2. Cooperative Observations at Nyiragongo Volcano in D.R. of Congo

Volcano Nyiragongo belongs to the Virunga volcanic group and is located in the central part of the western rift of the East African Rift System, just to the north of Lake Kevin in the Rep. Dem. Congo. Among the 8 volcanoes in the Virunga, Nyiragongo and its neighboring volcano Nyamuragira have bee presently active condition. Nyiragongo had a long-lived lava lake in the summit crater since 1928. After the eruption in 1977, the lava lake in the summit was not seen for about 5.5 years. However the lava lake re-appeared at the bottom of crater on 21 June 1982 and, thereafter, the surface of lake has ascent intermittently with the small eruptions in the crater. During the period from June 1994 to September 1996, the surface in the crater was elevated about 120 m and the supplied magma volume was about 1.3×10^8 m^3.

The 13 days prior to the Nyiragongo eruption on January 2002, the moderate felt shocks and also felt volcanic tremors were observed by local habitant at Rusayo village, where is located about 5 km south of the volcano. The Nyiragongo eruption was always preceded by the occurrence of tremors with large amplitudes. On January 10th, one week before the eruption, the forecast that new volcanic eruption is acute and that lava flows might direct their course toward Goma or Sake was issued to the local habitant and the foreign people in the Goma area by the Goma volcano observatory (GVO), the Centre de Rechereche en Sciences Naturelles (CRSN). This is the first successful prediction of volcanic eruption at Nyiragongo volcano based on the monitoring of seismo-volcanic activities, temperature measurements at fumaroles along the old fissure near the Shaheru cone and the surface observation of lava lake in the crater.

Fig. 1. The fissure on the mountainside at the elevation of about 2835 m with two fumaroles activity, the Shaheru crater buried by the new lava, and lava flows at foothill. (Photo taken by M. Kasereka, Nov. 11, 2002)

Fig. 2. Small spatter corn near the end of fissure, from which huge amount fluid lava was poured out and directed its course toward the Goma city. (Photo taken by H. Hamaguchi, Feb. 6, 2002)

The eruption started at 8:35 local time on January 17 along the fissure on the mountainside at the elevation of about 2835 m (Fig. 1). According to eyewitnesses of local habitants who are living at about 4 km NW outskirts of Goma, a rising of black plume was observed at about 10 o'clock near the foot of Shaheru cone and black rain and scoria came down after about 30 min latter. The present eruption was

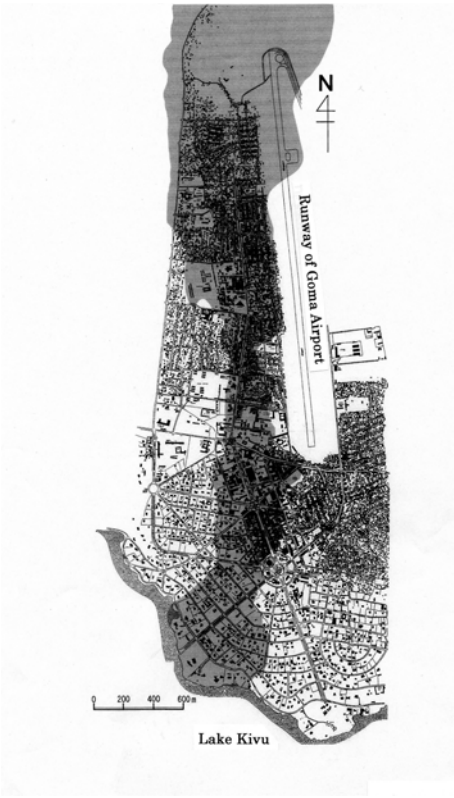

Fig. 3. The lava flow (shaded area) passed through the downtown of Goma. The original map is on the scale of one to two thousand prepared in 1998.

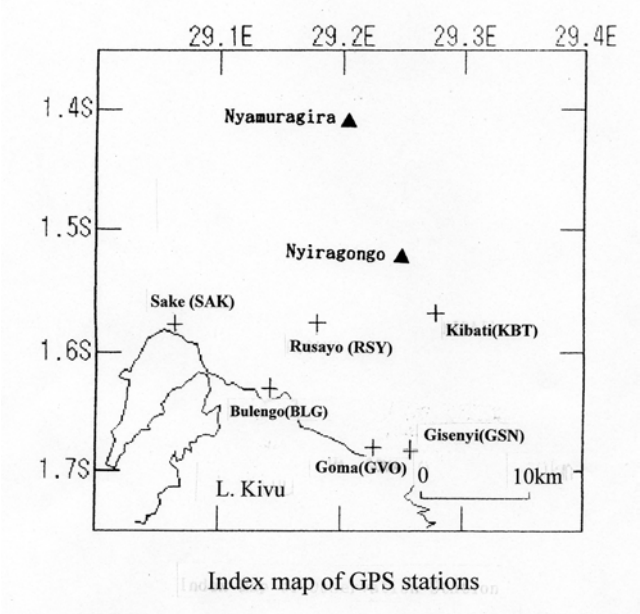

Fig. 4. Index map of GPS stations (cross) around the Nyiragongo volcano. Solid triangle is active volcano.

characterized by exceptionally long fissures (ca 13 km) that stated at the side of Nyiragongo mountainside (elevation 2835m) and ended at the outskirts of Goma (elevation 1600 m). A huge amount of lava was poured out from the three spatter cones (Fig. 2) at the southern end of fissure, which is close to the Goma International airport and inundated the suburbs and the central part of Goma city. The extremely fluid lava flows and strong emission of CO2 gas caused many fatalities. The more than 4500 houses and buildings in the city of Goma were collapsed and/or buried by lava flow, of which thickness in the downtown was over 2 m (see Fig. 3).

Immediately after the eruption stopped, large number of felt earthquakes was observed around Goma and Gisenyi area. This swarm activity continued for about three months and caused a collapse of local houses in and around Gisenyi. In order to continues monitor the crustal deformations due to fissuring, volcanic activity and/or rift movements, we constructed the GPS network at the southern part of Nyiragongo volcano. The network consisted of 6 fixed stations and one mobile station at the top of Nyiragongo (Fig. 4). The GPS monitoring sensor is a type MG-2110 (Furuno Electric Co.) with low power consumption and single frequency detection. A sampling time interval is

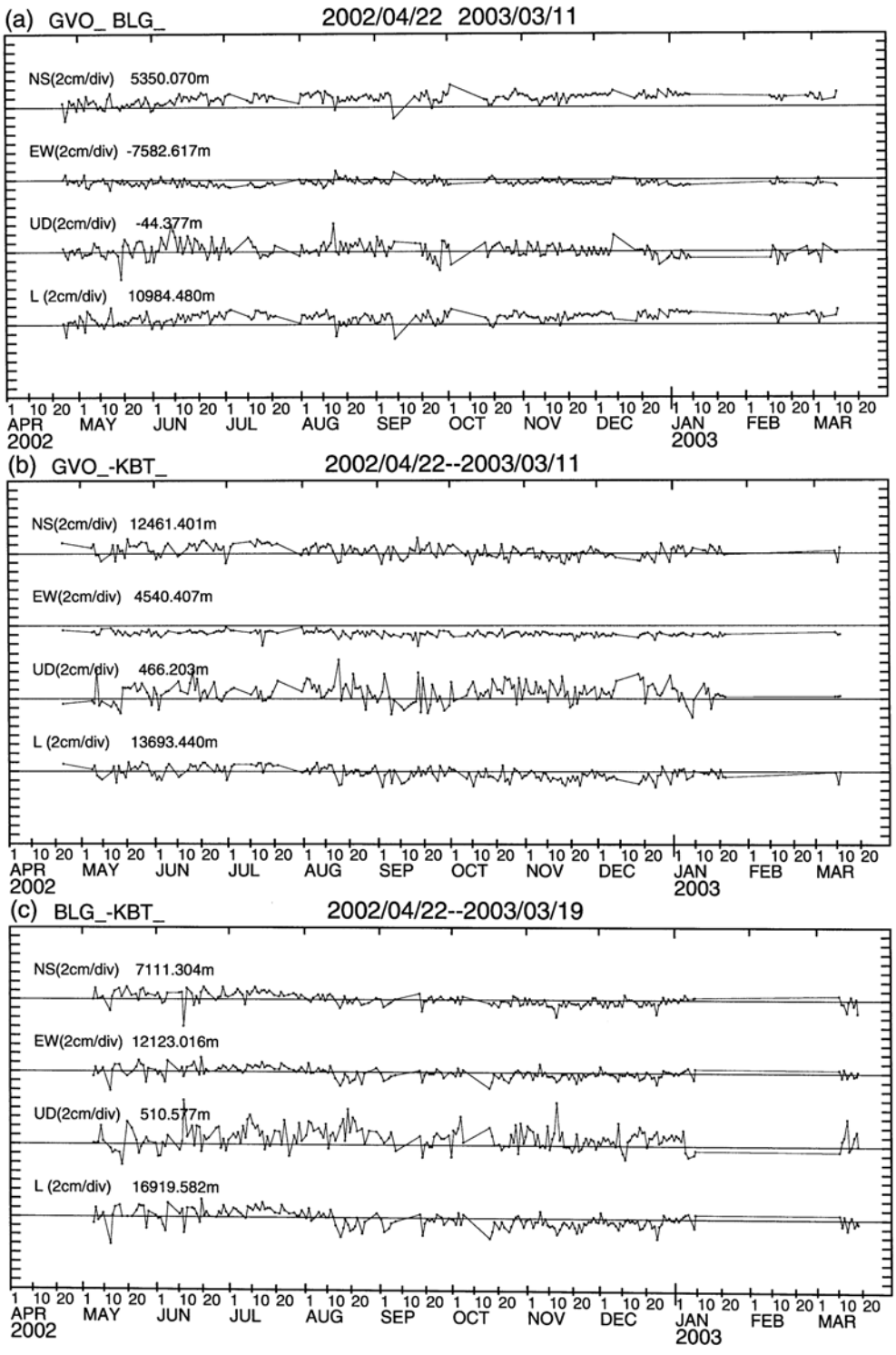

Fig. 5. Temporal changes of the horizontal (NS, EW) and oblique distances and height differences at three baselines; (a) GVO-BLG, (b) GVO-KBT and (c) BLG-KBT. The unit in the vertical axis is 2 cm/div.

fixed to be 30 sec. The cooperative observation between CRSN and Tohoku University was started at April 22, 2002. The data analyses reveal that the horizontal and vertical variations along all baselines for about one year from April 2002 to March 2003 were within the accuracy of the sensor (Fig. 5), suggesting that, even though new lava lake activity already re-appeared in the crater, there have been neither significant magma supply or drain-back nor a magma intrusion into the volcanic region.

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