assurance, GHG Standards & Comparison Activities

P01	Mobile Laboratory improving the data quality of ICOS atmospheric station network, *Hermanni Aaltonen
P02	5 years of ICOS compliant in situ GHG measurements at OPE: set up, quality control and calibration system, *Sébastien Conil
P03	Optimal dry cylinder sequencing on Picarro G2301 and G2401 CRDS instruments, *Rebecca Gregory
P04	Quality control of flask sample data using Ar/N_2 measurements, *Armin Jordan
P05	Comparison of Picarro and Los Gatos analysers for CO and N_2O at Hohenpeissenberg, *Dagmar Kubistin
P06	Update of Operation of the Flask and Calibration Laboratory for ICOS (Integrated Carbon Observation System), *Daniel Rzesanke
P07	QA/SAC Switzerland – Activities and Achievements, *Martin Steinbacher

Posters Isotope Measurements

P08	Methane in Hong Kong: isotopic characterisation of local and regional methane sources, *Rebecca Fisher
P09	European atmospheric $^{14}CO_2$ activities within the ICOS-RI network, *Samuel Hammer
P10	Simultaneous field-scale in-situ measurements of the four most abundant N_2O isotopocules, *Erkan Ibraim
P11	High precision spectroscopic measurement of N_2O clumped isotopic species, *Kristýna Kantnerová
P12	Development of new N_2O reference materials for $\delta^{15}N$, $\delta^{18}O$ and ^{15}N site preference within the EMPIR project SIRS, *Joachim Mohn
P13	$^{14}CO_2$ measurements from Baring Head, New Zealand, Rowena Moss
P14	Performance of radiocarbon analysis using NIES-CAMS and initial results for air samples obtained in Indonesia, *Yumi Osonoi
P15	Towards SI traceability for CO_2 isotope ratios: Identifying sources of error in optical spectroscopy measurements, *Craig Richmond
P16	Measurement of nitrous oxide isotopomers in air, *Peter Sperlich
P17	Stable isotope and mixing ratio measurement of atmospheric CO_2 over India, *Tania Guha, Yogesh K. Tiwari
P18	Pilot study measuring N_2O mole fraction, $\delta^{15}N^{bulk}$-N_2O, $\delta^{15}N^{\alpha}$-N_2O, and $\delta^{15}N^{\beta}$-N_2O using Picarro G-5101i instrument reveals analytical challenges, *Bruce H. Vaughn
P19	Measurement of N_2O isotopes at the high-altitude station Jungfraujoch, *Longfei Yu
P20	Evaluation of methane sources by isotopic analysis in central London, *Giulia Zazzeri

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POSTER SESSION

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Posters Measurement Techniques & Calibration

P21	Inter-comparison study of European atmospheric ^{222}Rn and ^{222}Rn progeny monitors, *Claudia Grossi
P22	Evaluation of an OA-ICOS (Off-axis Integrated Cavity Output Spectrometer) for N_2O measurements at Schauinsland station, *Johannes Gry
P23	Estimation of BG CO_2 concentration from CRDS measurements at AMY site in South Korea using Quality Assurance Flagging Codes, *Sang-Ok Han
P24	Synthesis and evaluation of near real air CO_2 reference gas, *Keiichi Katsumata
P25	Replacement of CH_4 calibration system for WCC-JMA, *Teruo Kawasaki
P26	Stability and Material Testing Results of Aluminum Cylinders and Regulator Comparisons, *Duane Kitzis
P27	Causes of Instability in the Relative Abundance of the Major Constituents of Reference Air in High-Pressure Tanks, *Eric J. Morgan
P28	Investigation of adsorption / desorption behavior of high pressure small volume cylinders and its relevance to atmospheric trace gas analysis, *Ece Satar
P29	11-year statistics for in-situ CO_2 data obtained in airliner project of CONTRAIL, *Yousuke Sawa
P30	A Nafion-based air sample dryer for atmospheric flask sampling allowing accurate measurements of CO_2 and its stable isotopes in humid air, *Hubertus A. Scheeren
P31	Potential bias in the NOAA manometric measurement system, *Michael F. Schibig
P32	Comparison of in situ N_2O and CO measurements using gas chromatography, reduction gas analysis and off-axis integrated cavity output spectroscopy, *Kieran Stanley
P33	Quantifying Nafion cross-membrane CO_2 and CH_4 gas leakage and it's dependence on sample mole fraction and water content, *Ann Stavert
P34	Optimisation of the Spectronus FTIR instrument for tall tower greenhouse gas observations, *Alex Vermeulen

Posters Emerging Technique

P35	Developing a lower-cost medium precision urban GHG monitoring system using commercial NDIR sensors, *Emmanuel Arzoumanian
P36	High-resolution Mobile Measurements of Methane Concentrations and Fluxes Using High-Speed Open-Path Technology on Cars, Ships, Airplanes, Helicopters and Drones, *George Burba
P37	The automated air sampler for the ICOS network, *Markus Eritt
P38	Measurement of greenhouse gases from novel ground-based remote sensing instruments; the FRM4GHG campaign at the Sodankylä TCCON site, N. Finland, *Mahesh Kumar Sha, David Griffith
P39	Technical challenges of using high precision atmospheric O_2 measurements as a tracer for determining carbon fluxes in terrestrial ecosystems, *Penelope A. Pickers

Posters Ocean Measurements

P40	Continuous observation of atmospheric oxygen concentration onboard a cargo ship sailing between Japan and North America, *Yu Hoshina
P41	Japan Meteorological Agency's ship-based observations for carbonate parameters in the surface and interior ocean, *Shinji Masuda
P42	Long-term monitoring of atmospheric greenhouse gases and data validation in NIES-VOS program, *Hideki Nara

Posters Urban Networks and Megacities

P43	CarboSense: a low-cost low-power CO_2 network for the city of Zurich and Switzerland, *Antoine Berchet
P44	Continuous Near-IR and Mid-IR CRDS Measurements of Atmospheric CO_2, CH_4, N_2O, and CO in the Megacities Los Angeles Network: Design Criteria, *Jooil Kim
P45	New monitoring project of GHGs and air pollutants around Jakarta, Indonesia, *Masahide Nishihashi
P46	Start of greenhouse gases and related tracer measurements at Tokyo Megacity, *Yukio Terao

Posters Site and Network Updates

P47	Trace gas mixing ratios, carbon, water, and energy exchanges measurements at ARM facilities, * Sébastien C. Biraud
P48	Greenhouse Gases: Background Concentrations in Brazilian coast, *V. F. Borges
P49	Observations and modelling combine to inform network developments, *Gordon Brailsford, Rowena Moss
P50	"CASLab": The United Kingdom's Clean Air Sector Laboratory at Halley Research Station, coastal Antarctica, *Neil Brough
P51	The Franco-Belgian greenhouse gases monitoring program at La Réunion Island, *Jean-Pierre Cammas
P52	Long Term Nitrous Oxide Measurements Over Amazon Basin Using Small Aircraft, *C. S. C. Correia
P53	Continuous observations of CO_2, CH_4 and O_3 in the boundary layer of the central Mediterranean basin, *Paolo Cristofanelli
P54	Carbon Monoxide Measurements as a Biomass Burning Tracer at the Amazon Basin, *L. G. Domingues

P55	Amazon Basin and Brazilian Coast SF_6 Study in a 15 Years Time Series, *R. S. Santos
P56	Atmospheric molecular hydrogen (H_2) at the WMO/GAW stations in China, *Shuangxi Fang
P57	Japanese observation programs of atmospheric greenhouse gases in polar regions, *Daisuke Goto
P58	First results of tall tower surface-atmosphere N_2O flux measurements over a mixed agricultural region in Central Europe, *László Haszpra
P59	Recent updates from the Cape Point long-term data records, *Casper Labuschagne
P60	Atmospheric CO_2/CH_4/CO measurements at the Amazon Tall Tower Observatory (ATTO, Brazil), *Jost V. Lavric
P61	Combined balloon, aircraft, and surface greenhouse gas measurements at Traînou supersite, France, *Céline Lett
P62	Atmospheric nitrous oxide observations at Mount Waliguan station in China, from 1995 to 2014, *Miao Liang
P63	The Australian Greenhouse Gas Observation Network – where we are and where we are heading, *Zoë Loh
P64	Atmospheric CH_4 and N_2O measurements at Suva, Fiji, *Francis S. Mani
P65	MOYA and Equianos: UK methane measurement and GHG monitoring, *Euan G. Nisbet
P66	Atmospheric greenhouse gas concentrations for five years over a tropical forest in Borneo Island, *Shohei Nomura
P67	Monitoring of Greenhouse Gases with in situ FTIR in East Anglia, UK, as part of a regional sampling network, *Hannah Sonderfeld
P68	Implementation of New Greenhouse Gas Measurements in Cholpon Ata, Kyrgyz Republic, *Martin Steinbacher

Posters Data Products and Policy

P69	ICOS ATC near real time greenhouse gases data: from collection to model validation on the importance of proper water correction and primary scale propagation, *Amara Abbaris, Léonard Rivier
P70	Data Services for Carbon Cycle Science at the ICOS Carbon Portal, *Alex Vermeulen

VENUE / EMERGENCY INFORMATION

GGMT-2017
Greenhouse Gases & Measurement Techniques

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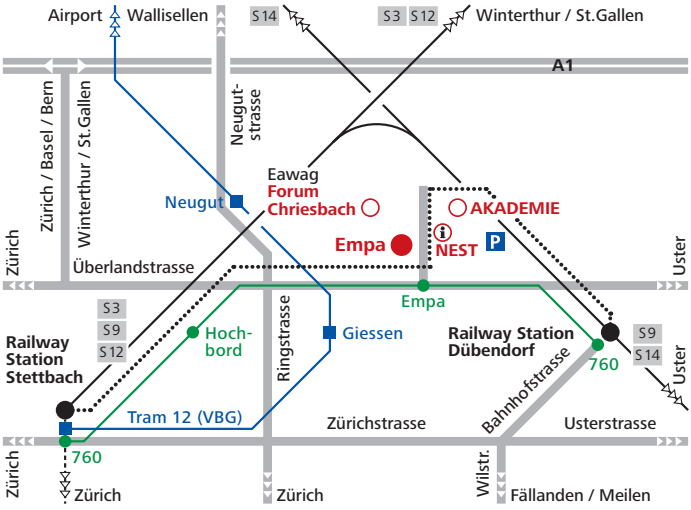

VENUE

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EMERGENCY INFORMATION

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