

Monitoring Ground Surface Displacement in China Case Studies of Landslides in the Three Gorges Area and Pubugou Reservoir Area, Crust Tectonic Movement in Tibet, Subsidence in South China

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Monitoring ground surface displacement in the Three Gorges by InSAR or correlation processing could help to mitigate landslide disasters by providing warnings of impending landslides as well as assessing what impacts they may have on specific large population centres. By using InSAR measures as precursors for ground collapse not only could help reduce loss of lives and property, and also could benefit to related research. ScanSAR interferometric application could greatly benefit tectonic research. PS InSAR and SBAS time series analysis in measurement of large scale ground surface subsistence would promote SAR operational application worldwide.

The methodological research will greatly enhance the ability of interferometric applications.

This research will promote the exchange between Chinese and European scientists. In addition, a new group of young scientists will be trained whilst taking part in the project.

There are many large scale hydropower projects in operation and the construction in progress in China, and thousands of landslides cause a lot of resources waste and property losses in these areas. Landslides represent one of the most diffuse and problematic natural hazards in many parts of the world, threatening urban areas, human activities and cultural heritage, thus influencing the socio-economic conditions of many countries. Thus, it is urgent to investigate new means to monitor landslide hazards in these reservoir areas.

InSAR is a potential earth observation approach, and it has been demonstrated to have a variety of applications in measuring ground movement, urban subsidence and landslides. Currently InSAR provides the ability to map accurate DEM and measure ground deformation to sub-centimetre accuracy. However, many factors affect InSAR to measure ground movement since dam constructions are built in a large scale area with a complicated climate and unstable geology. GPS has been widely used for deformation monitoring. GPS can provide three-dimensional earth surface deformation with high accuracy and high time resolution. And its performance is not sensitive to the weather and earth surface conditions. But the spatial resolution of GPS is low and its coverage is small. Comparing InSAR and GPS there are many complementary characteristics can be found. For example, the time resolution of GPS is high and its performance is not sensitive to the surface conditions. But the spatial resolution of GPS is low and its coverage is small. Unlike GPS, the time resolution of InSAR is low and its performance is sensitive to the surface conditions. But the spatial resolution of InSAR is high and its coverage is large. So it is foreseeable that integration of InSAR and GPS can overcome the limitations of a single technique and allow us to monitor landslide hazards with unprecedented time and spatial resolution.

中国地区地表形变监测案例研究 --以三峡地区滑坡、瀑布沟水电站地区滑坡、西藏地壳构造运动以及中国南方城市沉降为例

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InSAR及其相关处理技术在监测三峡地区地表形变中，通过提供山体滑坡的预警以及评估对特定人口中心区域造成的影响来帮助减轻滑坡灾害。通过使用InSAR技术预测地表塌陷不仅可以帮助减少生命和财产损失，同时也有利于其他相关研究。ScanSAR干涉的应用非常有利于构造运动的研究。在大尺度地表形变监测中，PS InSAR技术和SBAS时序分析技术将会推动全世界的SAR应用的发展。

InSAR方法理论的研究，将大大提高干涉应用的能力。

本研究将促进中国和欧洲科学家之间的交流。此外，新一代的青年科学家将会在接受培训的同时参加到项目中。

在中国有许多大型水电项目正在运行和建设中，在这些地区，成千上万的滑坡造成大量的资源浪费和财产的损失。山体滑坡是全世界许多地区最具有代表性的自然灾害之一，山体滑坡威胁城市地区安全、影响人类活动和破坏文化遗产，从而影响国家的社会经济状况。因此，研究新的手段监测库区滑坡灾害迫在眉睫。

InSAR是一种极具潜力的对地观测新方法，已在地表活动、城市沉降和山体滑坡监测中的广泛应用。目前，InSAR能绘制高精度的DEM和提供精度可达亚厘米级区域形变监测图。然而，由于大坝所在地区气象条件复杂，地质条件不稳定，许多因素制约着InSAR技术在这些区域的应用。GPS已广泛用于变形监测中。GPS可以提供高精度和高时间分辨率的三维地球表面变形，其对天气和地表的条件不敏感。但GPS空间分辨率低，覆盖面积小。比较InSAR和GPS会发现两者之间具有很好的互补性。例如，GPS的时间分辨率高，对地表条件不敏感，但GPS空间分辨率低，覆盖面积小。与GPS不同，InSAR的时间分辨率较低，对于地形敏感，但InSAR技术的空间分辨率高，覆盖面积大。所以InSAR和GPS的集成可以克服单一技术的局限性，并可以以前所未有的时间和空间分辨率来监测滑坡灾害。