



Investigating and monitoring landslide activity in the Big Sochi area of the Great Caucasus (Russia) using INSAR with Sentinel-1 images

Ekaterina Smolianinova, Elena Kiseleva, Pavel Dmitriev, and Valentin Mikhailov

Schmidt Institute of Physics of the Earth of the Russian Academy of Sciences, Russian Federation (katsmol@mail.ru)

The Big Sochi area is the place where the Olympic Games 2014 took place. This area has always been a region of high landslide risk due to widely spread clays and marls saturated by water from abundant precipitations. In recent years landslide risk assessment has become vital because of strongly increased human impact.

The area include coastal and mountain clusters. The conditions for InSAR are strongly different for these clusters. The coastal cluster is a highly populated area with lots of facilities being good reflectors while the mountain cluster is a vegetated rural area where few reflectors can be revealed. In the coastal cluster heights do not exceed 300-400m while in the mountain cluster- heights vary from 500 to 2500m. Mountains are covered with snow since November till May and in the coastal part there is no permanent snow cover at all. We have been studying the Big Sochi area since 2011. Using the StaMPS software we made PS-InSAR inventory map for the coastal part based on Envisat, TerraSAR-X and ALOS PALSAR data sets for 2007-2010 years. We found out that for the coastal landslides space adaptive filtering of amplitude of the ALOS PALSAR images by applying Kolmogorov-Smirnov test similar to SqueeSAR approach considerably increases the number of PS. For the mountain cluster (the Roza Khutor area) reliable results were obtained only for the ALOS PALSAR data set.

The Big Sochi area has been fully covered by Sentinel-1 acquisitions from ascending and descending tracks since 2015. This makes the idea of regular updating of PS-InSAR landslide inventory maps using S-1 images very inviting although not easy to accomplish. Higher frequency of S-1 as compared to ALOS PALSAR result in quite bad coherence of S-1 images in rural areas which are abundant in the Big Sochi. Simultaneous INSAR processing for coastal and mountain clusters is impossible due to absolutely different INSAR conditions. For the mountain cluster the best results were obtained using SBAS excluding winter images while in the coastal part application of PS methods (StaMPS, in particular) incorporating all year acquisitions appeared to be rather good. We present INSAR updated inventory maps as well as time series for particular landslides.

We concluded that S-1 images can be used to reveal landslides in the Big Sochi area and monitor their activity which is increasing due to human impact. DInSAR turned out to be useful to reveal activating landslides in the periods of heavy precipitation while SBAS and PS methods help to monitor their dynamics. Detailed INSAR based monitoring of landslides in the Big Sochi area incorporating S-1 images seems to be very promising as it can considerably reduce ground survey.

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