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A comparison between remote sensing approaches to water extent monitoring

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Monitoring the variation of water storage in a long period is a primary issue for understanding the impact of climate change and human activities on earth water resources. In order to obtain the change in water volume in a lake and reservoir, in addition to water level, water extent must be repeatedly determined in an appropriate time interval.

Optical satellite imagery as a passive system is the main source of determination of coast line change as it is easy to interpret. Optical sensors acquire the reflected energy from the sunlight in various bands from visible to near infrared. Also, panchromatic mode provides more geometric details. Establishing a ratio between visible bands is the most common way of extract coastlines because with this ratio, water and land can be separated directly. Also, since the reflectance value of water is distinctly less than soil in infrared bands, applying a histogram threshold on this band is a effective way of coastline extraction. However, optical imagery is highly vulnerable to occurrence of dense clouds and fog. Moreover, the coastline is hard to detect where it is covered by dense vegetation.

Synthetic aperture radar (SAR) as an active system provides an alternative source for monitoring the spatial change in coastlines. Two methods for monitoring the shoreline with SAR data have been published. First, the backscatter difference is calculated between two images acquired at different times. Second, the change in coastline is detected by computing the coherence of two SAR images acquired at different times. A SAR system can operate in all weather, so clouds and fog don't impact its efficiency. Also, it can penetrate into the plant canopy. However, in comparison with optical imagery, interpretation of SAR image in this case is relatively hard because of limitation in the number of band and polarization modes, also due to effects caused by speckle noises, slant-range imaging and shadows.

The primary aim of this study is a comparison between the performance and result of different methods of the water area monitoring over a long period by applying optic and SAR images. The secondary goal is investigation a method to integrate SAR and optical imagery for water extent monitoring to improve the performance. The case study of this paper is Urmia lake located in the northwest of Iran. Its area has impressively decreased since 1995, so water extent monitoring is vital in this case.