Gfg2 Second Summer School

1st to 3rd July 2013

GFZ

German Research Centre

for Geosciences

Student information

GFZ

Helmholtz Centre

POTSDAM

Background Gfg2 and the Second Summer School

Gfg2 (Gfg squared) is a three-year project, funded by the 7th Framework Program of the European Commission under the Environment theme (2010). Its mission is to assess the value of Global Navigation Satellite Systems (GNSS) for Global Environmental Earth Observation (GEEO) and the Global Earth Observation System of Systems (GEOSS).

The Second Summer School will support the GEOSS community to understand the capabilities of this technology as a remote sensing tool for Earth Observation application. The main theme is therefore an introduction to the different application possibilities of GNSS for remote sensing.

Basic rules of the summer school:

- The summer school is free to attend.
- There will be funding to cover the cost of travel for any student that needed it (up to 350€).
- Accommodation will be in single, en-suite study bedrooms with broadband access.
- Students will be accepted if they provide an abstract of a poster of their study/research in a relevant area (one of the GEOSS SBAs see figure 1 below).
- Outstanding poster submissions will be given the opportunity to present their work.
- Wherever possible, speakers will be experts in their field and have international standing.

Figure 1: The nine GEOSS Societal Benefit Areas

Travel

There will be a travel grant available to all students worth up to €350 to help cover the cost of attending the Summer School. Forms will be available at the Summer School for students to reclaim the cost of travel. **Please note that original tickets will be required, so the form and tickets are needed to be returned by postal mail**.

The registration will take place on Sunday 30th June 2013 in Haus H (see figure 2) from 16:00 until 18:00 Local Time Potsdam.

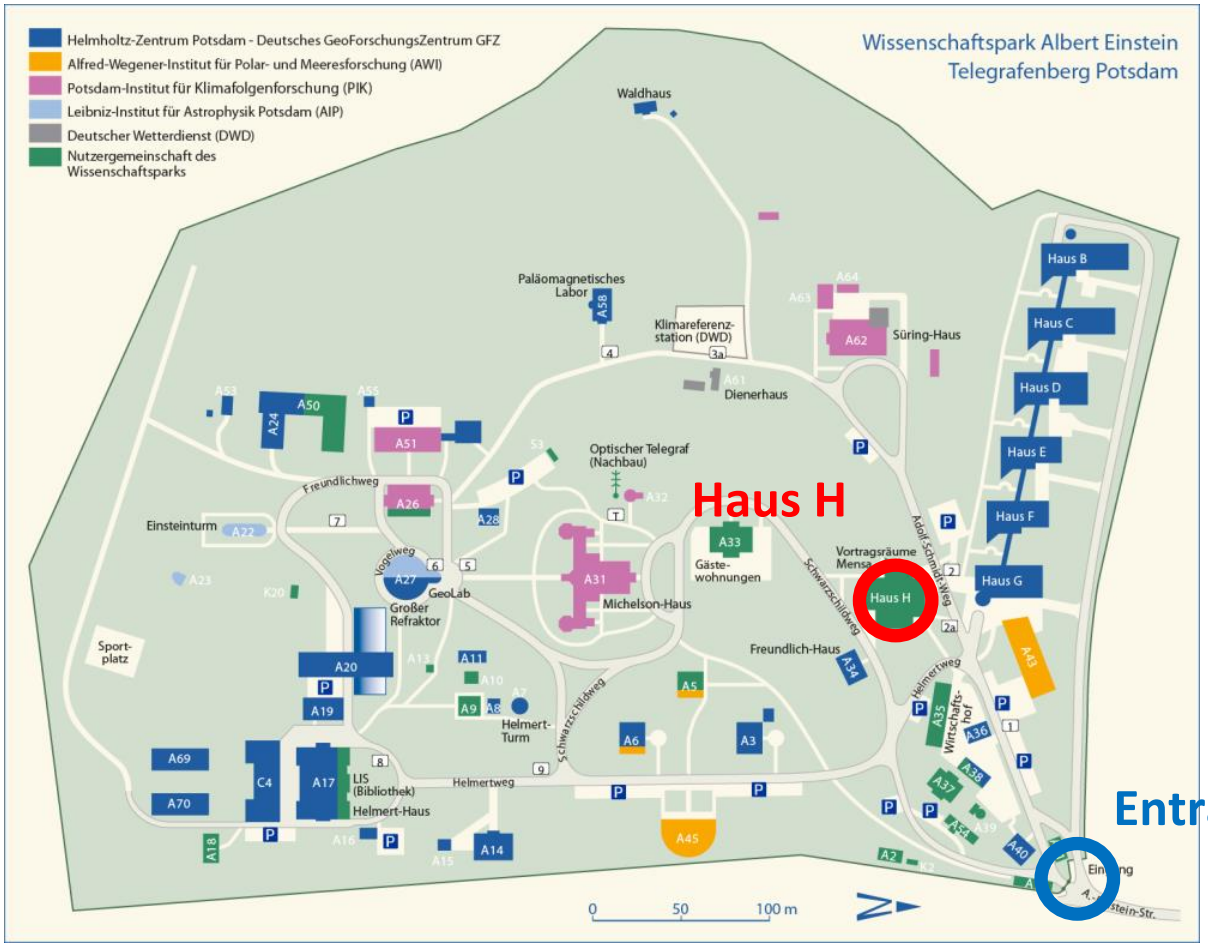

Figure 2: GFZ campus plan.

Accommodation

Each student will have a single en-suite study bedroom with an internet broadband connection.

All meals on Monday, Tuesday and Wednesday are included.

The address of the accommodation is (see map):

Mercure Hotel Potsdam City
Lange Brücke
14467 Potsdam
Germany

Tel.: +49 – (0)331 – 2722

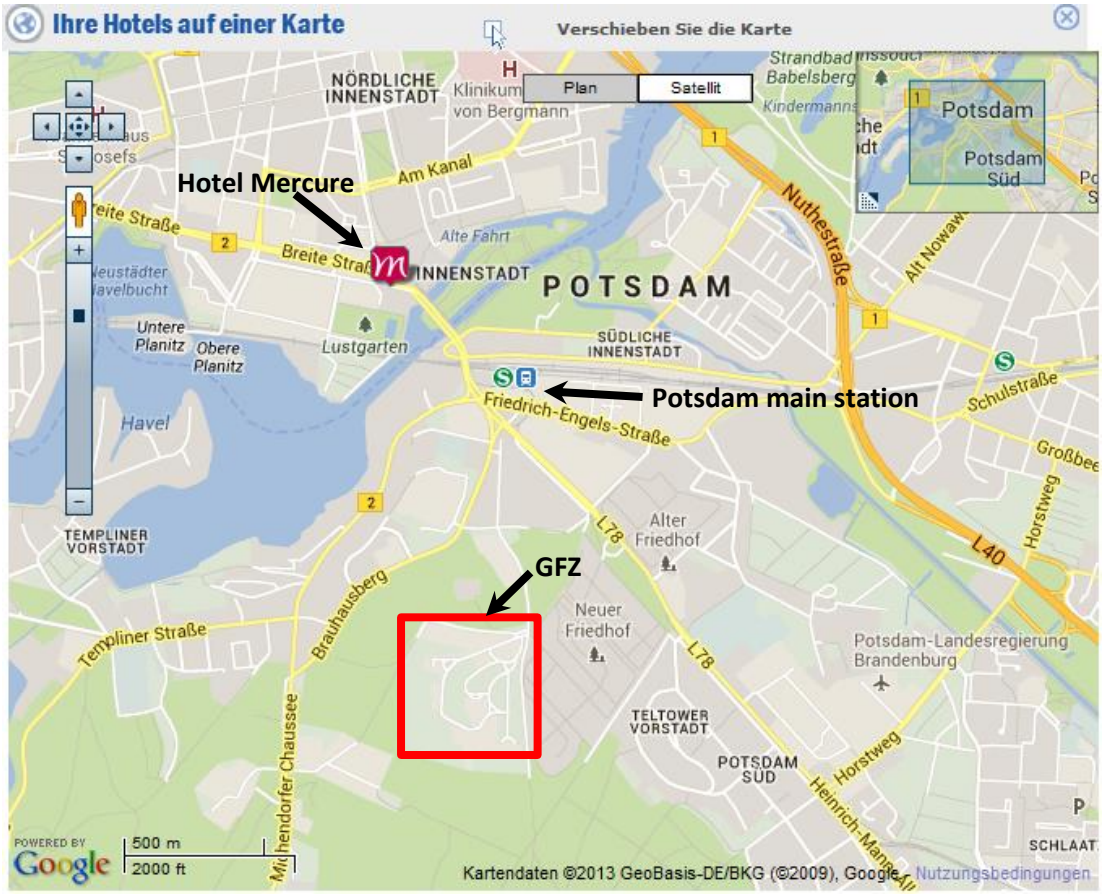

Figure 3: Hotel, GFZ and Potsdam main station plan.

Poster

Each student has to provide an abstract of a poster about their research (max. 500 words). For the summer school the related poster has to be presented.

Guidelines for the poster format:

Size: A0 (1189 x 841 mm)

Layout: Portrait

Style: Your research can be displayed in whatever style you like. Many people will want to produce a standard poster, others may decide to be adventurous and do something different. If you want some ideas Google *research posters*.

Contact Information – School Organizer

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GFZ German Research Centre for Geosciences
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D-14473 Potsdam

Tel.: +49 331 288 1812
Mobile: +49 151 14114333 (for emergencies only)

E-Mail: jamila.beckheinrich@gfz-potsdam.de

Gfg2 Summer School Timetable:

Sunday 30th June 2013: Arrival

16:00 to 18:00	**Registration, Allocation of accommodation**		Beckheinrich

Monday 1th July 2013: Introduction and fundamentals of GNSS remote sensing

09:00	**Welcome** **Background to Gfg2 project/Logistics**		Puig-Centelles Schuh/Wickert/
09:30	**Keynote Speech: GNSS for Earth Observation**		Larson
10:00	**Introduction and overview on GNSS based atmospheric remote sensing**		Elgered/Wickert
11:00	**Break**	Refreshments and posters	
11:30	**Space Geodesy for GNSS remote sensing**		Larson
12:30	**GPS signal structure and how receivers work**		Garrison
13:30	**Lunch**		
14:30	**Satellite orbit determination**		Jäggi
15:30	**Break**		
15:45 to 17.30	**Practical session (four sub-groups in parallel), GNSS Reflectometry, Geocaching at the Telegrafenberg, GNSS web portal soil moisture, GNSS and relativity**		Semmling/Egido/Beckheinrich/ Larson/Ramatschi/Beyerle/Vey
19:00	**Steam boat "Gustav" trip with barbecue**		Beckheinrich

Tuesday 2th July 2013: Techniques of GNSS remote sensing

09:00	**Ground based GNSS meteorology**		Guerova
10:00	**GNSS Water vapor Tomography**		Bender
11:00	**Break**	Refreshments and posters	
11.30	**Space based GNSS data (RO) and climate**		Kirchengast
12.30	**History of GNSS reflectometry**		Martin-Neira
13:30	**Lunch**		
14:30	**GNSS reflectometry for land surface properties**		Larson
15:30	**Break**		
15.45 to 17.00	**Practical session (four sub-groups in parallel), GNSS Reflectometry, Geocaching at the Telegrafenberg, GNSS web portal soil moisture, GNSS and relativity**		Semmling/Egido/Beckheinrich/ Larson/Ramatschi/Beyerle/Vey
18.30	**Dinner, Grill party at GFZ Campus**		

Wednesday 3th July 2013: Applications of GNSS remote sensing

9:00	**Applications of GNSS Reflectometry for remote sensing of Ocean/Ice surfaces and recent satellite missions**		Garrison
10:00	**GNSS and Weather forecast**	Refreshments	Jones
11:00	**Break**		
11:30	**GNSS for Ionosphere and Space Weather research**		Jakowski
12:30	**Lunch**		
14:00	**End of Summer School**		

Practical sessions:

GNSS Reflectometry (Dr. M. Semmling and Dr. A. Egido)

One principal of GPS reflectometry is the observation of an extra path introduced by signal reflection. This path leads to a delay of the reflected signal compared to the direct signal. Internally a dedicated receiver compares direct and reflected signals to provide so-called interferometric observations. Such observations are easier to achieve if separated antennas can be attached to the receiver. One possibility to control separated antennas is the so-called Master-Slave configuration which is used in the current GORS (GNSS Occultation Reflectometry Scatterometry) receiver. We will demonstrate in this practice how different setups of two antennas influence the interferometric observation. Depending on the number of participants individual setups can be tested.

Geocaching at the Telegrafenberg (M. Lange and J. Beckheinrich)

For those interested in the science history of the full of tradition Telegrafenberg campus, we will offer a professional guided tour through GFZ. Of course you have to find the way to the different buildings on your own using GPS.

GNSS Web portal soil moisture (Prof. Dr. K. Larson and Dr. S. Vey)

The group of Prof. Larson at the University of Colorado maintains a web site for water cycle products (snow depth, soil moisture, and vegetation growth index) derived from GPS data collected by geodetic-quality GPS receivers (http://xenon.colorado.edu/portal). She will describe how to produce and access these products and ancillary data (for terrain, precipitation, temperature), and other snow, soil moisture, and vegetation products. She will also briefly discuss how to validate these products.

GNSS and relativity (Dr. G. Beyerle)

Precise navigation and time transfer applications using the Global Positioning System (GPS) not only necessitate the availability of accurate atomic clocks, but also require an understanding of the fundamental principles of Einstein's theories of special and general relativity. Relativistic corrections are an important ingredient in the derivation of receiver positions from GPS pseudorange and carrier phase measurements.
In a simple experimental set-up the general relativistic effects on the GPS system are illustrated. Pseudorange observations from a JAVAD GeNeSiS receiver are processed in real time using two different methods: the first position estimate follows from the standard procedure, the second solution specifically neglects the general relativistic corrections. Both results, together with their temporal evolution, are superimposed on a digital map of the measurement site and displayed on screen in real time.

References:
Neil Ashby, Relativity in the Global Positioning System, Living Rev. Relativity, 6 (1) 2003 (www.livingreviews.org/lrr-2003-1)
Each group should not exceed a maximum of 10-15 persons.

Speakers:

Dr. Michael Bender

Michael Bender received the diploma in physics from the University of Hamburg, Germany, and the Ph. D. degree in physics from the University of Leipzig, Germany, in 2001. His main subjects include GNSS remote sensing of the atmosphere and tomography. His current research is the spatial monitoring of the tropospheric water vapor distribution by means of GNSS tomography and the assimilation of GNSS observations into numerical weather models.

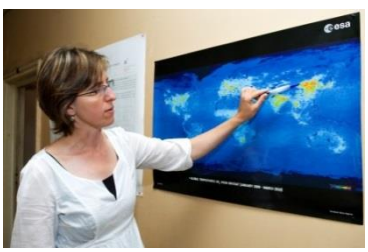
Prof. Gunnar Elgered

Professor Gunnar Elgered was born in Götene, Sweden, in 1955. He received the M.S.E.E and Ph.D. degrees from Chalmers University of Technology, Gothenburg, Sweden, in 1977 and 1983, respectively. The thesis was: "Water Vapor Radiometry with Applications to Radio Interferometry and Meteorology". Thereafter the research has continued with a focus on remote sensing of the atmosphere using space geodetic techniques and microwave radiometry. He has had several international assignments. For example: Chairman IAG Special Study Group 1.128: The Wet Propagation Delay (1991–1995) and Chairman of the COST Action 716—“Exploitation of Ground-Based GPS for Climate and Numerical Weather Prediction Applications” (1998–2004). Since 2001 he is professor in electrical measurements, and chairs the Department of Earth and Space Sciences at Chalmers. He teaches two undergraduate courses in "Engineering Measurements". Starting in 2013 he is member of the GNSS Science Advisory Council of ESA and one of two Swedish delegates in the COST Action ES1206—“Advanced Global Navigation Satellite Systems tropospheric products for monitoring severe weather events and climate (GNSS4SWEC)”.

Prof. James L. Garrison

Professor Dr. Garrison's interests lie in the utilization of Global Navigation Satellite Systems (GNSS), with an emphasis on improving the robustness of GNSS navigation and developing new applications of GNSS to the field of Earth remote sensing. At the present time, his research has three principal directions: First, the extraction of useful geophysical data from reflected GNSS signals. Second, improving the sensitivity of GNSS receivers to very weak or degraded signals. Third, the detection of ionospheric waves using large GNSS arrays.

Dr. Guergana Guerova



Dr. Guergana Guerova is a Marie Curie Fellow at the Department of Meteorology and Geophysics of Sofia University, Sofia, Bulgaria. Qualified meteorologist, Guergana is working in the field of ground-based GNSS Meteorology since 2000. In 2003, she received a PhD in Applied Physics from University of Bern, Bern, Switzerland. In the period 2004-

2009, Guergana worked as a post-doctoral fellow in the Swiss Federal Institute of Technology, Lausanne, Switzerland and University of Wollongong, Wollongong, Australia. She is currently leading a project titled: "Exploitation of ground-based Global Navigation Satellite Systems (GNSS) for Meteorology and Climate studies in Bulgaria/Southeast Europe" (http://suada.phys.uni-sofia.bg/?page_id=185).
Personal homepage: http://suada.phys.uni-sofia.bg/?page_id=196

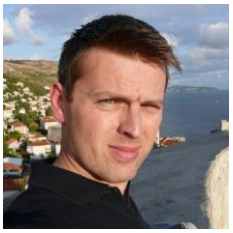
Dr. Norbert Jakowski

Dr. Norbert Jakowski received his diploma in physics in 1973 from the University of Rostock and was awarded a PhD in 1974 from the same university. Since 1974 he has been working in the Institute of Space Research, since 1991 in the German Aerospace Center at their branch in Neustrelitz. In the Institute of Communications and Navigation he is team leader of the ionospheric working group. He was/is involved in several national as well as ESA and EC projects related to ionospheric research, monitoring and modeling and the investigation of ionospheric impact on GNSS applications. He is national representative of the steering committee of the Space Weather Working Team and the 'Network of Experts on Electromagnetic Wave Propagation' at ESA.

Prof. Adrian Jäggi

Professor Dr. Adrian Jäggi received his diploma in astronomy in 2001 from the University of Bern and was awarded a PhD in 2006 from the same university. In the period 2007-2009, Jäggi worked as a Carl von Linde Junior Fellow at the Institute for Advanced Study of the Technical University of Munich. From 2009-2011 he worked as a senior research scientist at the Astronomical Institute of the University of Bern, where he became the Director of the institute in 2012. Jäggi's main research interests are precise orbit determination of low Earth orbiting satellites and the recovery of the Earth's gravity field using space geodetic data.

Dr. Jonathan Jones



Jonathan Jones holds a PhD from the Nottingham Geospatial Institute (formerly the Institute of Engineering, Surveying and Space Geodesy) at the University of Nottingham, and also holds a BSc (Hons) in Environmental Geoscience from Cardiff University. Actually he is head of Global Navigation Satellite System meteorology research and development work for the Met Office. He is working for the Met Office for over 10-years developing his GNSS expertise incorporating a strong blend of academic, commercial and cross government understanding through current and previous partnerships. Jonathan has both technical and GNSS processing expertise and has successfully delivered the operational GNSS-meteorology project and product management as well as partner channel expansion for the Met Office.

Prof. Gottfried Kirchengast

Professor Gottfried Kirchengast, born 1965 in Austria, studied physics, geophysics and meteorology at the University of Graz, Austria. Since 1996 he is head of the Atmospheric Remote Sensing and Climate System Research Group, which he founded, 1998 he received the prestigious START research prize (1.1 Mio. Euro research funds granted by an international jury, complemented later by many further prizes and awards), and 2002 he became lead investigator of a European climate satellite mission. In parallel he spent many research stays at German and U.S. universities and research institutions as well as many short-term visits worldwide.
In 2003 Kirchengast was appointed full professor at the University of Graz Geophysics Chair (Alfred Wegener's Chair, originally held by Alfred Wegener, 1924-1930) and since 2005 he is Director of the interdisciplinary Wegener Center for Climate and Global Change, which he initiated, at the University of Graz (www.wegcenter.at). Based on his merits he became in 2008 member and in 2011 lifetime member of the Austrian Academy of Sciences. In 2012 he received the top research prize of the State of Styria/Austria and was appointed adjunct professor at the Royal Melbourne Institute of Technology (RMIT) in Australia.
Kirchengast is author or co-author of more than 85 peer-reviewed (ISI) articles and more than 170 further scientific articles and reports as well as of several books. Furthermore supervisor of more than 25 PhD graduates, who he guided in their work and many of whom are successful also in international careers. In addition he is a leading or advisory member of many Earth observation and climate-related national and international bodies, projects, and initiatives.
(More information: www.uni-graz.at/gottfried.kirchengast)

Prof. Kristine M. Larson:

Professor Kristine M. Larson received her A.B. in Engineering Sciences from Harvard University and her Ph.D. in Geophysics from the Scripps Institution of Oceanography. She is currently a Professor of Aerospace Engineering Sciences at the University of Colorado, Boulder. Dr. Larson's research focuses on using high-precision GPS for both science and engineering, from measuring plate motion, volcanic inflation, and slow slip to developing new applications such as GPS seismology, soil moisture sensing, and snow depth monitoring. She currently leads the PBO H2O initiative, that produces water cycle products from the PBO network, http://xenon.colorado.edu/portal.

Dr. Manuel Martin-Neira

Manuel Martín-Neira received the M.S. and Ph.D. degrees in telecommunication engineering in 1986 and 1996 respectively from the School of Telecommunication Engineering, Polytechnic University of Catalonia, Spain. In 1988, he was awarded a fellowship to work on microwave radiometry at ESA (European Space Agency), in The Netherlands. From 1989 to 1992 he joined GMV, a Spanish firm, as responsible for several projects on GPS spacecraft precise navigation and

attitude determination. Since 1992, with ESA, in charge of the radiometer activities within the Payload, Equipment and Technology Section. He has developed new concepts for constellations of small satellites for Earth Observation. In particular he holds several patents related to aperture synthesis radiometry and on the use of GNSS signals reflected from the ocean (PARIS concept). He received the Confirmed Inventor Award from ESA in 2002, the Salva i Campillo Award and the Premio Jaime I in 2010 from Spain and a Certificate of Recognition for the SMOS mission in 2011 from IEEE. He is member of the Academie des Technologies of France. Since 2001 he is the Instrument Principal Engineer of ESA's Soil Moisture and Ocean Salinity (SMOS) mission.

Anna Puig-Centelles

Anna Puig-Centelles got her Degree in Computer Science in 2004 from the Universitat Jaume I (Castellon, Spain) and the M.Sc. from the Vrije Universiteit (Amsterdam, The Netherlands). In 2005 she researched not only at the Universitat Jaume I but also at the Universidad Rey Juan Carlos (Madrid, Spain) and at the Université de Limoges (Limoges, France). She obtained her European Ph.D. in 2010. After completing her thesis, she started working as senior research technician and project manager.

Prof. Harald Schuh

Professor Harald Schuh received his received the Diploma/M.S. and Ph.D. degrees in Geodesy in 1979 and 1986 respectively from the University of Bonn. From 1987 to 1988, he worked as an associate professor at the Geodetic Institute of the University of Bonn. From 1989 to 1995 he joined the German Air and Space Agency (DLR) in Cologne as Coordinator for research programs of the EC. From 1995 to 2000, he was the head of Department "Earth Rotation" of the German Geodetic Research Institute (DGFI) in Munich. From 2000 to 2012 he was professor for high geodesy at the University of Technology Vienna in Austria. Since 2012 he is the Director of Dept. 1 "Geodesy and Remote Sensing" at GFZ Deutsches GeoForschungsZentrum Helmholtz and professor for "Satellite Geodesy" at Technische Universität Berlin (TU Berlin). In addition he is vice-president of the International Association of Geodesy (IAG) and chair of the International VLBI Service for Geodesy and Astrometry (IVS).

Dr. Jens Wickert

Jens Wickert received his Diploma/M.Sc. in Physics 1989 from the University of Dresden and his PhD degree from the Karl-Franzens-University Graz in 2002. Since 1999 he is with GFZ and since 2002 the responsible scientist for GNSS remote sensing. Dr. Wickert is involved in numerous national and international research projects of various funding sources and satellite missions predominantly in a leading position. Only few examples are CHAMP (German geosciences satellite mission, PI radio occultation, RO), NRT-RO (International project stimulating the use of RO data for operational weather forecasts, PI), GEROS-ISS (Chair of

the science advisory group, ESA GNSS remote sensing mission). He also is the GFZ scientific responsible of the Helmholtz research program Atmosphere and Climate and currently also works as deputy head of the GPS/Galileo Earth Observation section. Dr. Wickert is currently author/co-author of around 110 ISI listed publications and received several research awards, e.g., the PECORA- and Wernher-von-Braun-Award, as member of the CHAMP/GRACE teams. His major professional ambition is to maximize the spectrum of GNSS applications and to increase the user community for Earth Observation and Geosciences in view of a strong interdisciplinary scientific background. More information is available here: www.jenswickert.de

Getting to the GFZ Potsdam (see also www.gfz-potsdam.de):

The Helmholtz Centre Potsdam **GFZ German Research Centre for Geosciences** has a good connection to the railway service and to the international airports of Berlin. From Berlin there is an easy access by public transport. From the Potsdam-main station you can walk in 15 Minutes to the Campus "Albert Einstein".

By Plane

From **Tegel Airport (TXL)** take Bus X9 to Bahnhof Zoo, change to S-Bahn S7, for Potsdam-Hauptbahnhof

From **Schönefeld Airport (SXF)** take the S-Bahn in direction Westkreuz until station Schöneberg, there change to S1 for Wannsee, change there to S7 for Potsdam-Hauptbahnhof.

By Train

Take the Railway or Berlins local trains called S-Bahn to Potsdam-Hauptbahnhof.

By Car

From **Berlin** take **B1** from Berlin-Wannsee or the motorway "Autobahn" **A115** to Hannover/Leipzig, Exit Potsdam-Babelsberg; follow the signs to "Zentrum" or "Landtag" and "GeoForschungsZentrum".

From **Hannover** or **Leipzig** on motorway "Autobahn **A110/E30**", take exit "Potsdam-Süd/Michendorf" to Potsdam follow the B2 northbound, turn right at "Am Brauhausberg" till "Albert-Einstein-Straße".

From **Hamburg** or **Rostock** on motorway "**A10/E55**", take exit "Marquardt" to Potsdam along **B273**, follow in Potsdam the signs to "Zentrum" and "Landtag" to "Albert-Einstein-Straße".

Instructions for users of satellite car navigation

When driving to the Science Campus “Albert Einstein” via satellite navigation, please use “Albert-Einstein-Strasse, 14473 Potsdam” as address and follow it uphill to its end.

Figure 4: Plan of the surroundings of Berlin.

From Potsdam Central Station to the GFZ:

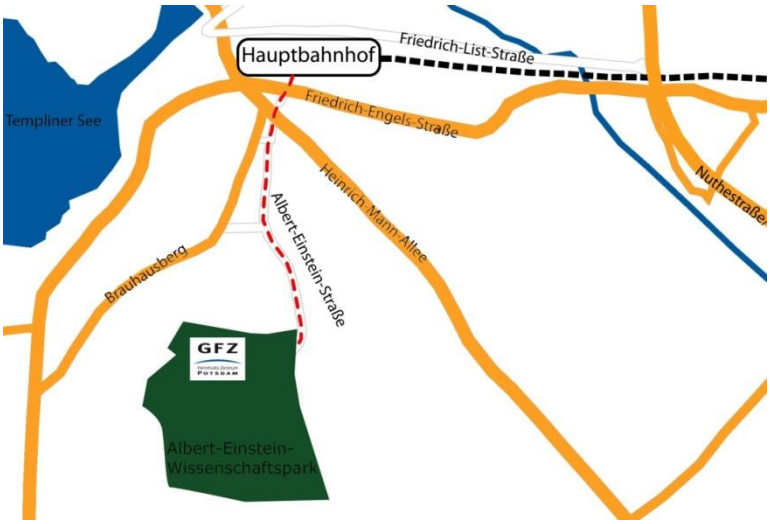


Figure 5: Path on foot from the Central Station Potsdam to the GFZ

By Foot:

Keep south, cross Friedrich-Engels-Str. and Heinrich-Mann-Allee continue uphill along Brauhausberg follow Albert-Einstein-Straße to its end; approximate duration: 15 minutes. Taxi takes approximately 10 minutes.

By Bus:

Take the bus **691** directly to the "Albert Einstein - Wissenschaftspark"