Concerted Earth Observation and Prediction of Water and Energy Cycles in the Third Pole Environment (CEOP-TPE)

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After the Arctic and the Antarctic, the Third Pole Environment centred on the Tibetan plateau and the Himalayas has Earths largest store of ice. Yet it is much less studied than its high-latitude counterparts, even though many more lives depend on it. The TPE is also called Asia's water tower, because its water feed the continent's largest rivers, which sustain 1.5 billion people across ten countries. Due to its high elevation, TPE plays a significant role in global atmospheric circulation and is highly sensitive to climate change. Intensive exchanges of water and energy fluxes take place between the Asian monsoon, the plateau cryosphere (glaciers, snow and permafrost) and the plateau atmosphere at various temporal and spatial scales, but a fundamental understanding of the details of the coupling is lacking.

Thus the objective of this CEOP-TPE project is:
To improve the understanding of the interactions between the Asian monsoon, glaciers/permafrost and the Tibetan plateau atmosphere in terms of water and energy budgets in order to assess and understand the causes of changes in cryosphere and hydrosphere in relation to changes of plateau atmosphere in the Asian monsoon system and to predict the possible changes in water resources in the Third Pole Environment.

A core innovation of the project is to verify or falsify recent hypotheses and projections of the changes of glaciers and permafrost in relation to surface and tropospheric heating on the Tibetan plateau as precursors of monsoon pattern changes and glaciers retreat, and their impacts on water resources in South East Asia.

Method: We will use both earth observation data and in-situ measurements to advance process understanding relevant to monsoon scale, and develop coupled regional scale hydro-climatic models to explain different physical links and scenarios that cannot be observed directly.

Deliverables: The deliverables will be scientific outputs in terms of peer reviewed journal publications, Ph.D. theses and data sets for quantification of water cycle dynamics in the Third Pole Environment.

"第三极环境"之水分与能量循环的协调观测与预测（CEOP-TPE）

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以青藏高原和喜马拉雅山脉为中心的"第三极"地区拥有巨大的冰储量，仅次于南极和北极地区。然而即使许多生命依赖青藏高原而存在，相对于其举世闻名的海拔高度，我们对青藏高原的研究相对薄弱。青藏高原地区孕育了数条亚洲最大的河流，为10个国家的15亿人口提供水源，因此"第三极"地区亦被称为"亚洲水塔"。由于第三极地区平均巨大的海拔高度，"第三极环境"在全球大气环流中发挥了至关重要的作用，同时对气候变化高度敏感。亚洲季风、高原冰冻圈（冰川、积雪、冻土）和高原大气圈之间正在不同空间和时间尺度上发生水分与能量通量交换，但是到目前为止，我们对其耦合细节缺乏根本理解。

因此，该项目（CEOP-TPE）的目标是：增进对亚洲季风、冰川冻土和青藏高原大气之间的水分与能量循环的认识，以期评估和理解亚洲季风系统中与青藏高原大气变化相关的冰冻圈和水圈变化原因，预测"第三极"地区水资源的可能变化。
该项目的一个核心创新点是针对高原地表和对流层加热引起的冰川冻土变化，进而引起季风模态变化、冰川退缩和它们对东南亚水资源的影响的一些假设和预测进行验证。

研究方法：将利用对地观测数据和野外实测数据增进与季风尺度规模相关的过程理解，同时发展耦合的区域水文气候模型解释不能直接观测的内在物理联系与耦合机制。

项目提交材料：成果的提交包括经同行评议在著名刊物上发表的文章、博士论文和为定量理解"第三极环境"中水循环变化所建立的数据集。