Helmholtz–OCPC Programme 2017-2021

for the Involvement of Postdocs in Bilateral Collaboration Projects with China

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Office of the China Postdoctoral Council (OCPC)
of the Ministry of Human Resources and Social Security
(MoHRSS)

Title of the project proposal: Closing the nitrogen balance of montane grassland soils and source partitioning of nitrous oxide emissions.

Helmholtz Centre and Institute:

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Institute of Meteorology and Climate Research
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Part A
Project Proposal:

The proposed project is embedded into KIT IMK-IFU activities in the TERENO project (TERrestrial Environmental Observatories, www.tereno.net) which aims to quantify the long-term ecological impact of global change on terrestrial ecosystem water and matter exchange. To this end, large grassland soil monoliths representing dominant soil types of the preAlpine/ Alpine Observatory (operated by KIT) were transferred into lysimeters, and translocated from high (850 m.a.s.l) to low (600 m.a.s.l.) elevation, by which they are exposed to a climate change analogy. To determine the effect of climate change and associated management practice on biogeochemical cycling, leaching of nutrients, yields and greenhouse gas fluxes are quantified at thigh temporal resolution.

The results gained based on the first approx. 5 years suggest that climate change may lead to the mining of soil C and N, which negatively affects important ecosystem and soil functions such as the storage of soil C and N, and the retention of nutrients. The lack of measurements of Nitrogen inputs via ammonia deposition and biological N_2 fixation (BNF) hamper the corroboration of this result.

Furthermore, and contrary to expectations, nitrous oxide (N_2O) emissions were not significantly enhanced by climate change as hot moments of N_2O emission (i.e., freeze-thaw events) are less frequent under warmer conditions and most likely due to high N_2/ N_2O ratios in denitrification. However, the development of N_2O mitigation strategies requires the identification of the dominant N_2O-producing biogeochemical process i.e. nitrification vs. denitrification.

Therefore, the successful candidate will address the named research questions by using state of the art laboratory and field measuring infrastructure including stable isotope techniques and laser absorption spectroscopy. She or he will design, plan and implement measurements of both ammonia deposition and BNF. These measurements are expected to start six months after the start of the fellowship and last at least for an entire annual cycle. These measurements will provide the basis for quantification of a complete N balance for montane grassland sites, and allow for a corroboration of the N-mining hypothesis. Experimental work is also closely linked to application of process based models such as LandscapeDNDC.

With regard to the effect of climate and management practice on the dominant source processes of N_2O production, the successful candidate will apply state-of-the-art N_2O isotopomer measurements based on quantum cascade laser absorption spectroscopy (QCLAS). Particularly this work is linked to ongoing continuous GHG emission measurements using automatic robot systems, thus on an operational basis, the successful candidate will (i) be responsible for maintenance and quality control of automated greenhouse gas measurements, (ii) improve the existing post-processing and (iii) take care of appropriately archiving of the data in a database.

Description of existing or sought Chinese collaboration partner institute

We want to seek for a Chinese collaboration partner institute, which has an outstanding research reputation in the research area of soil C and N cycles, like the Institute of Soil Science, Chinese Academy of Sciences (ISSAS). ISSAS was founded in 1953 and is an internationally highly reputable, national-level research centre. Outstanding ISSAS

research covers all disciplines of soil science, especially with regard to soil C and N turnover and associated greenhouse gas emissions of terrestrial ecosystems. Currently, one of the major research goals for ISSAS is seeking ways for sustainable development of agriculture while minimizing the environmental costs e.g. caused by greenhouse gas emissions and reactive N losses like ammonia.

It is worth mentioning, that KIT, IMK-IFU and in particular the division Biogeochemical Processes has already long term (>15 years) experience and exchange with Chinese partner institutions, including several joint projects in China and Germany. In view of the topic of our proposed project and the scientific background and national and international standing of ISSAS we would be delighted if we could use the 2017 Helmholtz – OCPC – Programme to further develop the fruitful collaborations with a long-term perspective to better understand how climate change affects greenhouse gas emissions (e.g. N_2O emission), N losses as well as the belowground soil C and N transformations and stocks of terrestrial ecosystem in Germany and China. We propose also to collaborate for developing mitigation options that reduce N losses and greenhouse gas emissions while not undermining or even ensuring the food security in Germany and China.

Required qualification of the post-doc:

- PhD in Soil Science or Environmental Science
- Experience in conducting biogeochemical field and laboratory measurements, meta-analysis, background in analytical methods (e.g. Gaschromatography, Infrared Spektroscopy),)
- Additional skills in programming (e.g. R, python, LabVIEW) and statistics

Part B

- Reason for the candidate's personal interest in a research visit to KIT
- CV and copies of certificates
- List of publications
- Two letters of recommendation
- Evidence of competence in English

Part C

- Completion of PhD within the past five years
- Not older than 35 years at the time of application