Karlsruhe Institute of Technology

Climate and Environment news

NEWSLETTER OF THE KIT CLIMATE AND ENVIRONMENT CENTER

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Dear Readers!

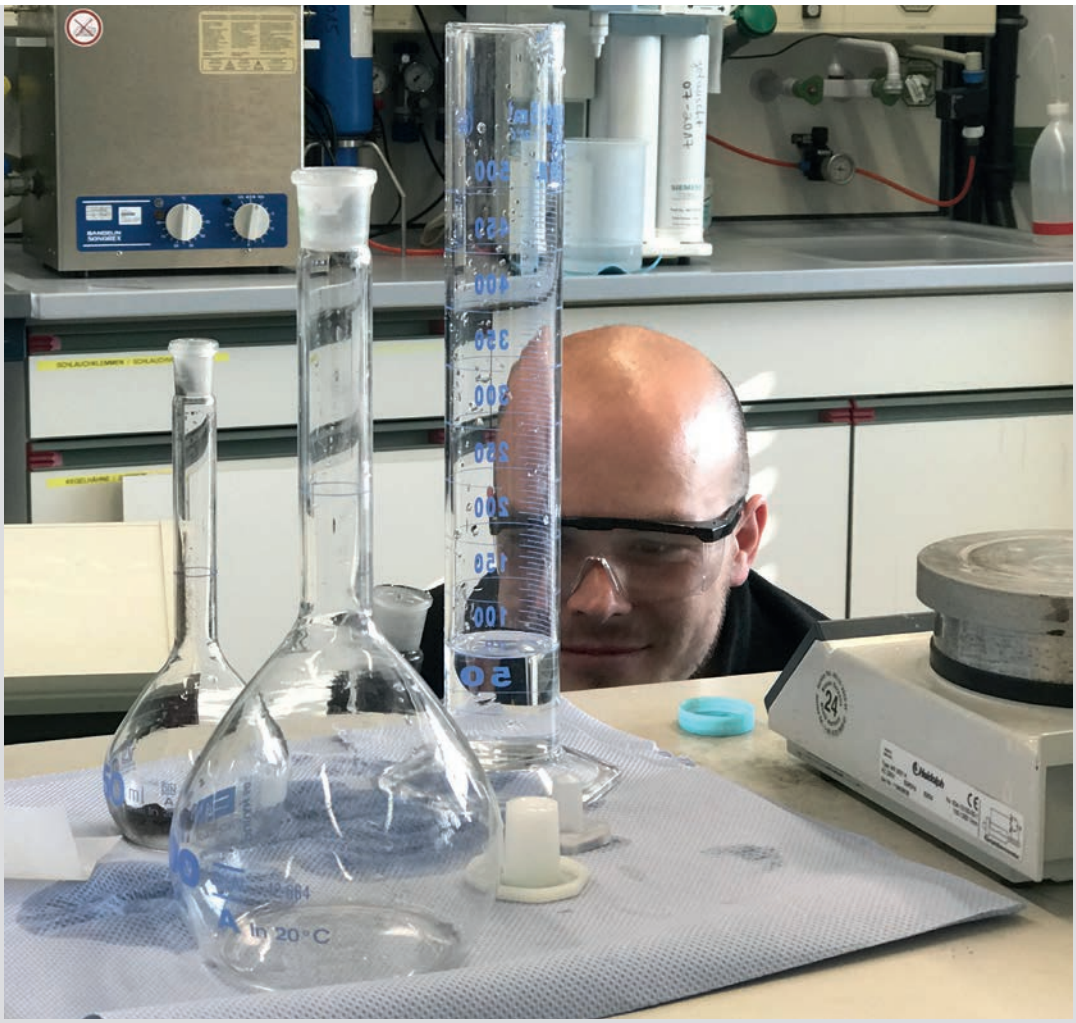
It was a hot summer. Heat and drought, the war in Ukraine, and rising costs for gas and electricity have been making people feel concerned and worried.

Germany is facing difficult tasks. We need sufficient energy for the economy and for the population and at the same time want to do without nuclear power and coal-fired power plants. Sustainable solutions are needed to master this balancing act. And science plays a crucial role in finding such solutions. The KIT Climate and Environment Center is facing up to these tasks and is ready to offer technological and nature-based solutions. Our cover story on pages 4–5 summarizes for you one approach that is currently being investigated at KIT: The extraction of lithium – white gold – from deep water, an environmentally friendly alternative to current extraction methods that can cause major environmental damage. Also, as you read the newsletter, you will learn what needs to be considered to achieve climate neutrality in the building sector, and you will be informed about ongoing discussions on downsides of energy extraction methods, for example emissions from wood stoves and impacts of wind turbines on their surroundings.

The environment and climate are highly complex systems that react to changes with varying degrees of sensitivity. Every cog in these systems is important. Researchers from all over the world are now called upon to keep an eye on the big picture and – despite the urgency required to react quickly – to always look at both sides of the coin. Researching the environment, developing solutions, and enabling progress are the tasks of the researchers at the KIT Climate and Environment Center. For a profitable balance, benefits and risks should always be considered and openly communicated. Weighing the pros and cons and deriving decisions for action from them ultimately is the task of politics.

In these challenging geopolitical times, I hope that reading the current newsletter of the KIT Climate and Environment Center will inform you about important topics from research and perhaps even bring one or the other impulse. In order to master fundamental global challenges, the exchange and networking of experts among each other and with society are essential.

Yours,
Professor Dr. Oliver Kraft
Vice-President for Research



Each experiment needs a specific amount of geothermal water. (Photo: R. Wachter, KIT)

White Rhinegold: The Lithium Raw Material Treasure

A KIT Research Group Investigates and Tests the Technical Possibilities of Extracting the Industry-coveted Light Metal from Thermal Water

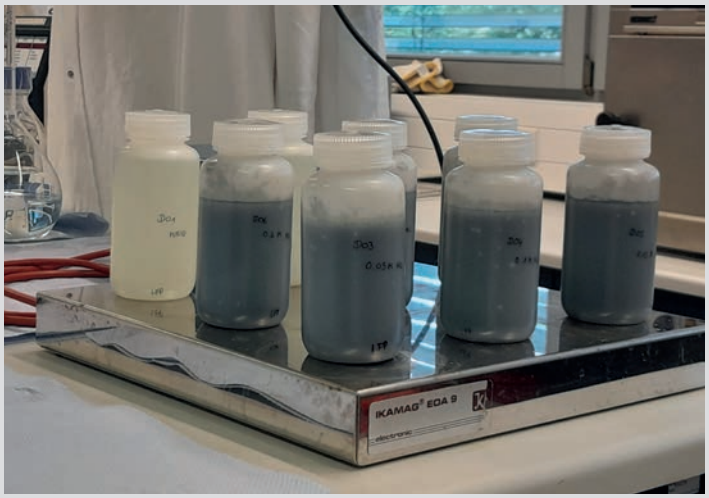
The Song of the Nibelungs is about a hoard of gold sunk somewhere in the Upper Rhine River. Despite large-scale search for a long time, that hoard of gold so far remained a legend. Nevertheless, the Upper Rhine Graben holds a treasure: Its hot deep waters contain silvery-bright lithium. It is used in all batteries and is what makes the transition to e-mobility possible – white gold for the industry. "There are large deposits in the Upper Rhine River," says Prof. Jochen Kolb, Professor of Geochemistry and Economic Geology at KIT. They are the largest in Europe and thus are globally significant. Kolb and his team are working to get the light metal out of the water in an environmentally friendly way. UnLimited is the name of the project, financed by the German Federal Ministry of Economics and with the energy company EnBW as a partner.

The site of the project is the Bruchsal geothermal power plant. There, EnBW pumps water at a temperature of around 130 degrees Celsius up from the depths, uses the heat difference to generate electricity, and injects it back underground, along with the salt load inside. "There are 160 milligrams of lithium in every liter," Kolb says. And this is precisely what we are looking for.

In the laboratory, the research group tested the so-called sorption process on two thermal waters from the Upper Rhine Graben. In this process, a dissolved target substance is physically or chemically bound to a solid receptor mineral. Several candidates for this were tested: Manganese oxide, zeolites, iron phosphate, and clay minerals. The latter were ruled out, but manganese oxide actually proved to be doubly beneficial. "It primarily binds the lithium, leaving other accompanying substances in the water. Moreover, this happens very quickly. After five minutes, 65 percent of the capacity is already reached." Considering the flow rate of 30 liters per second, that's important. Finally, the manganese oxide is filtered out and the lithium separated again. It is then ready for industrial use. The aim is to produce enough for 20,000 automotive batteries each year.

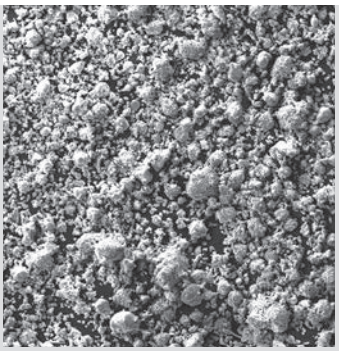
All this also costs energy, but the power plant must remain economic. "Preliminary calculations show that it will continue to generate electricity profitably."

However, where extraction is planned, resistance is mounting. "We take indications of risks seriously, and we have to secure everything."



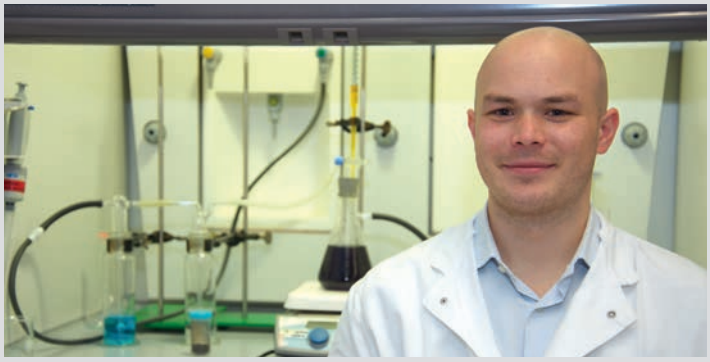
Samples in reaction vessels on a heated stir plate. Here, experiments with different weighted samples are made on the desorption of lithium from iron phosphate. The clear reaction vessels are so-called blanks, samples without iron phosphate, which serve to control the results. (Photo: R. Reich, KIT)

This starts with drilling. Staufen im Breisgau, a town where several hundred houses were damaged by drilling, is often cited in this regard. "But that's comparing apples and oranges," says Kolb. Staufen was a shallow well, to which different rules apply than to wells that reach down 2,000 to 5,000 meters, where the lithium-containing thermal water is found in the Upper Rhine Graben. "The deeper, the more dangerous – that's not true. Wells of a thousand meters and more are secured against the surrounding area up to seven times. This is what the operators already look after. If the thermal water were to come into contact with groundwater, for example, it would be diluted and cooled, or water would be lost. Both are undesirable. In the case of Bruchsal, the wells are already there anyway.



An image from the scanning electron microscope: Tiny cubic particles and small heaps of them. The cubes are lithium manganese oxide, the lithium has connected to the receiving manganese oxide. (Photo: K. Slunitschek, KIT)

Besides, the power plant does not expand. The pilot plant fits into a standard container; a subsequent addition will manage with a maximum of three containers of space. And the chemical substances required are not hazardous. "Risk assessments are made of earthquakes. That's up to the licensing authorities."



Doctoral researcher Klemens Slunitschek does the relevant laboratory experiments with lithium manganese oxide for the pilot project of lithium extraction in the Upper Rhine Graben. (Photo: R. Wachter, KIT)

However, extraction may bear risks, but this is rare. Risks need to be weighed up and calculated. Germany tends to kind of duck out of this. Domestic extraction of raw materials has virtually ceased, and almost everything is imported. Lithium, for example, often comes from Latin America. Environmental pollution and precarious working conditions are being indirectly outsourced far away. "I see an ethical problem there. I think we have a moral obligation to extract our own raw materials ourselves. With care, of course." Kolb explicitly advocates the balance between risk and extraction and engages in discussions on this topic, also at KIT, for example in the THINK-TANK Industrial Resource Strategies.

In Bruchsal, tests will soon start on a larger scale. The results will show how industry-oriented and environmentally friendly mining can be. "We are confident!" ■

Speeding up Decarbonization

A Study Recommends Fast-acting Measures in the Building Sector

To decarbonize the energy industry, we need more photovoltaic systems, among other things. (Photo: Pixabay)

If the German government and the European Union want to achieve their climate targets, they need to focus more on carbon budgets and implement fast-acting measures in the building sector. This is the conclusion drawn by the study "Taking Responsibility – The Building Sector on the Way to Climate Neutrality," conducted in 2021 by Prof. Kunibert Lennerts of the Institute for Technology and Management in Construction (TMB) together with colleagues on behalf of the German Property Federation (Zentraler Immobilien Ausschuss – ZIA). "We need to speed up the decarbonization of the energy industry and push ahead with the expansion of photovoltaics and generation of heat by heat pumps. By contrast, the potential of insulating the building envelope has been exhausted, so it is not worthwhile to establish tighter regulations," explains Lennerts. The new German government has taken into account recommendations for action both in the Coalition Agreement and in the new Buildings Energy Act. At the same time, the study makes it clear that there is a shortage of materials and skilled workers. Lennerts emphasizes: "We have to be realistic about our options: What can we really do, what can we manage?" According to him, it is important to focus on resource-saving renovation methods. In addition, planning and approval processes need to be simplified. ■

Tonga island struck by the tsunami and covered by ash. (Photo: New Zealand Defence Force, https://commons.wikimedia.org/w/index.php?curid=114424088)

Tonga Volcano Eruption: First Shock Wave Tsunami in 140 Years

CEDIM Unraveling a Mystery

With an immense blast and an enormous ash cloud, the Hunga Tonga-Hunga Ha'apai, also simply called Tonga volcano, really let off some steam on January 15, 2022 – on a spectacular scale that was last seen by the Krakatoa in 1883. The event immediately mobilized researchers around the globe, including the Center for Disaster Management and Risk Reduction Technology (CEDIM). "When an underwater volcano erupts, water is met by extremely hot magma, causing it to instantly evaporate, creating an explosive shock wave," says Dr. Andreas Schäfer of KIT's Geophysical Institute (GPI) and CEDIM. Such a volcanic eruption causes a tsunami by moving material similar to a landslide. So Schäfer researched the shape of the volcano, simulated different scenarios with larger and smaller landslides, and compared them to the data collected by buoys in the affected region. The tsunami researcher elaborates: "Landslide tsunamis have a particularly short wavelength, meaning that the wave can be extremely high and destructive locally but it quickly loses energy and becomes relatively harmless at longer distances." Damage on the islands of Tonga was in fact considerable but, as authorities reacted quickly, there were few fatalities.

However, buoy data from the pacific coasts of Japan and the US was puzzling. The tsunami waves arrived too fast and were too high, differing from what would be expected from a landslide tsunami. The explanation: The shock wave caused additional tsunamis. "An explosion pushes air aside. Satellite images show a shock wave traveling at the speed of sound through the clouds. This small difference in pressure lifted the ocean as the shock wave traveled along. Over great distances, this creates very long, enduring waves, which are pushed together once hitting the shores, creating higher waves," Schäfer explains. This led to greater damage than expected and two fatalities on the Pacific coast of Peru. "Even if shock wave tsunamis happen very rarely – most likely the last resulted from the Krakatoa eruption about 140 years ago – we still have to consider them. Especially when a volcano erupts in an ocean with such noise," the geophysicist stresses. More knowledge will help save lives. And in any case, Schäfer wishes for more awareness for human life, criticizing: "There are not enough reports about natural disasters that do not cause spectacular imagery but often have many victims, like earthquakes. Only by reporting on them can we cause awareness for these dangers." ■

More Info: The Center for Disaster Management and Risk Reduction Technology (CEDIM) is a KIT interdisciplinary research institution on the topics of (natural) disasters, risks, and safety. It was founded to contribute to understanding, detecting, and managing natural and anthropogenic risks. **www.cedim.kit.edu/english**

How CO_2 and Ozone Affect Plant Growth

Meta Study Reveals Research Need on Interactive Effects

Experimental examination of the impact of climate change and the way atmospheric CO_2 concentrations affect plant growth. (Photo: KIT)

In the last century, the concentration of the trace gases carbon dioxide and ozone in the atmosphere increased sharply. Both gases intensify the greenhouse effect but they have opposing effects on plant growth: Ozone is a highly reactive substance that damages cell membranes and thereby impedes the growth and metabolism of plants. A higher concentration of CO_2 on the other hand enhances plant growth. What happens when the atmospheric concentration of both gases increases? "We do not know much about that as there is a lack of studies examining more than one component", explains Professor Klaus Butterbach-Bahl at the Institute of Meteorology and Climate Research – Atmospheric Environmental Research Division (IMK-IFU), at the KIT Campus Alpin in Garmisch-Partenkirchen.

Together with international research partners, his team analyzed more than 800 studies to gather the current state of knowledge. Only very few studies addressed both trace gases at the same time. Therefore, not much is known about interactive effects and whether the effects of the gases offset or reinforce each other. Simultaneously increased levels facilitate the formation of wood biomass and chlorophyll but also lead to negative reinforcements: While crop yields remain the same, the nitrogen concentration in crops decreases, causing rice or wheat to contain less protein – and flour with high protein content is needed for applications like baking.

Butterbach-Bahl states: "Our environment is changing dynamically and different factors change at the same time. To represent this complexity, we need experiments that incorporate various environmental factors including stress conditions like high temperatures and long dry periods. We have to learn more about the interactions." Ultimately, this data is needed to review model predictions and better depict possible futures. ■

Oscillating Wind Turbines

Wind Turbines Cause Ground Movements – Imperceptible for Residents But Still Problematic

Installation of a seismometer in a borehole at the WINSENT test area near Stötten in the Swabian Jura. (Photo: KIT-GPI)

Wind turbines are giant oscillators. The spinning rotor blades cause ground movements – similar to earthquakes. Can local residents feel these? "No," says Professor Joachim Ritter at KIT's Geophysical Institute (GPI). Together with other research institutions, his team examined causes for complaints from residents living in areas with wind turbines and to what extent the reported issues are actually perceptible. According to surveys, noise including subsonic noise is the most common cause for complaints. However, some residents reported that they sensed vibrations coming from the wind turbines. "We measured the extent of ground emissions with seismometers at three different wind farms and determined that residents are not able to sense these waves," Ritter explains. "Nearby trains for example cause much stronger vibrations. Another comparison showed that people did not even notice a distant earthquake that caused considerably stronger ground movements than the wind turbines."

Nevertheless, the vibrations from wind turbines bring about some issues: They interfere with sensitive instruments like high-resolution microscopes or seismometers. The ground movement caused by the wind turbines lead to disturbances in these instruments. The seismological services of some countries already call for bigger exclusion zones for wind turbines. "This is a great dilemma that we need to do more research on," Ritter stresses. "We just received 1.5 million euros from the State of North Rhine-Westphalia to examine the problem of seismological stations and find solutions." Possibly, the emissions could be dampened by further detaching wind turbines from the ground to reduce vibrations. Filters could be another way to reduce the interfering signals at the seismometers. ■

Measuring ground movements on the foundation of a wind turbine with a mobile seismological station. (Photo: KIT-GPI)

Wood Stoves Worse Than Dieselgate

Wood-burning Stoves Pollute the Air More Than Combustion Engines

At times, being in a peaceful suburb can be more uncomfortable than being at a traffic junction – at least in terms of air quality. When residents light their fires during the colder months of the year to enjoy the evening in front of their cozy wood stoves, the particulate pollution levels in the vicinity are significantly higher than those at a busy road. This was proven by a team surrounding Professor Achim Dittler, Head of the Working Group Gas Particle Systems at the Institute for Mechanical Process Engineering and Mechanics (MVM) that carried out measurements around Karlsruhe. "The smoke is drawn into the neighboring houses and people inside become passive smokers," the chemical engineer summarizes. And there are other polluting factors as well: When burning wood, nitrogen oxides and other harmful substances like aldehyde and polycyclic aromatic hydrocarbons are released. "Judging by air quality, it is worse than living at a main road because modern vehicles are built with very effective emission control systems that stoves are missing," Dittler explains.

When smoke continuously enters into living spaces for example through window rebate ventilators, exposed residents can currently protect themselves using home air purifiers with activated carbon filters. Dittler complains: "Those who try to advocate for clean air are held up by the authorities, missing emission limits for real operation, and legislative loopholes. In addition, wood-burning stoves have an image of sustainability and there are policies promoting them – even though they are proven to pollute the air and harm the climate." Dittler suggest several possible solutions: Limits on the real operation of stoves and fireplaces should be implemented along with independent controls. The CO_2 costs should be adjusted according to actual CO_2 emissions and emission control including exhaust gas purification should become mandatory. In the meantime, it is better not to use wood-burning stoves to avoid harming the climate, the environment, and everyone's health. ■

Dangerous ventilation: Fires from fireplaces and stoves contaminate the air with smoke gases. (Photo: A. Dittler/KIT)

Christian Scharun Wins FameLab Germany

He takes issue with methane emissions from drilling rigs in the North Sea – that are not recorded accurately. Christian Scharun of the Institute of Meteorology and Climate Research – Atmospheric Trace Gases and Remote Sensing Division addresses this problem. In May, he won FameLab Germany with his efforts. Toward the end of November, he will participate in the international competition. ■

Christian Scharun. (Photo: KIT)

Humboldt Fellow from India

Professor Manish Mamtani of the Indian Institute of Technology came to KIT from May to the end of July 2022 through a Humboldt Fellowship. He worked at the Institute of Applied Geosciences – Structural Geology and Tectonics together with Professor Christoph Hilgers and Professor Agnes Kontny on magnetite deformation mechanisms, combining different microscopy technologies. Observations on the nanoscale revealed intracrystalline deformations in magnetite. ■

Prof. Manish Mamtani. (Photo: Private)

Prof. Christoph Hilgers


(Photo: KIT)

Various committees, boards, and advisory councils – and since February of this year, scientific spokesman of the KIT Climate and Environment Center (ZKU): Just like he is committed to research itself, Christoph Hilgers is involved in shaping the relevant framework conditions. His enthusiasm for this was already aroused at the beginning of his career. "Basic research, applied research, and management. I guess I have always carried something of that thinking with me," he says.

Hence, he always looks at things with one scientific and one economic eye. "The global challenges are clear, after all. We need nature-based and technological solutions for them. These have to come from us, from Germany. Because we have the responsibility and the possibilities." Precise experiments, excellent laboratory work, accurate data evaluation, forward-looking technology development, and comprehensible and appealing communication to society. "Researching air, soil, water, and subsoil at ZKU and developing solutions – it is precisely the networked coming together of different disciplines that is the strength of KIT." Hilgers is keen to support this together with the researchers and staff at ZKU.

In doing so, he is always committed, always motivated: "The art is: I don't work. I follow my passion. Researching the environment, developing solutions, that's how we want to be visible as KIT and enable sustainable progress." ■

Prof. Almut Arneth


(Photo: M. Breig, KIT)

"As a human community, we are not using our land sustainably" – Almut Arneth never tires of repeating this insight. The professor at the Institute of Geography and Geoecology and head of the Ecosystem-Atmosphere Interactions Department and the Modeling of Global Land Ecosystems Working Group at KIT-Campus Alpin in Garmisch-Partenkirchen knows exactly what she is talking about: For almost 30 years, the biologist has been researching the processes in land ecosystems under the influence of global environmental and climate changes. She is also the author of reports by the Intergovernmental Panel on Climate Change (IPCC) and the Intergovernmental Panel on Biological Diversity (IPBES), among others. For her excellent scientific work, Almut Arneth has now been awarded the Gottfried Wilhelm Leibniz Prize 2022 of the Deutsche Forschungsgemeinschaft (German Research Foundation) – Germany's most valuable science prize, endowed with 2.5 million euros. "This is a huge honor, and the prize money gives me more flexibility to implement exciting projects and attract or retain staff with interesting skills," says Arneth. "Supporting young scientists is really important to me, because a career in research is hard work – combined with a bit of luck." Her own path led her from studies in Ulm and Bayreuth and a doctorate in New Zealand to research work in New Zealand, Hamburg, and Jena and finally to a professorship in Sweden. Since 2012, the passionate scientist has been working at KIT. ■

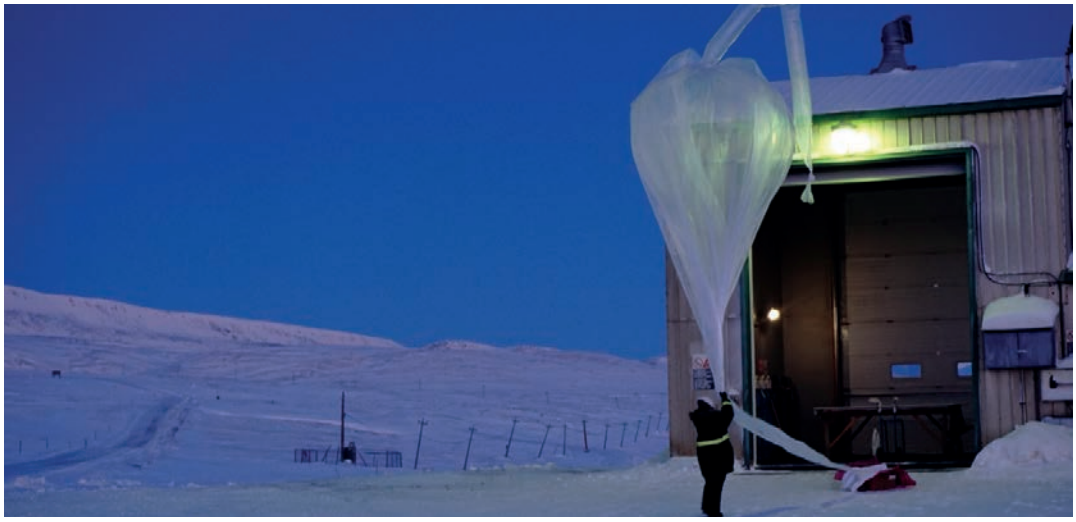
The Globe is Rolling!

The IMK-TRO Interactive Presentation Globe at Hannover Messe

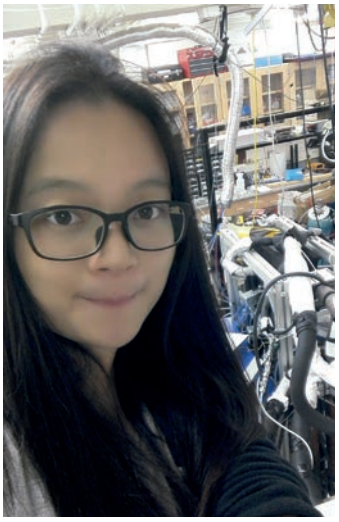
At the end of May this year, the big day had arrived. After several months of preparation, the presentation globe of IMK-TRO set out on its first journey. Many boxes and cables were packed into two big crates and unpacked one week later at the fairground in Hanover. Centrally placed in the middle of one of the two KIT booths, it became the ultimate eye-catcher. The visualizations created in the months before showed current research results.

As a matter of fact, the globe had already been expected. Before the fair started, a journalists' tour led past the KIT booth. Dr. Susanna Mohr (IMK-TRO/CEDIM) and Dr. Hans Schipper (IMK-TRO/South German Climate Office) explained the possibilities and advantages of such a globe to the journalists. On the first day of the fair, Federal Chancellor Olaf Scholz and his entourage then made their way to the globe and were received by KIT President Prof. Holger Hanselka.

Other KIT topics at the so-called Future Hub at Hannover Messe included CEDIM, the spinoffs Risklayer and Aimino, SECUSO, IRM, and the South German Climate Office. The booth was a great success, not least due to the professional and great support by KIT's Event Management team. In the meantime, IMK-TRO's interactive presentation globe is back in the foyer of the Physics Building at Campus South. ■



Ellen Eckert preparing a RAVEN ozone balloon during her stay at Eureka, Canada. (Photo: E. Lutsch)



Xiaoli Shen during laboratory work at MIT in the USA. (Photo: X. Shen)

More Than Just an Offer

Focus on Internationality: GRACE Motivates to Have a Stay Abroad

Promoting and challenging – this is a core principle of the GRACE Graduate School at KIT. The program supports doctoral researchers, for example, by offering special courses or exchange events, but also expects particular commitment, i.e. a research stay abroad, from the participants. "The idea of internationalization has been an inseparable part of GRACE from the very beginning," says Dr. Andreas Schenk, scientific coordinator of GRACE. "We encourage people to make appropriate contacts on their own. But if there is any uncertainty, we also lend a hand." The goals of doing research in a foreign country are manifold. "It is understood as a kind of peer review of ongoing work by the host group. You get to know new methods and approaches and possibly also a different research mentality. At British or U.S. universities, for example, doctorates are based on a more school-like approach than at universities in Germany. So overall, it's a good benchmark for one's own work." Admittedly, there were also critical voices at the beginning. After all, the participants are not available at their home institute during their time abroad. "But in the meantime, this has been accepted and research trips are even welcome, not least because when they return, the doctoral students often bring along valuable scientific contacts." ■

Read more:
www.grace.kit.edu

Raw Materials in Short Supply

How Can Supplies be Secured?

Russia turns off the gas tap, and raw material supplies fail to materialize. The Ukraine war makes our problems very clear: "As an industrialized country, Germany is dependent on energy and raw material imports. We need a suitable strategy for a climate-neutral circular economy," says Prof. Dieter Stapf, spokesman for the steering committee of the THINKTANK Industrial Resource Strategies and head of the Institute for Technical Chemistry (ITC). In one of the THINKTANK focuses, policymakers and society are informed about the opportunities of a circular economy for plastics. "The chemical industry has a severe raw material problem," Stapf emphasizes. "We need to recycle much more. Mechanical recycling is not enough to replace fossil raw materials; we urgently need to promote chemical recycling in a way that is open to technology.

The THINKTANK is also currently working on resilient raw material supply and resource security. A lithium study will soon be published: "Where will we get this important element for the production of lithium-ion batteries in the future? How much demand could be met through recycling? How can we extract more lithium in Europe? These questions are extremely important to politics and business," explains Stapf. In addition, he says, there is a need to discuss the extraction of shale gas in Germany. Importing shale gas from the U.S. or the Middle East in the future will not only be expensive, but the transport-related CO_2 emissions will also have a negative impact on the climate and the environment. ■

New ways for old plastics: Recycling bag ("Yellow Bag") sorting residues. (Photo: KIT)

Read more:
www.thinktank-irs.de

"We Need Timely Solutions"

Networking ZKU More Closely with Process Engineering and Thus Becoming Faster

"After all, we are also measured by the contribution we make to the economy and society," says Prof. Thomas Hirth, Vice-President for Transfer and International Affairs of KIT. (Photo: KIT)

Climate protection, energy transition, resource and raw material security – we have a lot of big tasks to do. The KIT Climate and Environment Center (ZKU) can contribute even more. A conversation with Prof. Thomas Hirth, Vice-President for Transfer and International Affairs at KIT, about the future orientation of KIT.

Prof. Hirth, where should the journey of the ZKU go?

From my point of view, ZKU has to network even more with other disciplines at KIT, especially with process engineering. After all, we have no time to lose and need technological solutions for sustainable energy supply, mobility, water management, raw material and material efficiency, and the development of the circular economy. These are the lead and growth markets of environmental technology. The ZKU is very much concerned with environmental impact. But it kind of lacks a direct link to concrete applications. If our climate and environmental researchers cooperate even more closely with other disciplines, technological solutions will emerge that can be used to tackle global environmental problems. This would allow us to leverage even more of ZKU's potential.

Where do you see unleveraged potential?

We know a lot about ecosystems, geo-resources, material flows, and global systems. We can describe the state of the atmosphere, know much about gases that are harmful to the climate, and can identify and analyze environmental problems. With this knowledge, we should approach other disciplines more and develop solutions, for example, to reduce greenhouse gas emissions or make better use of raw materials. After all, as KIT, we are also measured by the contribution we make to the economy and society.

How can the disciplines come closer together?

There is a lot of knowledge on several sides that is not yet being optimally brought together. That's why we need formats where the various experts join to discuss topics, write project proposals, and get industry on board. These can be workshops or discussion forums, or brainstorming sessions where ideas are collected. Through stronger networking, we also gain efficiency and speed. I think that's extremely important, because we need solutions promptly.

What are the topics for which cooperation is particularly in demand?

Everything that has to do with CO_2 – from reducing emissions to using CO_2 as a raw material – requires the expertise of many disciplines. The same applies to the development of a circular economy, which we can only do together with industry. The sustainable use of water as a resource depends heavily on technologies. How can we recycle water even more efficiently and how can nutrients be recovered from wastewater and returned to production? These are all topics where we have a lot of work to do. The availability of raw materials is another important interface between life sciences and process engineering. Our THINKTANK Industrial Resource Strategies is a good example of successful cooperation between environmental research and process engineering.

What else is important?

The development of systemic solutions. That's the strength of KIT and that is what can be further expanded. For example, we also have a great deal of expertise in economics, humanities, and social sciences. New solutions must not only make ecological sense, but also offer economic advantages. Not only has KIT the ability to develop technological solutions, but we also have the skills to assess and evaluate them ecologically and economically.

The transformation must be ultimately managed by society, politics, and business. How can knowledge transfer be improved?

After all, what we develop at KIT is to be transferred to the economy and society. Innovation days strengthen the connection between science and industry. At our Innovation Day this year, which was attended by KIT researchers and representatives from industry, sustainability was a major topic. And we have to involve society more and offer more dialog formats like Science Week to make science understandable. With "KIT im Rathaus" ("KIT in the City Hall"), we have already established another format. Here, the individual KIT centers regularly present themselves and discuss with the audience. So we are already well on the way – but there is still room for improvement. ■

KIT Climate and Environment Center

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Spokesperson of Topic 1:	Atmosphere:	Professor Dr. Thomas Leisner
Spokesperson of Topic 2:	Water:	Professor Dr. Olivier Eiff
Spokesperson of Topic 3:	Georesources:	Professor Dr. Jochen Kolb
Spokesperson of Topic 4:	Ecosystems:	Professor Dr. Almut Arneth
Spokesperson of Topic 5:	Urban Systems and Material Flow Management:	Professor Dr. Stefan Emeis
Spokesperson of Topic 6:	Natural Hazards and Risk Management:	Professor Dr. Michael Kunz
Spokesperson of Topic 7:	AI in Environmental Sciences:	Professor Dr. Stefan Hinz

Just a Snapshot

Vacation pics as a source of data: How snapshots create eco-knowledge

It doesn't have to be a professional photo: Biodiversity can as well be determined using blurred snapshots. For the model, the resolution of the images is even downscaled. (Photos: K. Hennrich/KIT)

How is which ecosystem doing worldwide? A team from KIT's Institute of Geography and Geoecology can tell – quickly, from the office, using photos shared by the social network.

"As a rule, maps of the functional properties of plants are based on a few measurements. Using climate data and spatially limited samples, previously trained models calculate the state of ecosystems. We had a different idea," says Christopher Schiller about his master's thesis project. "There are tons of nature shots with geocoordinates online. Quasi optical measurements of functional biodiversity. Without field researchers."

Schiller and the team use images from the platform iNaturalist and a deep-learning model. The latter can estimate plant features on a photo basis. Foliage or seeds, professionally sharp or simply snapped and blurry: "The model reliably estimates how large the leaf area or even growth height probably is." The idea behind this is that plant characteristics are statistically related.

It is true that the model does not achieve the same accuracy as field research and laboratory studies. "But if a plausible estimate is needed quickly and cheaply, that's certainly possible."

Schiller, C.; Schmidtlein, S.; Boonman, C.; Moreno-Martínez, A.; Kattenborn Teja. (2021). Deep learning and citizen science enable automated plant trait predictions from photographs. Scientific Reports, 11 (1), Art. No.: 16395. doi:10.1038/s41598-021-95616-0 ■