

## Terrain Measurement

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The main objectives will include:

- DEM generation combining SAR data at different frequencies, with different techniques
- Subsidence/landslide analysis & monitoring
- Tomographic SAR analysis in urban areas
- Glacier motion monitoring

The scientific investigations will focus on topographic mapping and Earth deformation monitoring using datasets acquired by different Synthetic Aperture Radar (SAR) sensors (ERS, ENVISAT ASAR, Sentinel-1, TerraSAR-X, COSMO-SkyMed, ALOS-2, and HJ-1C). Because large areas in China are covered by clouds and mist throughout the year, SAR is the best sensor for the job. InSAR techniques provide researchers a set of tools for topographic mapping, as well as for monitoring deformations on the Earth surface. Differently from Dragon-2, in Dragon-3, SAR datasets of high spatial and temporal resolution (TerraSAR-X, COSMO-SkyMed) are available.

This makes it now possible to apply successfully multi-image processing analysis for high resolution topographic measurement and land subsidence monitoring. To achieve the advantage of high-resolution SAR data, current InSAR techniques must be updated. Multi-band SAR datasets and the combination of SAR data from different sensors and different bands can provide us with more information. In addition, cross-validation can be performed by comparison among results from different data sources. It is especially meaningful for analyzing of landslides, subsidence due to mining or underground water extraction, and seismic activity.

This proposal will respond to the ESA mission objectives in the following aspects:

- Evaluating the capability of multi-orbit / multi-sensor SAR data in generating DEMs and monitoring Earth surface deformations
- Investigating DEM generation by combining multi-orbit / multi-sensor SAR data
- Developing relevant algorithms and data processing procedures
- Cost-benefit analysis for the technology transfer from European partner to Chinese partner to speed up the technical diffusion in China and explore the applications of ESA data in topographic measurement.

The project will be supported by several funding sources including the Natural Science Foundation of China (project 41174120), the project "Monitoring deformation of large-scale manmade objects based on High-resolution spaceborne SAR image stack" by the Ministry of Education, China, and the internal funding resources of the State Key Laboratory of Information Engineering in Surveying, Mapping and Remote Sensing of Wuhan University.

## 地形测量主题

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主要研究目标：

1. 基于多种技术集成的多波段SAR数据DEM提取
2. 地表沉降及滑坡分析与监测
3. 城市地区SAR层析成像研究
4. 冰川运动监测

本主题的研究重点是利用由多种合成孔径雷达（SAR）传感器（ERS, Envisat ASAR, Sentinel-1, TerraSAR-X, COSMO-SkyMed, ALOS-2和HJ-1C等）获取的数据集，进行地形测绘和地表形变监测。由于中国大部分地区常年受到云层覆盖，SAR成为最适合该主题研究内容的传感器。雷达干涉测量（InSAR）技术既可用于地形测量，也可进行地表形变监测。与"龙计划2"项目不同的是，在"龙计划3"项目中，将主要用到高空间/时间分辨率的SAR数据（TerraSAR-X和COSMO-SkyMed）。

这些新数据的使用使得高分辨率地形测量和地面沉降监测成为可能。为了充分发挥高分辨率数据的优势，需要对现有的InSAR技术进行完善和拓展。多种传感器、多波段数据的组合使用会为我们提供更多的信息。此外，通过对不同数据源获取结果的比较，可以实现不通波段实验结果之间的交叉验证。本项目的研究对于研究因采矿、地下水开采、地震活动等引起的滑坡和地表沉降具有重要的意义。

本主题将从如下几个方面响应ESA的任务计划：

1. 评价多轨道、多传感器SAR数据的DEM制作及地表形变监测能力
2. 研究基于多轨道、多传感器数据组合DEM提取的方法
3. 发展相关的数据处理流程和算法
4. 分析评价从欧方合作伙伴到中方合作伙伴进行技术转移的成本效益，以加快在中国的技术扩散，并拓展ESA数据在地形量测领域中的应用。

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