Maximising Impact by Decision Support Tools for sustainable soil and water through UK-China Critical Zone science

From the Critical Zone to decision support tools for China's agriculture

MIDST uses critical zone science to improve decision making on land and water use in a broad range of regions in China through the development and deployment of decision support tools (DSTs) aligned to the needs of farmers, advisors and policy-makers.

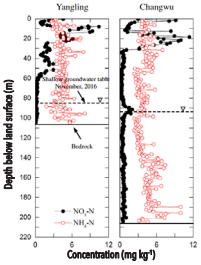
Objectives

1. To integrate holistic CZO science to improve the quality and breadth of DST outputs.
2. To identify and assess relevant DSTs to predict the impacts of alternative land and water management decisions at farm and regional level.
3. To up-scale site-specific CZO data across contrasting regions to test how management scenarios influence national scale land and water policy objectives.
4. To give confidence and training in DST deployment by farmers, advisors and policy experts in specific regions of China.
5. To provide a robust technology platform for interface development by the IT sector in China.

What's new?

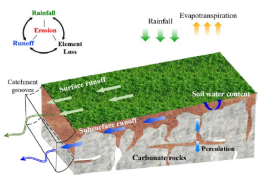
The NSFC/NERC CZO network provides unprecedented knowledge of how land works, from the top of vegetation, through soil, to the bedrock below. One novel finding across all sites was deep soil N and its complex transport behaviour.

Loess Plateau[1]



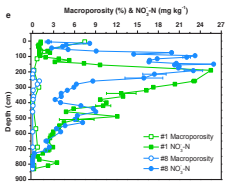
- 0.2 to 1.0 billion tonnes of deep mineral N

Karst[2]



- 1 – 1.7 Tg N loss
- 90% in wet season
- 90% subsurface

Red Soil[3]



- 80% N from 1-8 m
- Nitrate correlated with macroporosity

[1]Jia, X.X., Zhu, Y.J., Huang, L.M., Wei, X.R., Fang, Y.T., Wu, L.H., Binley, A. & Shao, M.A. 2018. Mineral N stock and nitrate accumulation in the 50 to 200 m profile on the Loess Plateau. Science of the Total Environment, 633, 999-1006.
[2]Song, X.W., Gao, Y., Green, S.M., Dungait, J.A.J., Peng, T., Quine, T.A., Xiong, B.L., Wen, X.F. & He, N.P. 2017. Nitrogen loss from karst area in China in recent 50years: Anin-situ simulated rainfall experiment's assessment. Ecology and Evolution, 7, 10131-10142.
[3]Wu, H.Y., Song, X.D., Zhao, X.R., Peng, X.H., Zhou, H., Hallett, P.D., Hodson, M.E. & Zhang, G.L. 2019. Accumulation of nitrate and dissolved organic nitrogen at depth in a red soil Critical Zone. Geoderma, 337, 1175-1185.

China CZO Partner Institutes

Institute of Soil Science, CAS; Institute of Eco-Environment and Soil Science, CAS; Institute of Geographic Sciences and Natural Resources, CAS; Institute of Geochemistry, CAS; Northwest A&F University, Nanjing University of Science and Technology, Nanjing University, University of Science and Technology of China, Tinajing University, Beijing Normal University, Peking University

UK Partners

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The University of Sheffield	Tim Daniell
University of Stirling	David Oliver
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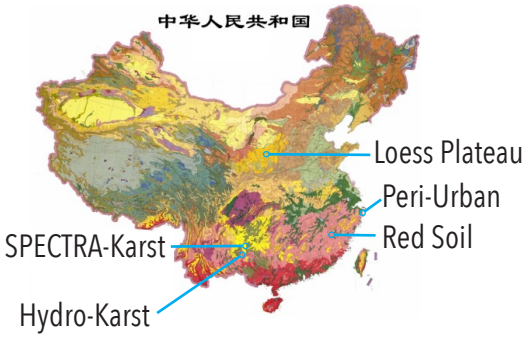
The China CZO Network

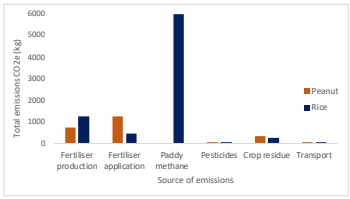


From CZO to Decision Support Tools

- Coupled envrionment/economic DSTs informed by CZO science for industry and farmers.

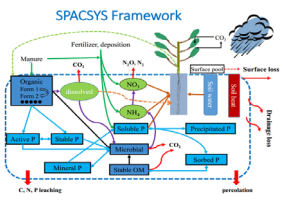
CFT COOL FARM TOOL

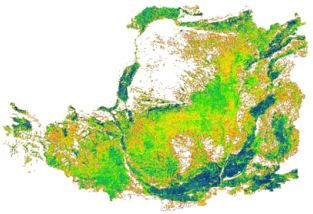
Example: Crop choice impacts on greeenhouse gas emissions. Red Soil CZO with the Cool Farm Tool.



- Complex regional DSTs incorporating a range of CZO processes for policy making.

Example: Change in soil organic carbon stock to 2100 with better land management choices for SE China. Modelled with ECOSSE.





Towards a CZO regional DST. First steps combining a number of tools including SPACSYS to learn how land management affects soil ecosystem services, social economy and agricultural productivity. Natural capital concepts to be integrated.

Postdoctoral Scientists

Dr Ying Zheng, University of Glasgow, *Knowledge exchange and stakeholder engagement.*
Dr Joe Oyesiku-Blakemore, University of Aberdeen, *Adapting readily available DSTs with CZO data.*
Dr Sarah Dennis, University of Leeds, *Project coordination and DST testing*
Dr Boyi Liang, Peking University/University of Exeter, *Novel DSTs with CZO science. Natural capital*
Dr Huiyi Yang, Rothamsted Research, *Large-scale DST implementation for CZOs.*

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