Past, Present and Future Dynamic of Glaciers in the Himalaya, Tibet and Tienshan Regions from Earth Observations and Field Missions

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Climate warming over the 20th century has caused drastic changes in Mountain glaciers globally, and of the Himalayan Glaciers in particular. Monitoring of the Himalayan Glaciers has revealed a mixed picture; while many of the Himalayan Glaciers are retreating, in some cases locally stable or advancing glaciers in this region have also been observed. Recent controversies around the future of the Himalayan Glaciers, fuelled by projection reproduced in the 2007 Intergovernmental Panel on Climate Change (IPCC) report, have called for further observation and investigation into the time evolution of Himalayan Glaciers mass balance. Melting of the Himalayan Glaciers has direct consequences for the sea level worldwide, mountain glaciers being the prime contributors to changes in ocean mass. A significant rise in sea level could have a dramatic societal and economic impact. Melting of the Himalayan Glaciers also has direct consequences for regional hydrology; this directly affects the water supply that large river systems provide to over 1.4 billion people, and increases the risk of flooding events.

Earth Observation missions provide a way to precisely measure key variables over large areas, variables that help us understand and quantify the changes affecting the Himalayan Glaciers. It provides, for example, key dataset to understand the mechanisms by which mass is being lost and how the Himalayan Glaciers responds to the forcing of heat transport by the atmosphere. The purpose of this proposal is to quantify the degree of mass imbalance of the Himalayan Glaciers by exploiting Earth Observation dataset from past, present and future European Space Agency, Third Party, and Chinese satellite missions as well as field observation. The dataset will be used to produce deliverables such as glacier elevation change, flow divergence, and improve the determination of mass imbalance at the scale of the Himalayan range. The outcome of this work will provide a clearer understanding of the mass transfer between the Himalayan Glaciers and the hydrologic system, and a better grasp on the future of the Himalayan Glaciers, the Himalayan water supply, and the sea level worldwide.

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综合卫星对地与地面观测的喜马拉雅山、西藏及天山区域冰川过去、现今及未来的动态变化

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20世纪以来的气候变暖已经使山地冰川发生了剧烈变化，特别是喜马拉雅山地区的冰川。目前，对喜马拉雅山区的冰川监测给人一幅不甚分明的景象：该区域许多冰川在退缩，局部地区却有冰川表现出稳定或前进现象。近来关于喜马拉雅山区冰川未来的争论也由于政府间气候变化委员会（IPCC）第四次评估报告的出炉而被重新点燃，这使得对该区域冰川物质平衡的演化进行更深入观测与研究成为必要。山地冰川是影响海洋物质来源变化的主要因素，因此喜马拉雅山冰川的融化对海平面上升已经产生了直接的影响。海平面的显著上升将对社会、经济造成重大影响，喜马拉雅山区冰川的融化也将对区域水资源产生直接影响，它直接影响到为14亿人提供水资源的河流系统的补给，同时也会增加洪灾爆发的风险。

对地观测任务提供了开展区域重要要素变化精确测量的方式，有助于理解并评估影响喜马拉雅山区冰川变化的因素，如其提供的数据集对于认识冰川物质亏损以及气候变暖该区域冰川的影响有重要帮助。本项目的目的就是综合利用欧空局、第三方卫星机构以及中国卫星过去、现在及未来的对地观测数据集，定量观测喜马拉雅山等区域的冰川物质平衡。这些数据集将被用来获得如冰川表面高程变化、流速分布特征等信息以及确定喜马拉雅山区域尺度的冰川物质平衡。这项研究的结果将使人们更清晰地认识到喜马拉雅山等区域的冰川与水力系统之间的物质传输，将提高人们对未来喜马拉雅山等区域的冰川与水系统的关系的理解，以及更好的理解冰川与水资源供给以及与全球海平面上升之间的关系。