

Current and Future Geodetic Satellite Missions for Global Change Monitoring (GSM4GCM)

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Global change deals with large- and small-scale processes that modify the Earth's atmosphere, land and ocean, and drive broad planetary changes in the Earth System, which is one of the greatest challenges that humanity faces today. The Earth Explorer missions of ESA's Living Planet Programme provide an important contribution to the understanding of system Earth through the observation of global change in space and time, such as tectonic motion, Earth surface deformation, sea level changes and gravity, magnetic and atmospheric fields. In order to face the challenges due to global change the Chinese government launched the National major science plans" for global change research. The Dragon 3 Cooperation Call for Proposals provides an excellent opportunity for us to cooperate in the exploitation of Chinese, ESA and TPM EO data in P.R. China. Using innovative geodetic space-borne sensor systems, dedicated gravity field and altimeter satellites monitor these processes over a range of spatial and temporal scales. The integrated analysis of these Earth observation data shall improve the knowledge about comprehensive Earth system models used for analysis and prediction of the changing Earth.

The objective of this joint GSM4GCM project is:

To bring together and further develop the expertise of the project partners (GIS/Stuttgart, IWF/Graz and WHU/Wuhan) in the area of satellite geodesy; to strengthen already existing scientific cooperation between European and Chinese research teams, as an extension of our collaborative projects (DAAD, Germany and CSC, China PPP Projects 2008-2010); to train young scientists; to research the global changes in P.R. China and at global level through the exploitation of Chinese, ESA and TPM EO data, particularly the geodetic satellites GOCE, SWARM, HY-2 and ENVISAT.

The main innovations of the project are the combined and consistent analysis of the satellite gravity measurements and satellite altimetric data; to take advantage of the new multi-satellite SWARM mission to bridge the gap of gravity field monitoring between the current GRACE mission and its successor, at least on the longest scales; and to support the constellation design of Chinese future gravimetric satellite as realized case study.

Method: We will advance process understanding by combined and consistent analysis of gravimetric and geometric space-based observations from the current and future geodetic satellite missions together with regional and local in-situ measurements to monitor sea level changes along Chinese coast, hydrological changes of inland water bodies and the large-scale time-variable gravity field in China.

Deliverables: The deliverables will be scientific outputs in terms of peer reviewed journal publications, PhD theses and analysis results of global change in China and at global level.

全球变化监测的当前及未来大地测量卫星任务 (GSM4GCM)

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全球变化涉及地球大气、陆地、海洋和地球系统内部广泛的大、小尺度变化过程，是当前人类面临的最严峻的挑战之一。欧空局"生存行星 (Living Planet)"计划选定的地球探测任务通过观测诸如构造运动、地表形变、海平面变化、重力场、地磁场以及气压场等全球时空变化，为人类理解地球系统的作用机理作出了卓越的贡献。为了应对全球气候变化的挑战，中国政府启动了支持全球变化研究的国家重大科学计划-龙计划。龙3合作计划提供了利用中国区域、欧空局以及TPM地球观测数据开展合作研究的平台，有助于利用新型大地测量空基传感器系统，精细地球重力场及测高卫星以多维时空尺度监测地球系统变化过程。联合多源地球观测数据将提高人类对应用于分析和预报地球变化的复杂地球系统模型的认识。

GSM4GCM合作项目的目标：通过本国际合作项目，汇集合作机构的卫星大地测量领域专家学者（大地测量所/斯图加特，IWF/格拉茨和武汉大学/武汉）开展合作研究；作为中德PPP合作项目（德意志学术交流中心，德国和中国留学基金委，中国PPP项目，2008-2010年）的延伸，进一步加强欧洲和中国相关研究团队之间的科学合作；培养年轻科学家；利用中国、欧空局以及TPM地球观测数据，特别是GOCE，SWARM，HY-2和ENVISAT等大地测量卫星观测数据，研究区域（中国）及全球范围的地球变化。

主要创新点：提出联合卫星重力测量和卫星测高数据研究相关地球变化，并进行一致性分析；充分利用新的多卫星的SWARM任务的优势，至少可以从长期尺度上弥补当前GRACE及其后续卫星任务之间重力场监测不连续的不足，并为中国未来重力卫星的星座设计提供技术支持。

技术途径：利用当前及未来大地测量卫星任务的重力及几何空基观测数据，区域及局部实测数据，通过联合处理和统一分析，监测中国沿岸的海平面变化，内陆水体的水文变化以及大尺度重力场时变，进而推进对这些变化过程的认知和理解。

提交的成果：在国际地学界高水平期刊上发表研究论文；培养博士研究生；提供中国及全球区域的全球变化分析结果。