

INTISARI

Provinsi Gorontalo yang terletak di bagian utara Pulau Sulawesi merupakan kawasan yang rawan terhadap aktivitas tektonik karena berada di pertemuan tiga lempeng aktif, yaitu Lempeng Eurasia, Pasifik, dan Australia. Pada 18 Januari 2023, terjadi gempa dengan magnitudo 6,3 Mw yang dipicu oleh aktivitas Sesar Gorontalo. Gempa ini menimbulkan deformasi permukaan bumi yang signifikan, khususnya pada fase *preseismic* dan *coseismic*. Keterbatasan jumlah stasiun CORS dan cakupan yang belum merata menyebabkan pemantauan deformasi belum mampu merepresentasikan pola spasial secara menyeluruh. Penelitian ini bertujuan untuk menganalisis deformasi vertikal yang terjadi akibat gempa tersebut dengan pendekatan teknologi *Interferometric Synthetic Aperture Radar* (InSAR) untuk menentukan besar dan arah deformasi, mengevaluasi ketelitian InSAR terhadap data CORS, serta mengevaluasi tipe sesar Sesar Gorontalo.

Metodologi penelitian dilakukan dengan citra satelit Sentinel-1 dengan arah *descending* dari portal COMET-LiCS dan mengolahnya menggunakan perangkat lunak LiCSBAS berbasis Linux. Pengolahan mencakup koreksi atmosfer menggunakan data GACOS, *masking*, *clipping*, hingga proses *time series* dan *velocity inversion*. Hasil deformasi kemudian dikonversi dari LOS *displacement* menjadi deformasi vertikal berdasarkan *incidence angle* dari satelit. Validasi deformasi dilakukan dengan membandingkan data InSAR terhadap data CORS dengan uji statistik t-test.

Hasil penelitian menunjukkan bahwa deformasi vertikal akibat aktivitas Sesar Gorontalo pada fase *preseismic* didominasi oleh penurunan bertahap di sebagian besar titik, seperti TS2, TS7, dan TS8 yang mencatat nilai lebih dari -50 mm. Fase *coseismic* memperlihatkan perubahan signifikan dengan penurunan tajam di beberapa titik, terutama TS2 dan TS8 yang mencapai hingga -88 mm dan -131,83 mm yang menandakan pelepasan energi secara tiba-tiba akibat gempa 18 Januari 2023. Validasi data InSAR dengan data CORS menunjukkan bahwa di titik CALO tidak terdapat perbedaan signifikan sedangkan di titik CGUT terdapat perbedaan signifikan yang disebabkan oleh keterbatasan panjang *time series*. Berdasarkan pola deformasi, profil topografi, serta grafik kumulatif pergeseran, Sesar Gorontalo dikategorikan sebagai sesar *oblique*, yaitu kombinasi pergerakan vertikal dan mendatar, dengan kecenderungan penurunan di barat laut dan kenaikan di tenggara.

Kata Kunci: Gorontalo, deformasi vertikal, gempa bumi, InSAR, *preseismic*, *coseismic*

ABSTRACT

Gorontalo Province, which is located in the northern part of Sulawesi Island, is an area prone to tectonic activity because it is located at the confluence of three active plates, namely the Eurasian, Pacific, and Australian Plates. On January 18, 2023, an earthquake with a magnitude of 6.3 Mw occurred triggered by the activity of the Gorontalo Fault. This earthquake caused significant deformation of the earth's surface, especially in the preseismic and coseismic phases. The limited number of CORS stations and uneven coverage have caused deformation monitoring to not be able to represent the overall spatial pattern. This study aims to analyze the vertical deformation that occurred due to the earthquake with the Interferometric Synthetic Aperture Radar (InSAR) technology approach to determine the magnitude and direction of the deformation, evaluate the accuracy of InSAR on the CORS data, and identify the types of faults that are active in the study area.

The research methodology was carried out with Sentinel-1 satellite imagery in the descending direction of the COMET-LiCS portal and processed it using Linux-based LiCSBAS software. Processing includes atmospheric correction using GACOS data, masking, clipping, to time series and velocity inversion processes. The deformation results are then converted from LOS displacement to vertical deformation based on the incidence angle of the satellite. Deformation validation was carried out by comparing InSAR data with CORS data with t-test statistical tests.

The results of the study show that the vertical deformation due to the activity of the Gorontalo Fault in the preseismic phase is dominated by gradual decline at most points, such as TS2, TS7, and TS8 which recorded values of more than -50 mm. The coseismic phase showed significant changes with sharp decreases at several points, especially TS2 and TS8 which reached up to -88 mm and -131.83 mm which signaled a sudden release of energy due to the January 18, 2023 earthquake. Validation of InSAR data with CORS data showed that at the CALO point there was no significant difference while at the CGUT point there was a significant difference caused by the limitation of time series length. Based on the deformation pattern, topographic profile, and cumulative graph of shift, the Gorontalo Fault is categorized as an oblique fault, which is a combination of vertical and horizontal movements, with a tendency to decline in the northwest and rise in the southeast.

Keywords: Gorontalo, vertical deformation, earthquake, InSAR, preseismic, coseismic