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SOURCES OF ARTEFACTS IN SYNTHETIC APERTURE RADAR INTERFEROMETRY DATA SETS

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Abstract. In recent years, much attention has been devoted to digital elevation models (DEMs) produced using Synthetic Aperture Radar Interferometry (InSAR). This has been triggered by the relative novelty of the InSAR method and its world-famous product—the Shuttle Radar Topography Mission (SRTM) DEM. However, much less attention, if at all, has been paid to sources of artefacts in SRTM. In this work, we focus not on the missing pixels (null pixels) due to shadows or the layover effect, but rather on outliers that were undetected by the SRTM validation process. The aim of this study is to identify some of the causes of the elevation outliers in SRTM. Such knowledge may be helpful to mitigate similar problems in future InSAR DEMs, notably the ones currently being developed from data acquired by the TanDEM-X mission. We analysed many cross-sections derived from SRTM. These cross-sections were extracted over the elevation test areas, which are available from the Global Elevation Data Testing Facility (GEDTF) whose database contains about 8,500 runways with known vertical profiles. Whenever a significant discrepancy between the known runway profile and the SRTM cross-section was detected, a visual interpretation of the high-resolution satellite image was carried out to identify the objects causing the irregularities. A distance and a bearing from the outlier to the object were recorded. Moreover, we considered the SRTM look direction parameter. A comprehensive analysis of the acquired data allows us to establish that large metallic structures, such as hangars or car parking lots, are causing the outliers. Water areas or plain wet terrains may also cause an InSAR outlier. The look direction and the depression angle of the InSAR system in relation to the suspected objects influence the magnitude of the outliers. We hope that these findings will be helpful in designing the error detection routines of future InSAR or, in fact, any microwave aerial- or space-based survey. The presence of outliers in SRTM was first reported in Becek, K. (2008). Investigating error structure of shuttle radar topography mission elevation data product, Geophys. Res. Lett., 35, L15403.

Conference Paper (PDF, 475 KB)

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