Issue 2023/1

CRC 1502
DETECT

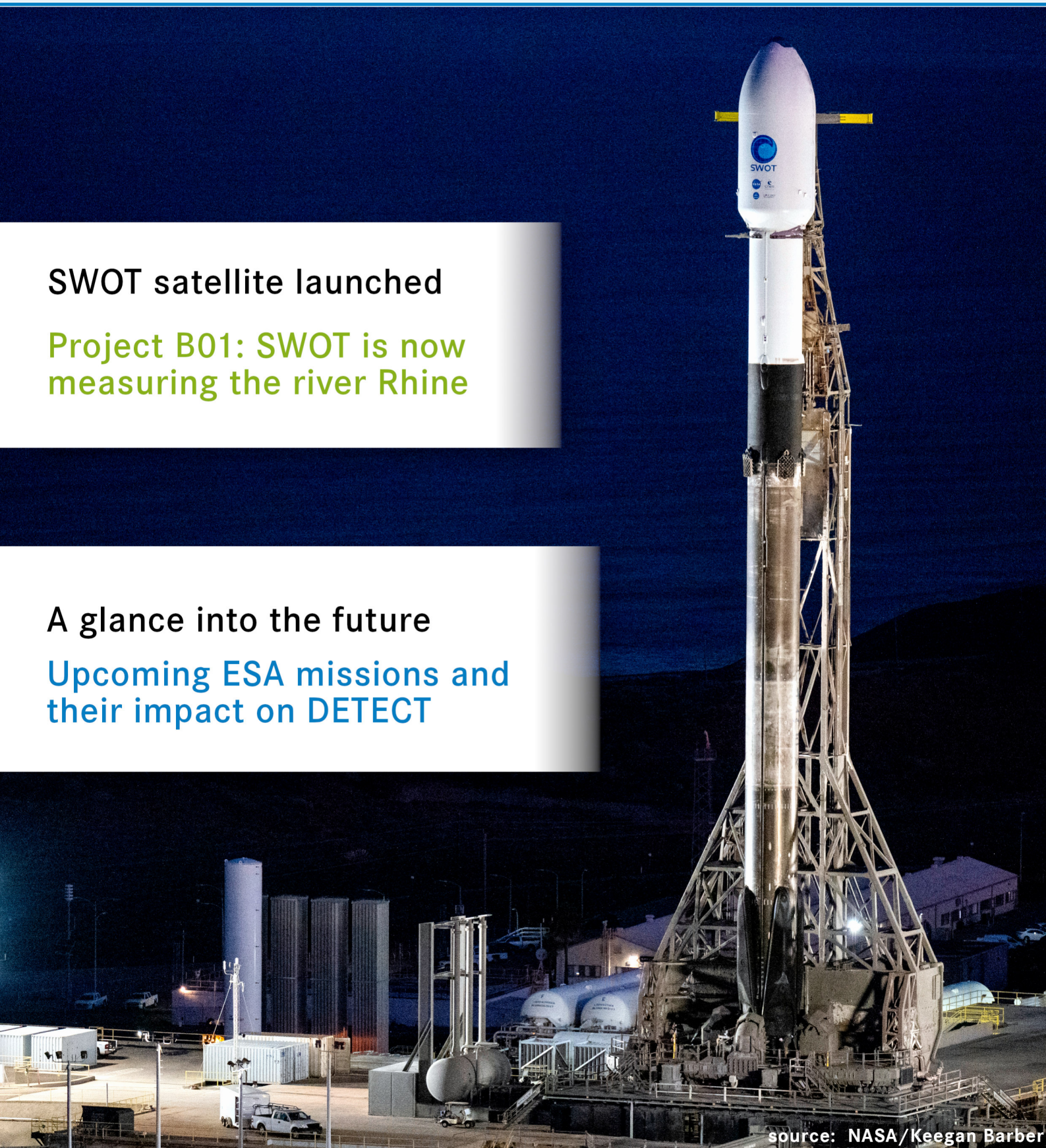
Newsletter

SWOT satellite launched

Project B01: SWOT is now measuring the river Rhine

A glance into the future

Upcoming ESA missions and their impact on DETECT



source: NASA/Keegan Barber

Welcome to the second productive CRC DETECT year!

A warm welcome to 2023, the second year of challenges and fruitful teamwork in DETECT! First project results were presented during our first status meeting on December 21. Building on these results we are now looking forward to further insights and innovative papers!

As part of the measurement campaign in project B01, GNSS IR instruments for interferometric reflectometry and micro stations are currently being installed along the Rhine River. Water surface elevation measured by these instruments, and data from available gauges, will be used to estimate water level slope and discharge. This measurement campaign also supports the cal/val activities for the Surface Water and Ocean Topography (SWOT) satellite mission successfully launched on December 16. Project B01's PI Luciana Fenoglio attended the launch. In this issue she reports from this event and explains the expected benefits of the SWOT mission for project B01.

The ESA Ministerial Council decided on November 23 that the TRUTHS, HARMONY, MAGIC and GENESIS mission proposals will move forward. The tasks of these missions and the potential benefits for DETECT are explained in this issue.

In our interview, this time Amirhossein Nikfal introduces himself. Amir was elected Postdoc-Representative by the DETECT Assembly in autumn. He works for the central 'Data infrastructure and services project' Z03.

Finally, our official DETECT website https://sfb1502.de is now online. Step by step, we will further develop and update the website. Furthermore, we will soon include an internal, non-public area to support the scientific projects and for administrative process explanations. Please visit the website, submit your project descriptions and provide feedback!

Enjoy reading!

Sincerely,

Jürgen Kusche
DETECT'S Speaker

Harry Vereecken
DETECT'S Co-Speaker

Silke Hüttel
DETECT'S Co-Speaker

Frank Siegismund
DETECT'S Scientific Coordinator

After its successful launch, the SWOT satellite measures water level and discharge of the river Rhine for 100 sec every day

by Luciana Fenoglio

I have attended the launch of Surface Water and Ocean Topography (SWOT) from Vandenberg Space Force Base (VSFB). The launch, on a SpaceX Falcon 9 rocket, was first targeted on Monday, December 12, 2022 in the early morning hours and finally happened on Friday, December 16. My invitation came after three years of membership in the Early Adopters (EA) group and two years in the SWOT Science Team and just before the exploitation of real SWOT data, which makes this experience unique.

A mini-symposium, organised in Buellton (CA) on December 14 (see Figure below), was followed by a guest briefing on science and application by the SWOT science leads. The following guest reception was interrupted by the announcement that the launch was postponed from the 15th to the 16th, which reduced the enthusiasm on that evening. The following day, on December 16, a bus picked us up at 1:45 am to reach VSFB at 2:15. At 3:46 - perfectly in time - SWOT was launched.

Designed to make the first-ever global survey of Earth's surface water, the Surface Water and Ocean Topography, or SWOT satellite, will collect detailed measurements of how water bodies on Earth change over time. Oceanography and Hydrology are the two primary goals. The satellite will survey at least 90 percent of the globe, studying Earth's lakes, rivers, reservoirs and oceans at least twice every 21 days to improve ocean circulation models and weather and climate predictions as well as aid in freshwater management around the world.

SWOT launch on a SpaceX Falcon 9 rocket

source: NASA/Keegan Barber

Participants to the mini-symposium on SWOT science and application on 15 December 2022, with science leads of oceanography, hydrology and coastal zone

source: Luciana Fenoglio

In CRC 1502 DETECT, the SWOT mission is relevant for Project B01. The first scientific goal is to understand the complex error pattern of the new sensor instrument. This knowledge will also be important for the assimilation of the SWOT data in the later phases of the CRC. Second scientific goal is to explore algorithms to derive, in connection with analytical and numerical modelling, river discharge from – first time – detailed measurements of the uneven topography of a river surface from space.

After launch the operations teams are steadily working to conduct the Launch and Early Operations Phase (LEOP) of the project. The overall plan is to start the payload turn-on during the first three weeks of January 2023. In the calibration phase of the SWOT mission, the reference satellite track will pass for 3 months once a day over the Rhine River and the German coast, which represents a unique research opportunity. B01 plans to collaborate with the calibration/validation (cal/val) SWOT teams and with the Bundesanstalt für Gewässerkunde (BfG, Germany's Federal Institute of Hydrography in Koblenz). Within January we plan to install instruments on four bridges on the Rhine and GNSS low-cost instruments for the calibration campaign. A new report will follow.

SWOT fairing decal with fixtures in place

source: NASA/USSF 30th Space Wing/Steve Gerli

SWOT in orbit (illustration)

source: NASA

Future ESA missions

by Stephanie Fiedler, Jürgen Kusche, Bibi Naz, und Anne Springer

At the ESA Ministerial Council held in Paris on 22/23 November 2022, government ministers representing ESA's Member States backed four Earth observation satellite missions that will significantly benefit the research in DETECT in future phases: the TRUTHS, HARMONY, MAGIC and GENESIS missions.

HARMONY (previously known as STEREOID, Stereo Thermo-optically Enhanced Radar for solid Earth, Oceans and Ice Dynamics) will be launched in 2029 as ESA's Earth Explorer 10 Mission, and will provide high resolution simultaneous measurements of small shifts in the shape of the land surface related to earthquakes, volcanic activity, glacier flows and surface height changes.

This is achieved through flying two companion satellites in loose convoy with the Sentinel-1 spacecraft, consisting of a passive synthetic-aperture radar and a multi-view thermal-infrared instrument. In cold regions, HARMONY will deliver, over the coming decades, globally consistent and highly resolved views of multi-annual glacier volume changes at sub-km resolution. It will also allow, for the first time, to study the seasonal and sub-seasonal changes in glacier flow processes from space by measuring variations in lateral ice flow and associated elevation changes simultaneously over large areas. This will be useful for the analysis of changes in snow/ice mass impacted by climate change and for a better understanding of sea-level rise.

Within DETECT, long-term, high-resolution snow/ice mass changes from HARMONY will contribute to bridging an observational gap to improve our understanding of the physical processes causing the widespread changes of the cryosphere. It would be of high value for not only improving the representation of cold region processes in the land surface models through model calibration and validation, but also for improving these processes through data assimilation. This will ensure improved and continuous (in space and time) estimates of snow/ice mass changes over large scales, needed to better quantify climatic response of cryosphere changes and their complex interactions with sea and atmosphere.

ESA's TRUTHS (Traceable Radiometry Underpinning Terrestrial- and Helio-Studies) mission aims at measuring the irradiance that Earth receives from the Sun, and the radiation from Earth into space. The combination of these two measurements allows to monitor the radiation budget that governs the climate of our planet.

TRUTHS: a standards laboratory in space

source: ESA

The novelty of ESA's endeavour is their goal to set a gold standard for the precision of these measurements through a calibration system for the instruments operated on board of the satellite. Measurements from TRUTHS therefore open the door for calibrating other observations and models.

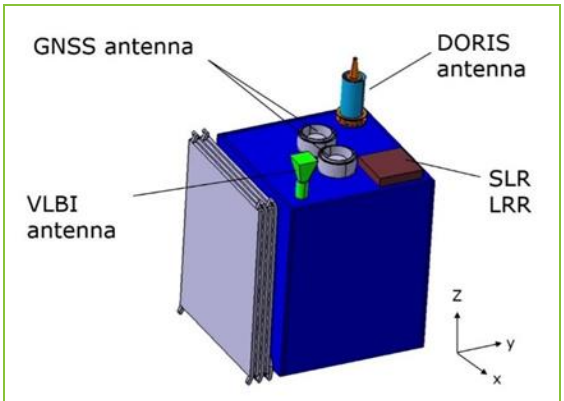
Monitoring the radiation fluxes is essential to characterise Earth's changing climate and to evaluate to what extent actions to mitigate climate change are effective. Not at last these measurements will be useful to evaluate and further improve climate model simulations. It makes data from the TRUTHS mission also attractive for the next phases of DETECT, with the evaluation of radiation in the next-generation climate models by B02 being just one example.

ESA approved also the MAGIC (Mass change And Geosciences International Constellation) mission – a gravimetry mission that will continue the outstanding records of GRACE and GRACE-FO. This implies long-term information about mass changes in hydrosphere, atmosphere, biosphere, oceans, and mass variations inside the Earth. Compared to previous gravity missions, the temporal (down to 3 days) and spatial resolution (about 100 km) will be increased.

Like for the GRACE missions, main observable of MAGIC will be the variation of the distance between two satellites, which are chasing each other; measured by a laser interferometer with nanometer precision. Ultra-sensitive accelerometers will observe non-gravitational signals for corrections to the measured ranges. So far, the preferred satellite constellation comprises one satellite pair in a near-polar and another in an inclined circular orbit. MAGIC will be of high relevance for DETECT in various aspects: the mission will provide total water mass changes also at sub-monthly time scales and, thus, can be suitable also for near-real time applications.

It will be possible to resolve also smaller river basins, which implies a great asset also for flood and drought monitoring. Together with the GRACE and GRACE-FO records a long time series of continental water storage variability will be created, which is highly relevant for investigating climate change. For regional high-resolution hydrological and Earth system models, MAGIC will be a valuable tool for validation and calibration, and will improve these models through data assimilation.

The GENESIS mission will target a global reference system with unprecedented accuracy and stability, so as to be able to detect the smallest variations in the Earth system components.



Geodetic payloads on GENESIS satellite

source: ESA

Based on ESA's heritage and expertise in developing Galileo and EGNOS (European Geostationary Navigation Overlay Service) for the European Commission, via its FutureNAV programme the agency responds to the future needs of satellite positioning, navigation and timing.

Within this framework, GENESIS will, for the first time, combine all space-geodetic techniques (satellite laser ranging, Doppler-based 'DORIS' radio positioning, Very Long Baseline Interferometry VLBI, as well as GNSS) on a single space platform, and in this way will allow to much better constrain systematic errors and enable the realization of a highly precise reference frame. GENESIS will, put in simple words, serve to improve the accuracy and/or resolution of many other EO missions including MAGIC and HARMONY and thus potentially enable new science in later phases of DETECT.

Notes from the DETECT coordination office

Minutes and Presentations from DETECT Meetings available on sciebo

To foster the scientific project work within DETECT, many meetings have already been held and many more will follow. During the cross-cluster-meetings we agreed on the EURO-CORDEX region for the model integrations and developed specifications on coordinate systems and data formats.

To maximize the benefit from these meetings, presentations and, whenever project-overarching important decisions are taken, the minutes of these meetings will be stored in our sciebo project box. In this way, everyone is able to either review the meeting results or, for those not able to attend the meeting, inform themselves about outcomes and whom to contact for questions.

The files are stored in folder ...> CRC1502 Community > Meetings. So far, all .pdf-files of all past meetings are available in the 2022 subfolder. If, for any 2022 meeting, your presentation is still missing, please upload the corresponding pdf!

Administrative process for requesting and accounting for central travel funds

The update of the relevant application process and on how to claim for reimbursement of travel expenses has been stored in folder ...> CRC1502 Community > Travel Regulations

For any further questions on travel funds and the reimbursement of travel expenses, please contact Dorothee Berkle-Müller at the DETECT Coordination Office.

The interior design and technical equipment of the DETECT building is progressing

Step by step, the decorative and technical equipment of our DETECT building is progressing.

Furthermore, we are happy to announce that WiFi is now also available in the DETECT building.

source: Dorothee K. Berkle-Müller

DETECT scientists

Interview with PostDoc Amir H. Nikfal, working for the Z03 project at DETECT

Amir, what attracts you to work in DETECT?

My last job as a climate scientist, was to manage a workflow, consisting of an atmospheric model, and an energy balance model, to derive some agrometeorological variables, such as evapotranspiration and biomass growth. This workflow demanded lots of input and output data, such as atmospheric global forecast data to run the model, satellite data, as well as soil and elevation data. Various data formats are processed through this workflow, such as NetCDF, GeoTIFF, Shapefiles, etc.

Since DETECT (Z03) project deals with data management tasks, I think it is perfectly in line with my past experience. Moreover, I perceive DETECT project as a valuable opportunity to make new collaborations and learn new techniques.

What do you see as the big challenge of the CRC?

I think, since the number of collaborators in the DETECT project is quite high, it might be a challenge to organize and coordinate the work of the whole team and collaborators. However, by holding regular meetings, this challenge is not much likely to affect the project's outcome.

And what do you see as your personal challenge in your role in DETECT?

As a matter of fact, I've always welcomed the challenges I face in my work, since coping with them leads to new insights and learning new skills. However, considering that data management is a vulnerable task, and many (if not all) collaborators need to get access to and work with the data, I will try not to let these challenges affect other collaborator's performance and outcomes.

About Amirhossein Nikfal

Amir H. Nikfal is a meteorologist who has been working in the fields of atmospheric modeling, climate data, and workflow management for climate applications. He was educated in Iran.

His last institute before joining the DETECT project was Atmospheric Science and Meteorological Research Center in Tehran.

Announcements – save the date!

Activities within DETECT

IRTG Lecture Series

To introduce the PhD students to interdisciplinary science conducted in the CRC, a lecture series is held twice a year. The series addresses the different disciplines in an introductory fashion, including concepts and techniques relevant for research in modelling and observation of the water cycle, as well as of the land surface and its use, also beyond what is applied in current CRC projects.

The number of participants for specific courses might be limited. Anyone interested to participate in a specific course has to check admission with the responsible lecturer listed in the table of lectures below.

14. Feb.	8:00-11:00	Frank Ewert: **'Crop modelling'**
14. Mar.	8:00-11:00	Jürgen Gall: **'Machine learning'**
14. Mar.	13:00-16:00	Stephanie Fiedler: **'Global climate model simulations'**
18. Apr.	8:00-11:00	Jan Vanderborght: **'Soil physics'**
18. Apr.	13:00-16:00	Jan Börner: **'Land use and environmental policies'**

DETECT Land & Climate Seminar

Mondays at 10:15 (zoom-link)

30. Jan.	Heike Schimmel, Wulf Amelung: **'Ecosystem parameterization'**
3. Apr.	Bernd Schalge, Jan Keller: **'Development, generation, and evaluation of regional reanalyses'**
17. Apr.	Theresa Göbel, Wolfgang Britz: **'Scenario development'**

30 May – 01 Jun.

DETECT Retreat

The DETECT plenary retreat is planned as a two-day event (half day/full day/half day) and will take place at the Hotel Schützenhof in Eitorf. The agenda is scheduled to be composed of scientific exchange (project developments, networking, synergies, general science topics etc.) and team building measures.

Further information on registration, venue and agenda-planning will be provided in due time.

21 Jun., 9:00

General Assembly 2023

The agenda will follow in due time.

30 Nov. all day

Status-Meeting 2023

The agenda will follow in due time.

Dates already earmarked for 2024:

Please enter in your calendar!

21-23 May 2024

Retreat including General Assembly

28 Nov 2024

Status meeting 2024

Other announcements

1-2 Feb.

Geoverbund ABC/J Expert Talk

"Land surface models (LSMs): current trends, future needs and opportunities"

This workshop brings together experts on land surface modelling and discusses the current LSMs and development, their limitations and the resulting needs for future development.

Please check here.

3 Feb., 15:30-16:30

CESOC Seminar Series

“My research”

Prof. Dr. Jürgen Gall, Department of Information Systems and Artificial Intelligence, University of Bonn:

“Analyzing Temporal Visual Data”

CESOC continues the seminar series “My research” Fridays at 3:30 pm in which members of CESOC will give a talk on their research and are happy to answer questions afterwards in a short discussion.

It will be held via Zoom and is open to any interested person within the CESOC research disciplines (any Earth system sciences, mathematics or computer science). Please contact info@cesoc.net, if you would like to participate.

Place: Zoom

23-24 Feb.

Courses at Jülich Supercomputing Centre (JSC)

ESM User Forum training course of JSC, which will take place as an online event. The forum will comprise presentations on actual developments towards exascale Earth System Modeling as well as ESM related information from JSC. Most topics are centered around the activities described in the Helmholtz Joint Lab ExaESM.

You can find all information on the ESM User Forum including an agenda and registration form here.

The course provides an overview of current developments at JSC related to the JUWELS system and gives users from the Helmholtz Joint Lab ExaESM the opportunity to discuss their specific developments, issues and challenges. While it addresses directly users of the JUWELS ESM partition, it is open to whoever is interested in Earth System Modelling. We’ll also reach out to novel projects dealing with exascale applications in geosciences.

Recent and Upcoming Events

23-28 April 2023

EGU General Assembly

The EGU General Assembly 2023 brings together geoscientists from all over the world to one meeting covering all disciplines of the Earth, planetary, and space sciences. The EGU aims to provide a forum where scientists, especially early career researchers, can present their work and discuss their ideas with experts in all fields of geoscience.

More info here.

11-20 July 2023

IUGG 28th General Assembly of IUGG

Deadline of Abstract Submission: 14th of February 2023

The 28th IUGG General Assembly will be held 11-20 July 2023 at the Messe Berlin – City Cube, Berlin, Germany. This is a special opportunity for participants from around the world to come together and share their science and culture. Join us for a host of scientific activities, including special public lectures, keynote Union lectures and a wide variety of themed sessions.

More info here.

23-27 October 2023

WCRP Open Science Conference 2023

Every decade the World Climate Research Programme (WCRP) brings together communities from around the world to showcase recent and significant advances in climate science, identify gaps and opportunities, and jointly develop future plans.

The next WCRP Open Science Conference, focusing on “Advancing climate science for a sustainable future”, will be held in Kigali (Rwanda) and online on 23-27 October 2023, with the major goal of bridging science and society.

More info here.

Congratulations

Harry Vereecken has been awarded this year’s Alfred Wegener Medal he will receive from the European Geophysical Union (EGU) during its General Assembly, which will be held from 23–28 April.

Link FZ Jülich IBG-3

Congrats Harry!

Frank Ewert, Wulf Amelung and Stefan Siebert belong to the highly cited researchers in 2022!

Link Uni Bonn

Link Uni Göttigen

Congrats Frank, Wulf and Stefan!

With his Raspberry Pi system, Makan Karegar (B01) has won a price at the ideas competition Enacom.

Link myscience.de

Congrats Makan!

Publications

...will soon be published on our website

https://sfb1502.de

Impressum

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