

INSAR ATMOSPHERIC DELAY MITIGATION BY GPS; CASE STUDY IZMIT EARTHQUAKE INTERFEROGRAMS

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ABSTRACT:

The Propagation delay when radar signals travel from the troposphere has been one of the major limitations for the applications of high accuracy Interferometric Synthetic Aperture Radar (InSAR). In this GPS data used for defining meteorological effects on radio signals. 1999 Izmit earthquake is chosen for the case study of tropospheric effects on InSAR images according to previous studies. Due to process of GPS data with BERNESE tropospheric delay model gained and compared with ROI_PAC processed interferograms and it can be easily figured out that the delay amounts are really reliable. As a result of this study, importance of atmospheric change in Turkey climate will be pointed out using SAR and GPS data integration with meteorological aspects.

1. INTRODUCTION

Earth sciences are developed in last decades with the development of space technologies especially in space geodesy and remote sensing. Global Navigation Satellite Systems (GPS) and remote sensing sensors are highly affected from these fast developments. As known space geodesy is based on electromagnetic waves and their reflection from earth surface. Variation in the refractive index of the atmosphere causes changes in the electromagnetic waves propagating through it. Therefore corrections of these atmospheric effects should be determined and applied with the assessed measurements. Atmospheric effects grouped in two types; ionospheric and tropospheric effects. Ionospheric effects can be removed by signal combinations during data processing. Tropospheric effects are directly related to troposphere and cannot be removed but can be modeled. The aim of this study is the correction of troposphere effects over Synthetic Aperture Radar (SAR) images and interferograms by using acquired GPS measurements in İzmit, Turkey.

Turkey is divided into seven regions due to socio-economical, administrative, climate and natural (soil, vegetation) similarities of related land. İzmit Province (40° 45'N 30° 01'E) which is in Marmara Region. Marmara has the largest share in production and industry of Turkey. The area is just

on the North Anatolian Fault (NAF), which extends from Karlıova in Eastern Turkey to the Gulf of Saros in the Northern Aegean Sea, is one of the longest active strike-slip faults in the world with about 1500km length and hit region 2 times with large earthquakes in 17 August and 12 November 1999 with 7.4 and 7.2 Mw. After these earthquakes Ziyadin Çakır and Rob Reilinger worked with the SAR data and publish papers by the help of these papers using InSAR technique for deformation monitoring to get more current insight in Turkey. (Çakır et al., 2003)(Reilinger et al., 2000)

2. GPS AND SAR DATA

The data for this study are GPS and ERS1/2 tandem SAR images before and after earthquake (12-13 August 1999 and 16-17 September 1999). GPS data is gathered from Marmara GPS Network (MAGNET) continuous operated GPS network which is designed and managed by TÜBİTAK Marmara Research Center and SAR images are taken from Dr. Ziyadin Çakır (Istanbul Technical University). (Figure 1) Open source software is chosen for image and GPS data analysis. BERNESE software used for troposphere modeling due to capabilities of modeling time interval to get the more

