

RESEARCH

Strategies for the development of volcanic hazard maps in monogenetic volcanic fields: the example of La Palma (Canary Islands)

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Additional File 1

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Abstract

Traditionally volcanic-hazard assessments have been applied to stratovolcanoes, where volcanic hazard maps represent important tools for volcanic crisis management and land-use planning. In recent years, several improvements have been made for monogenetic volcanic fields focused on, among other things, the development of spatial models to deal with one of the main problems in these areas, namely the unknown vent location. However, volcanic hazard maps of monogenetic volcanic fields present some significant differences with respect to those developed for stratovolcanoes, including the fact that they commonly represent multiple eruptive processes spread over the possible vent opening area. Likewise, the scientific communication of the volcanic-hazard assessment and how this information is comprehended are critical issues in the development of mitigation strategies for monogenetic volcanic fields.

In this research, we focused on developing volcanic hazard maps using simple numerical hazard models in combination with a random approach for vent location to cover the whole vent opening area. We added some spatial methods to better manage potentially affected areas. The maps were designed for use in a digital environment (Geographic Information System) by Civil Protection professionals in high-risk monogenetic volcanic fields on small oceanic islands. The methodology presented does not use susceptibility base maps for hazard assessment to avoid possible underestimation of low probability areas by Civil Protection. The methodology represents an attempt to respond to the most important questions of where, when and how a new eruption might take place in a monogenetic volcanic field. The example presented here was developed for La Palma (Canary Islands).

Keywords: Hazard assessment; Expected eruptive scenario; Hazard map; Monogenetic volcanism; La Palma; Canary Islands

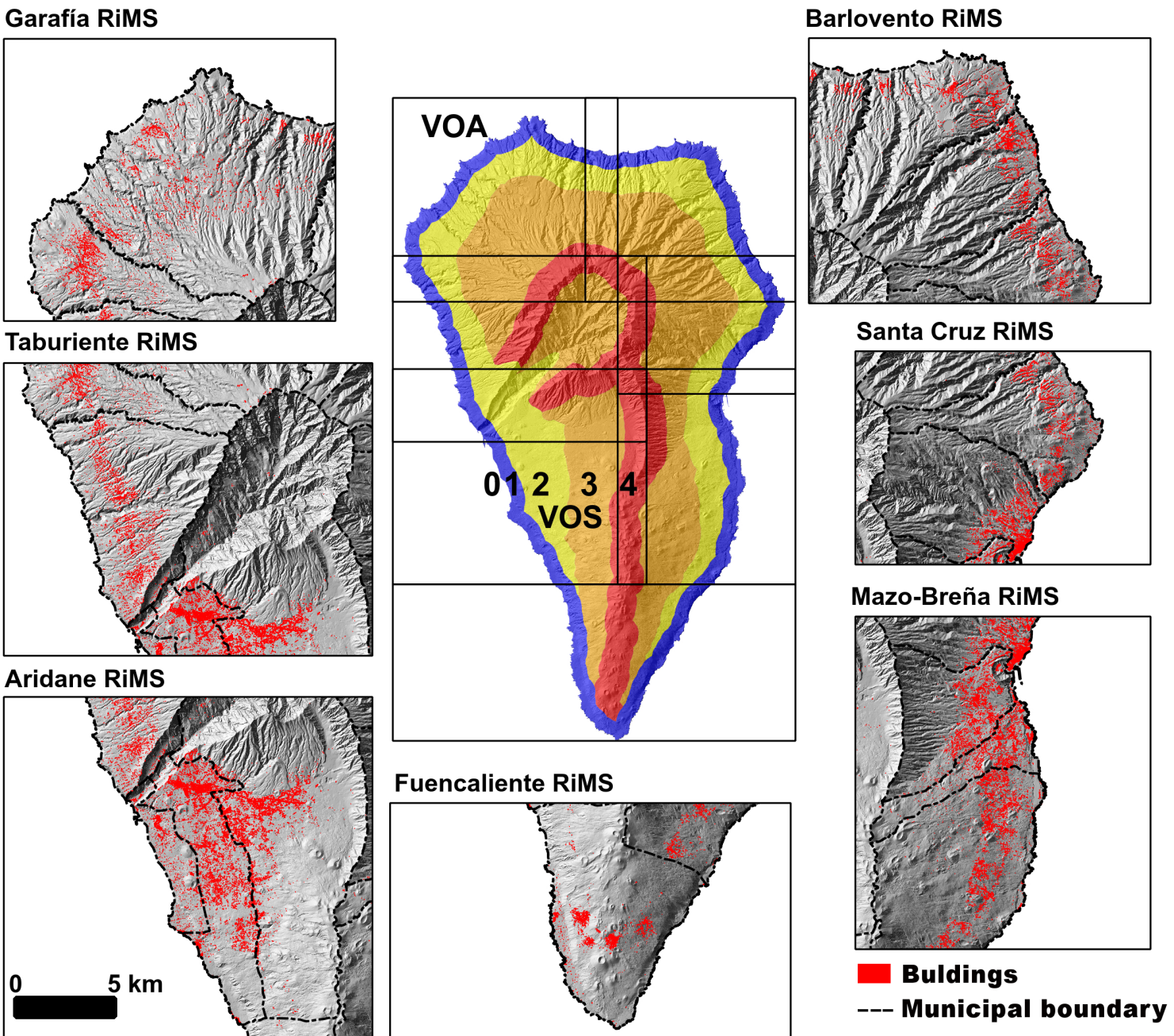


Figure 1 In Spanish, we used a different the nomenclature to refer VOS (Zona) and RiMS (Sector).

1 Lava flow hazard maps

Here we present all lava flow hazard maps develops for all RiMS and VOS.

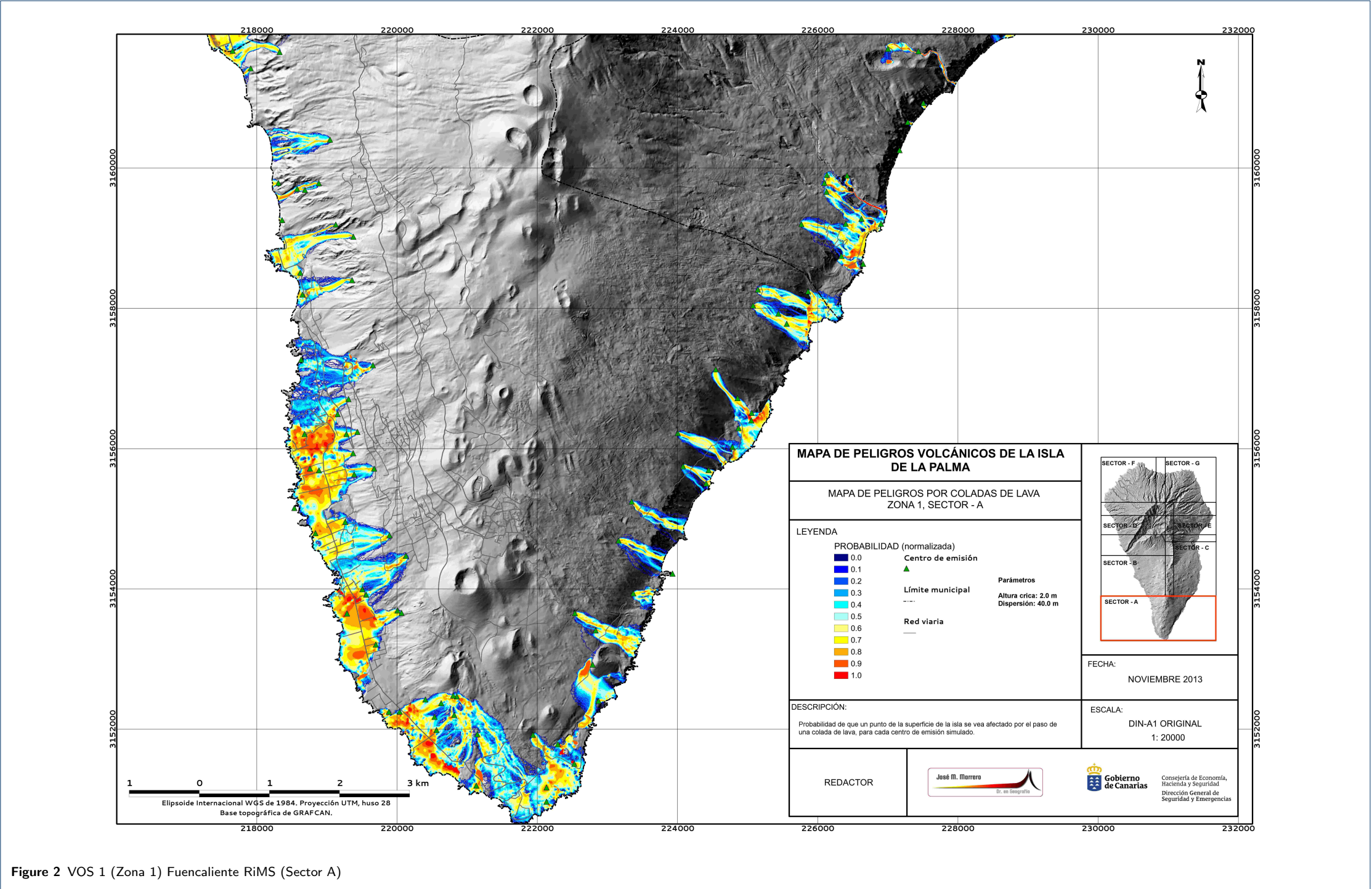


Figure 2 VOS 1 (Zona 1) Fuencaliente RiMS (Sector A)

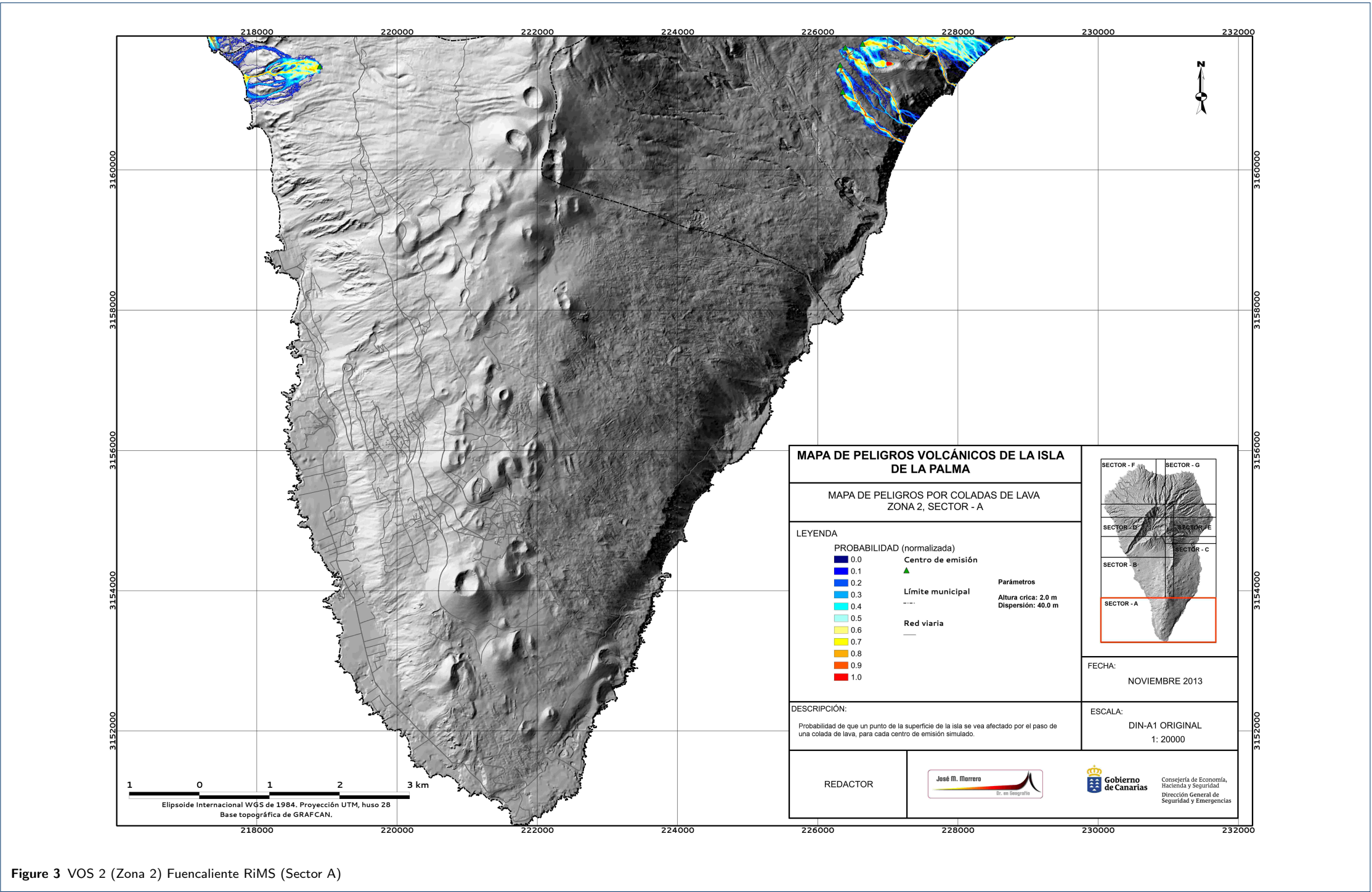


Figure 3 VOS 2 (Zona 2) Fuencaliente RiMS (Sector A)

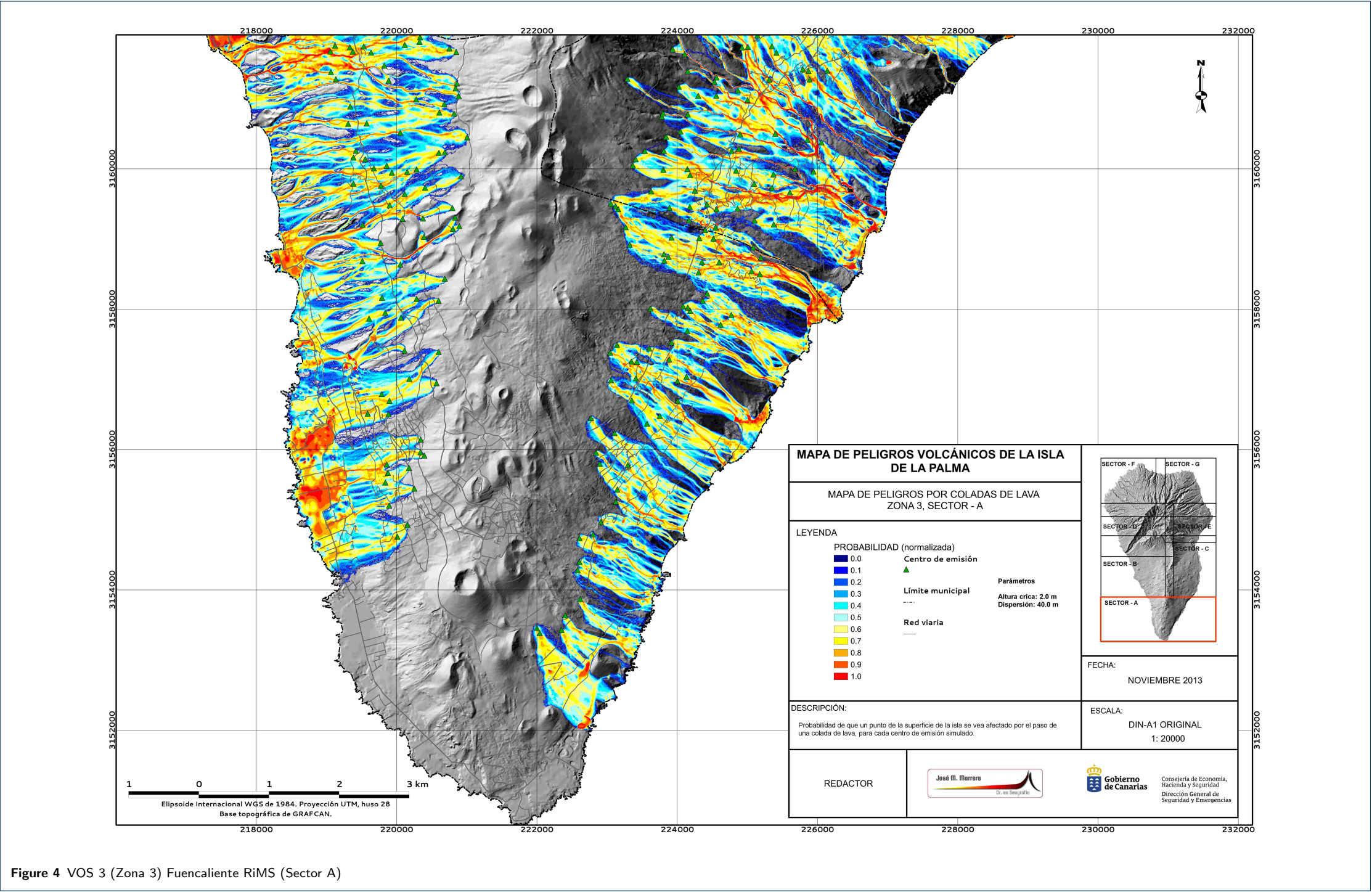


Figure 4 VOS 3 (Zona 3) Fuencaliente RiMS (Sector A)

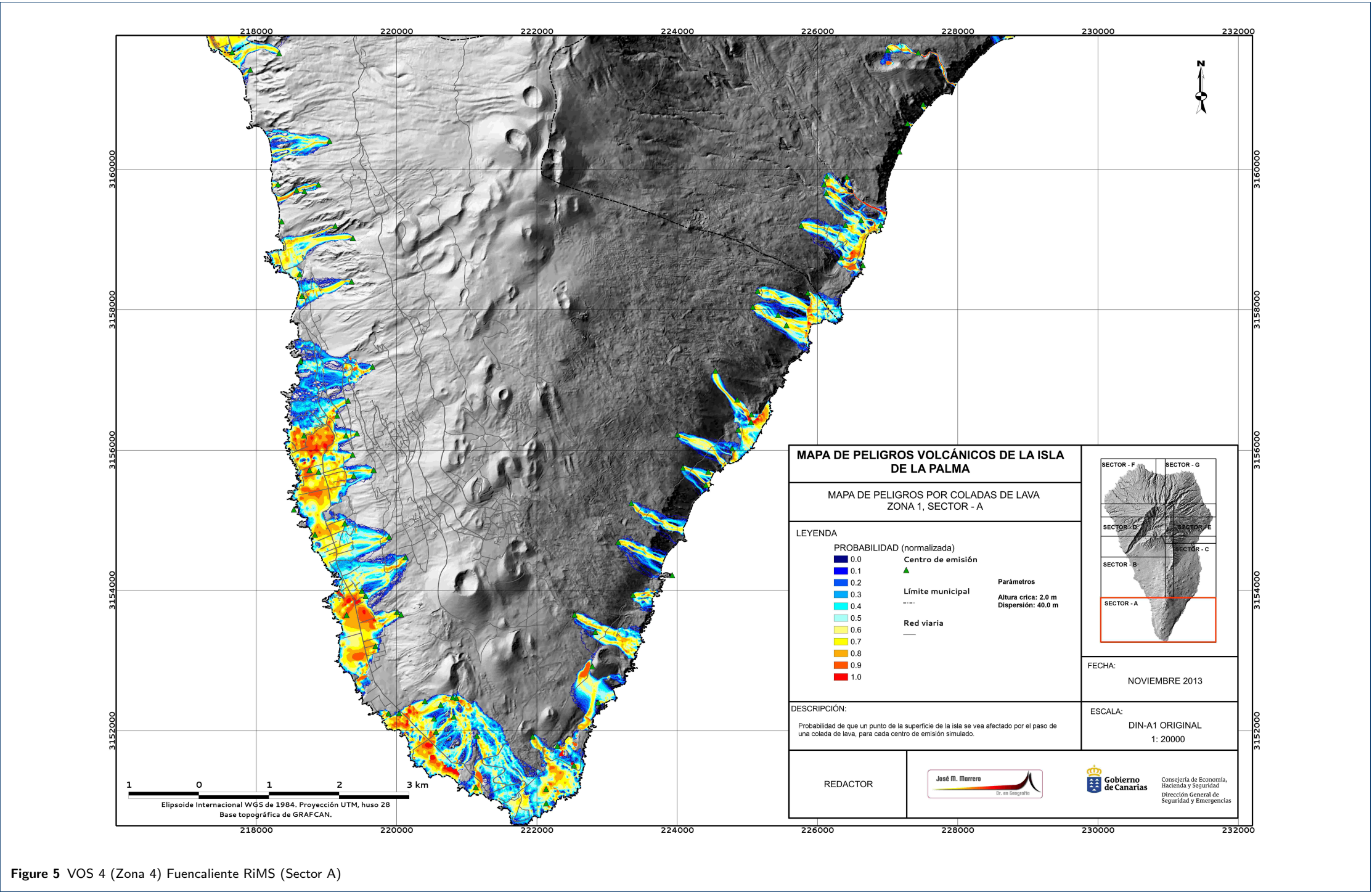


Figure 5 VOS 4 (Zona 4) Fuencaliente RiMS (Sector A)

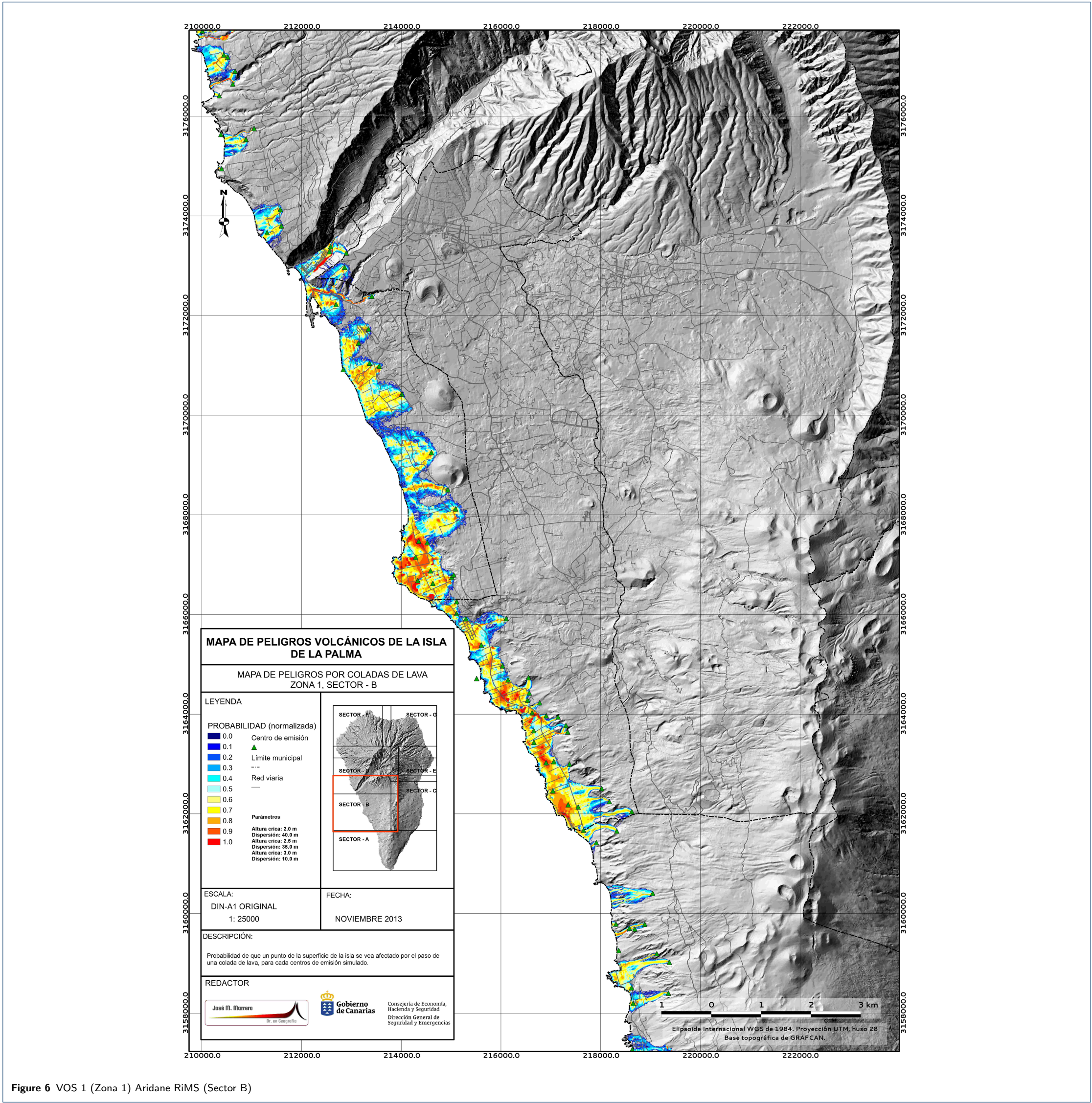


Figure 6 VOS 1 (Zona 1) Aridane RiMS (Sector B)

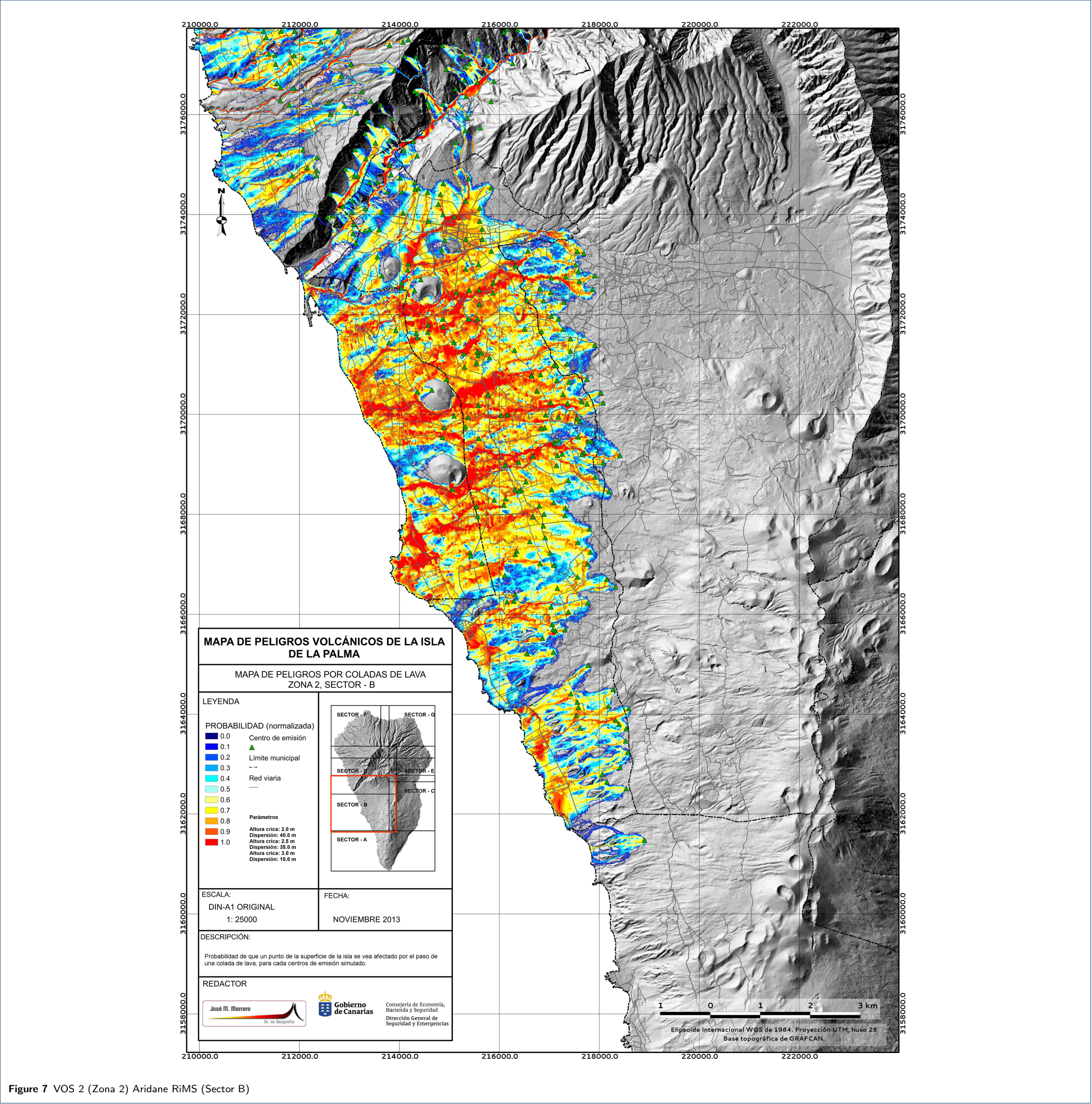


Figure 7 VOS 2 (Zona 2) Aridane RiMS (Sector B)

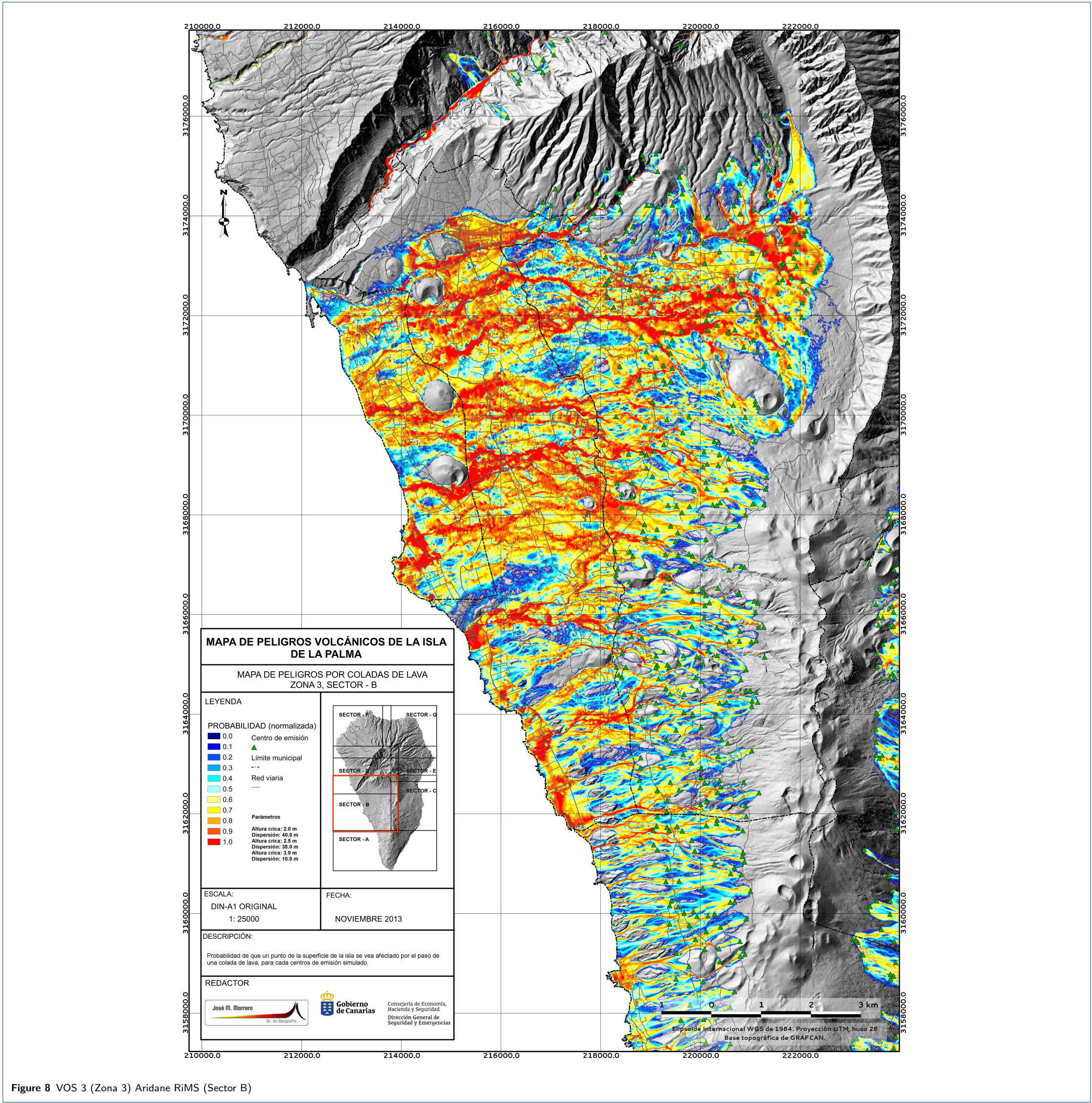


Figure 8 VOS 3 (Zona 3) Aridane RiMS (Sector B)

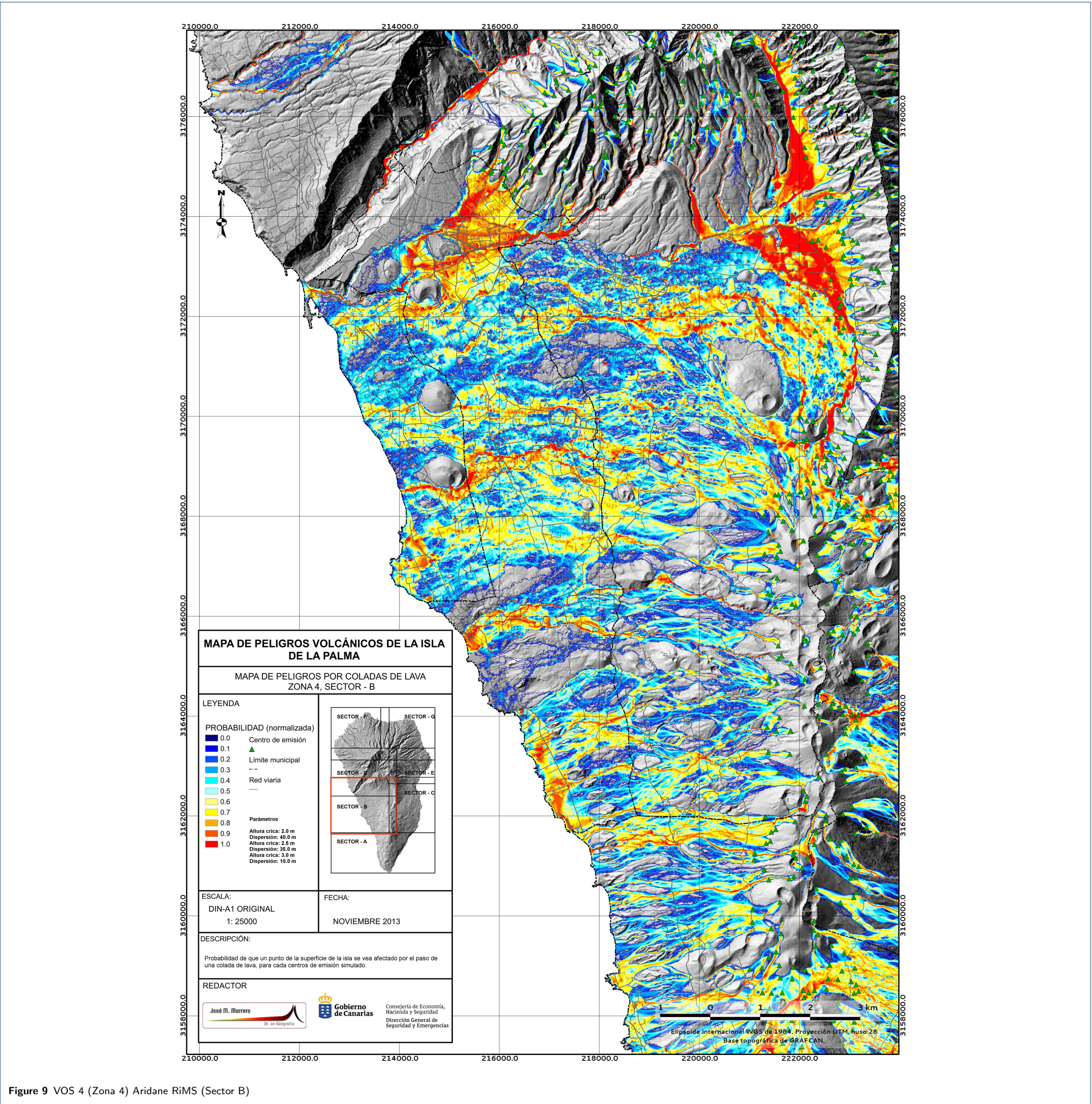


Figure 9 VOS 4 (Zona 4) Aridane RiMS (Sector B)

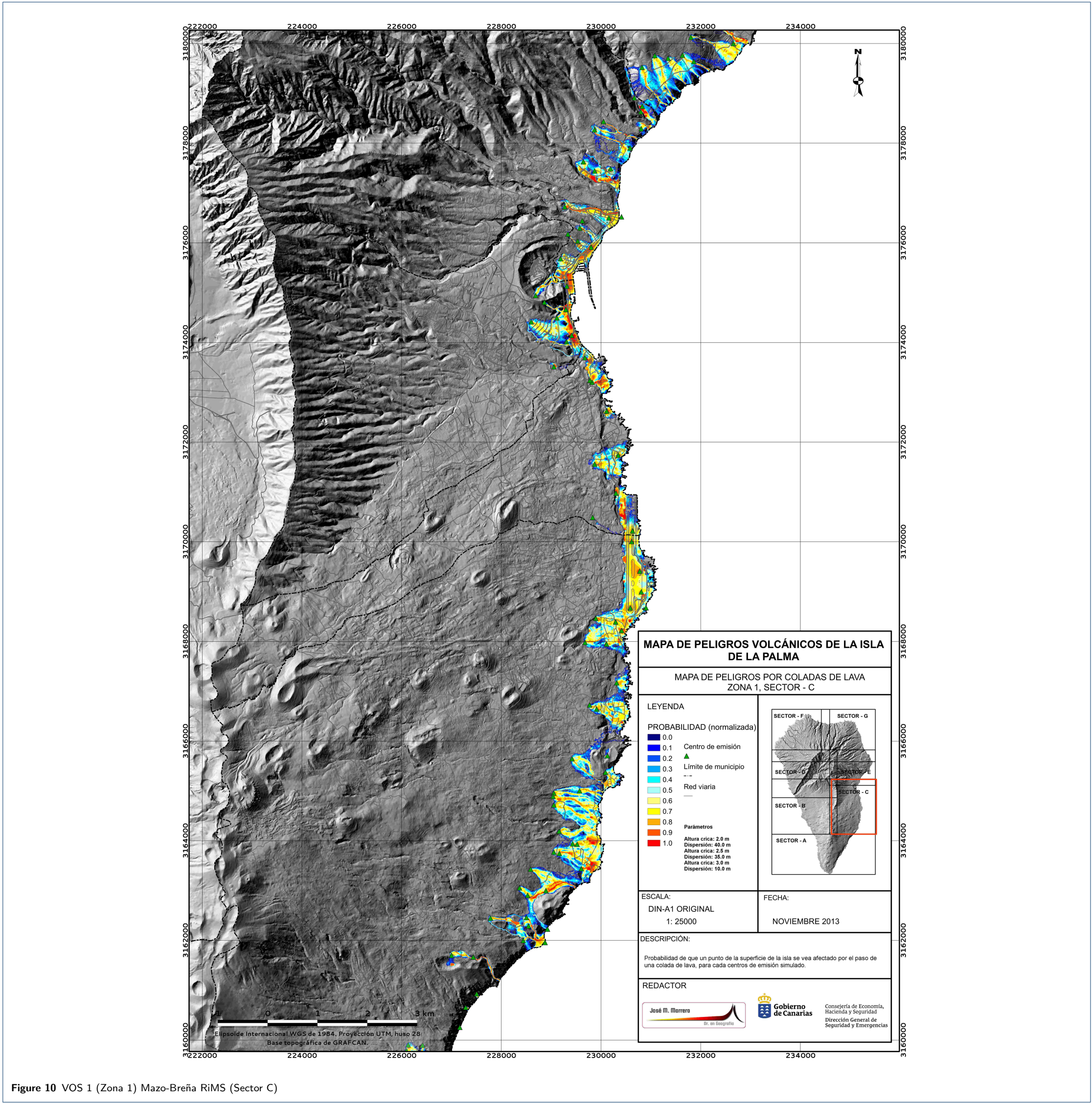


Figure 10 VOS 1 (Zona 1) Mazo-Breña RiMS (Sector C)

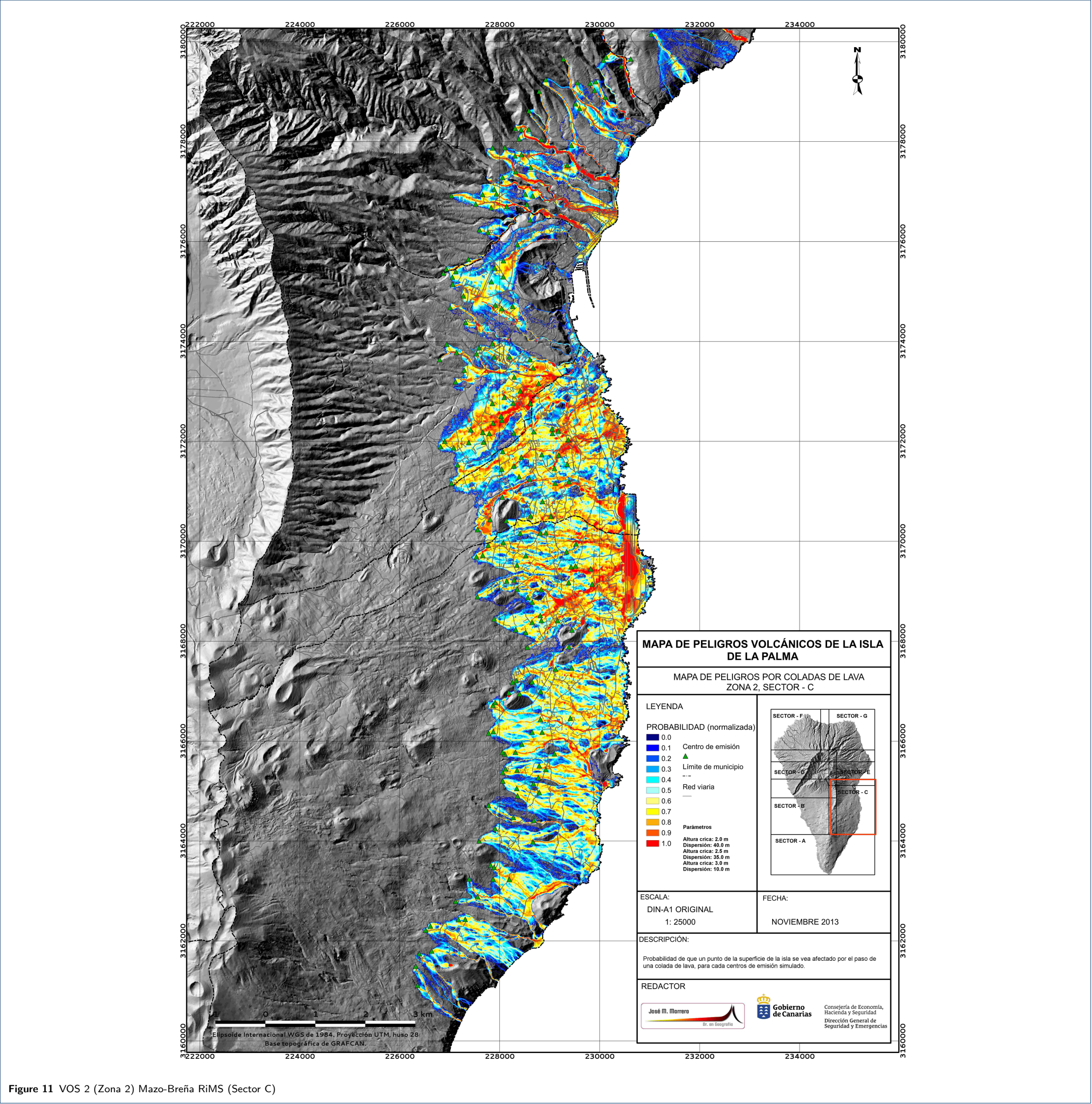
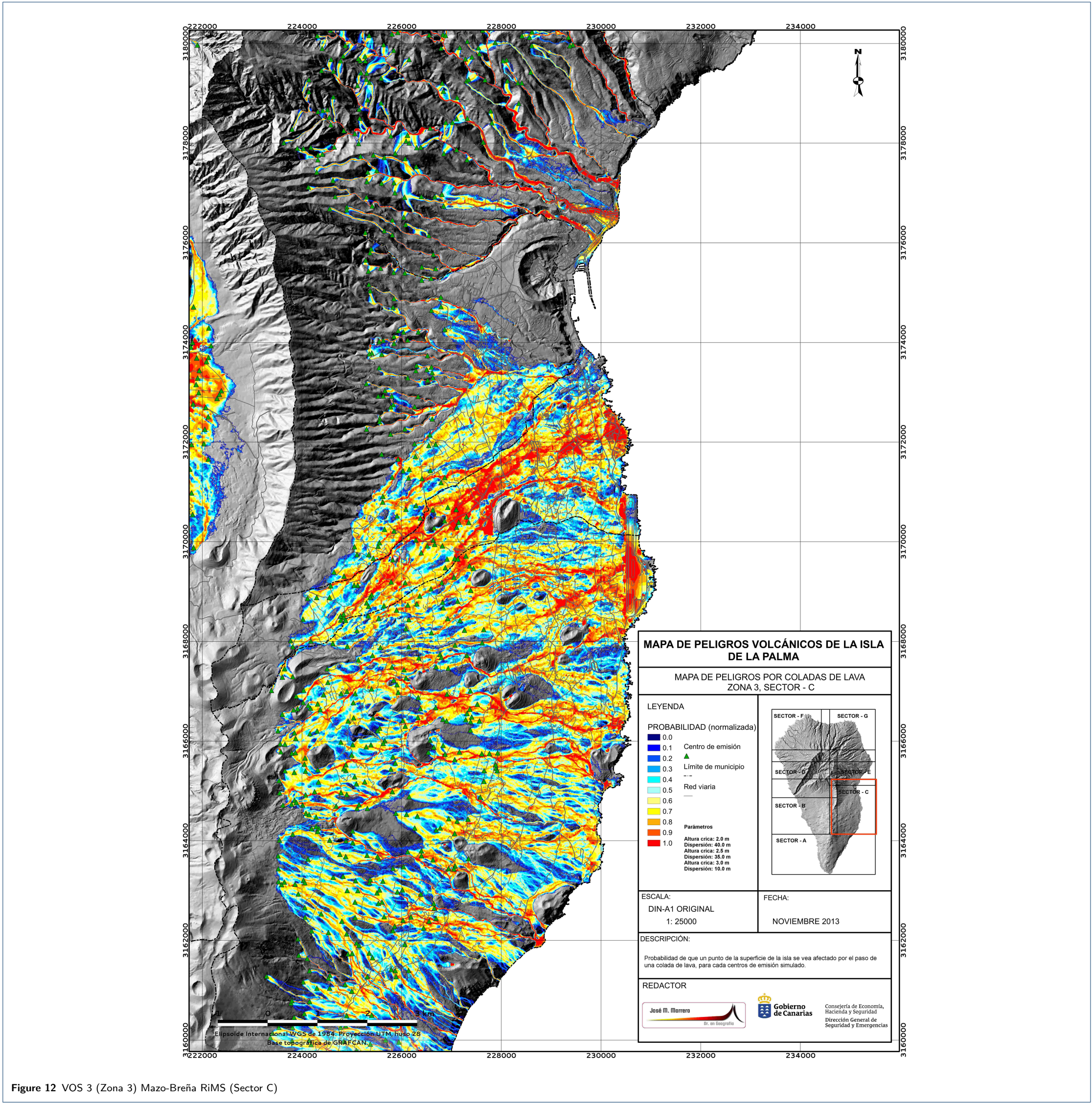


Figure 11 VOS 2 (Zona 2) Mazo-Breña RiMS (Sector C)



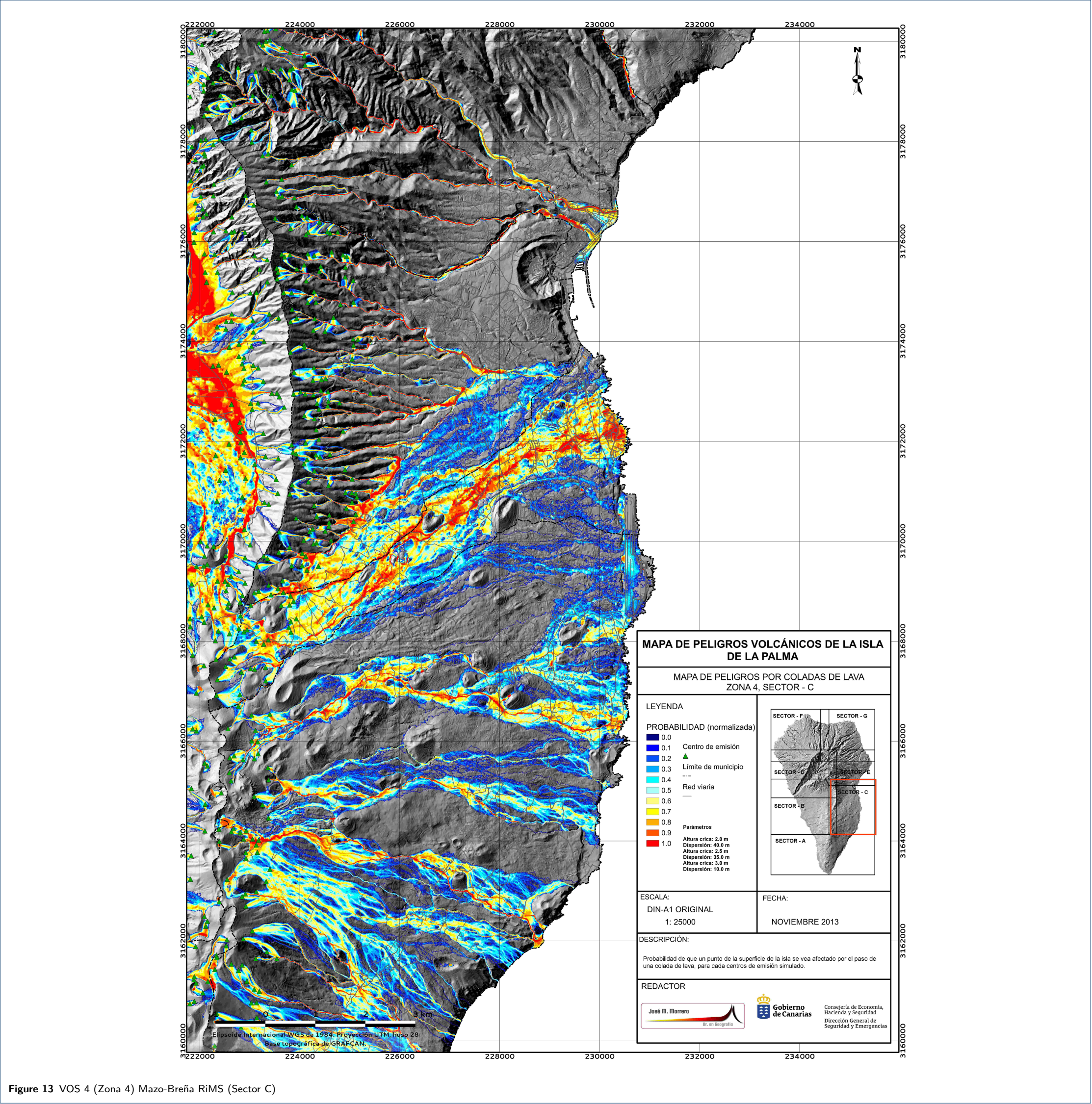


Figure 13 VOS 4 (Zona 4) Mazo-Breña RiMS (Sector C)

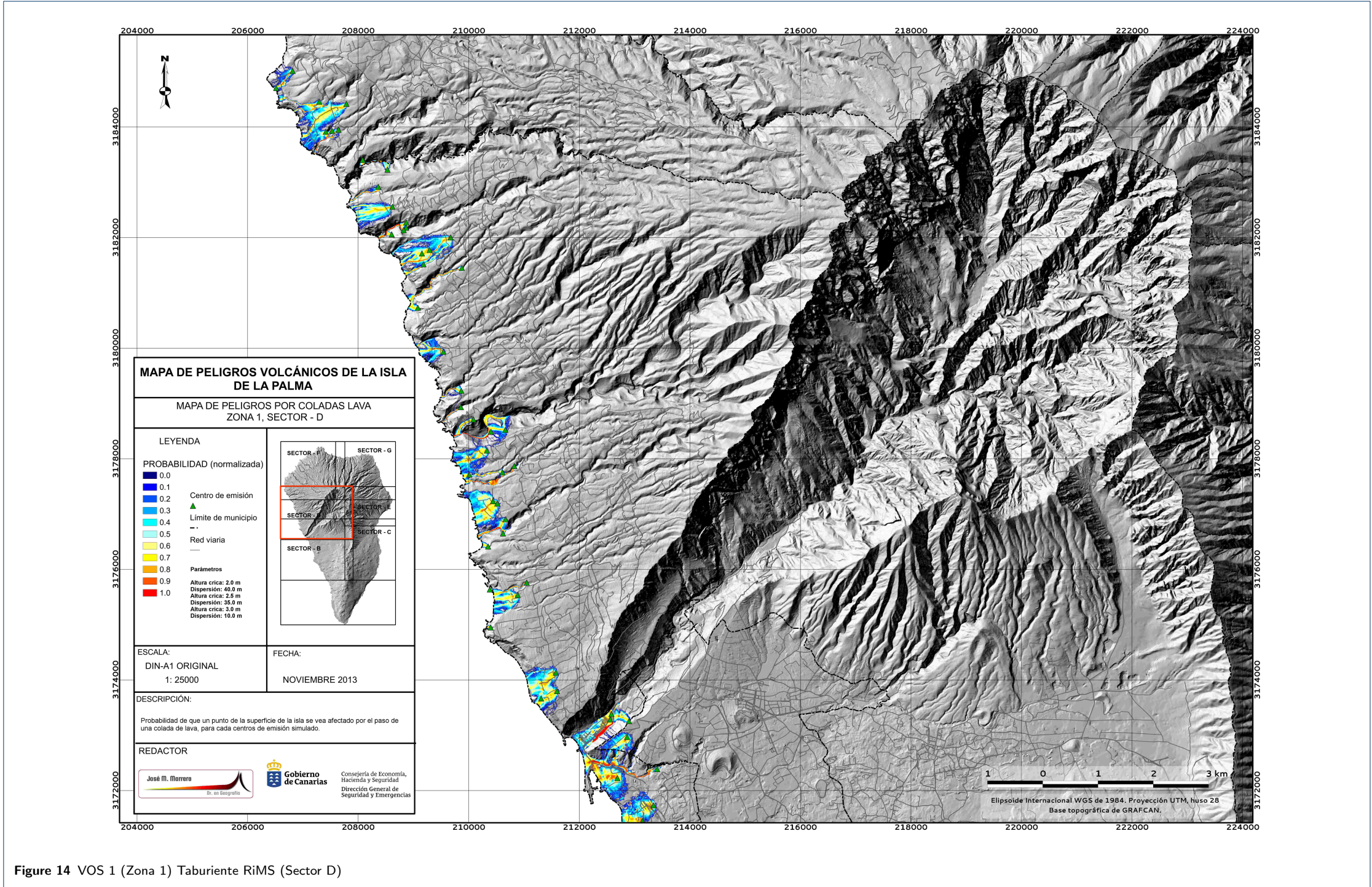


Figure 14 VOS 1 (Zona 1) Taburiente RiMS (Sector D)

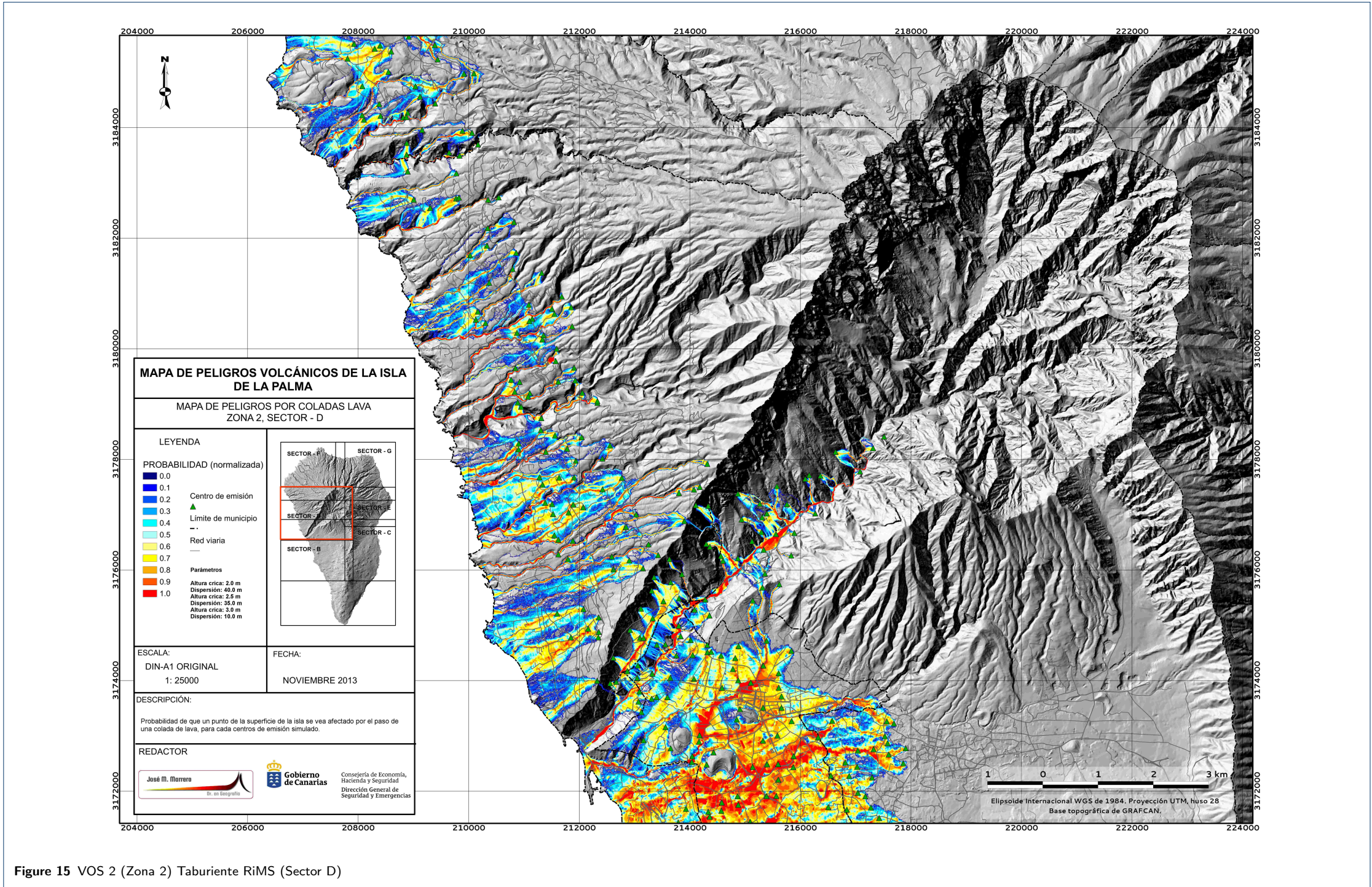


Figure 15 VOS 2 (Zona 2) Taburiente RiMS (Sector D)

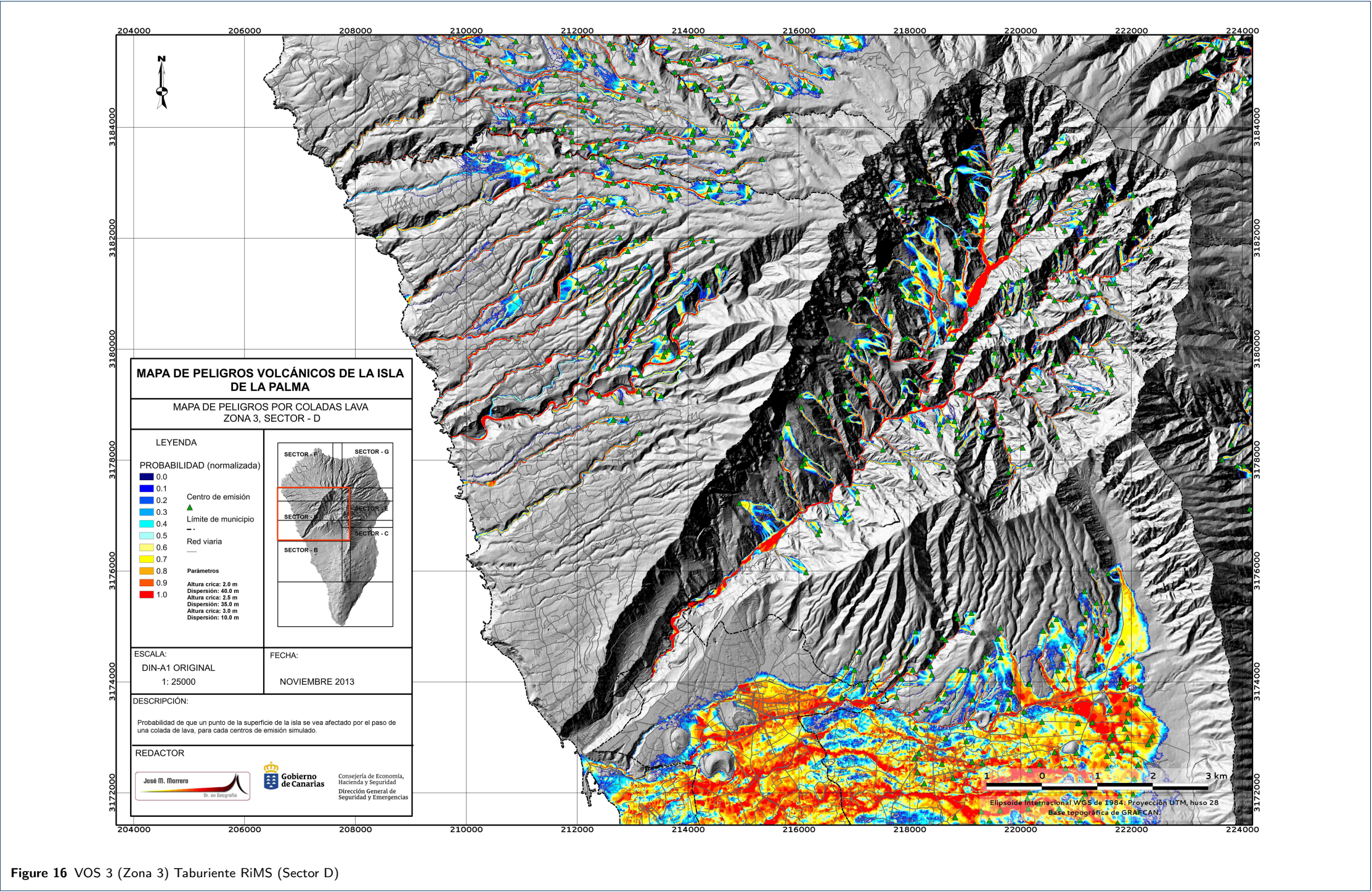


Figure 16 VOS 3 (Zona 3) Taburiente RiMS (Sector D)

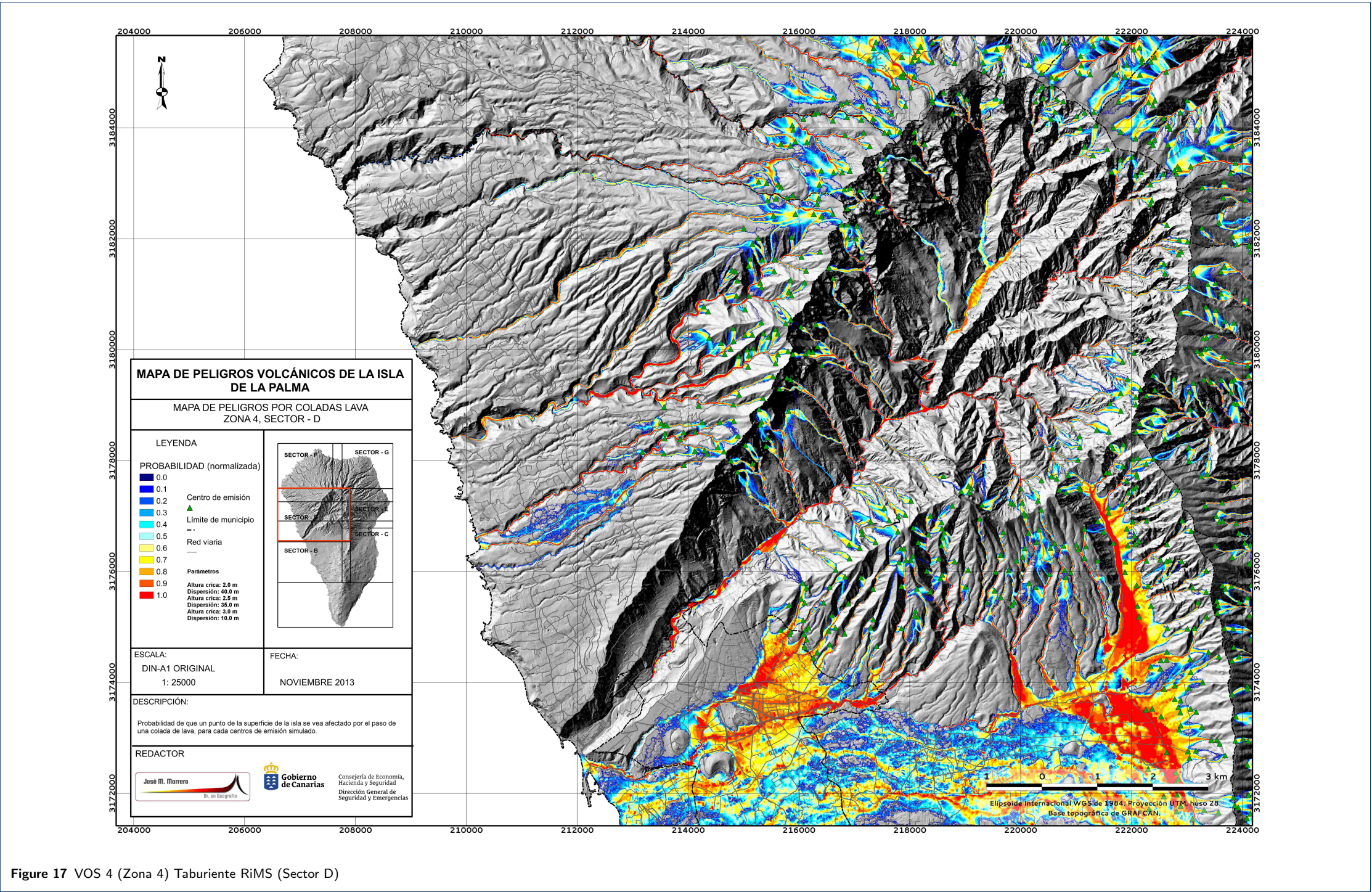


Figure 17 VOS 4 (Zona 4) Taburiente RiMS (Sector D)

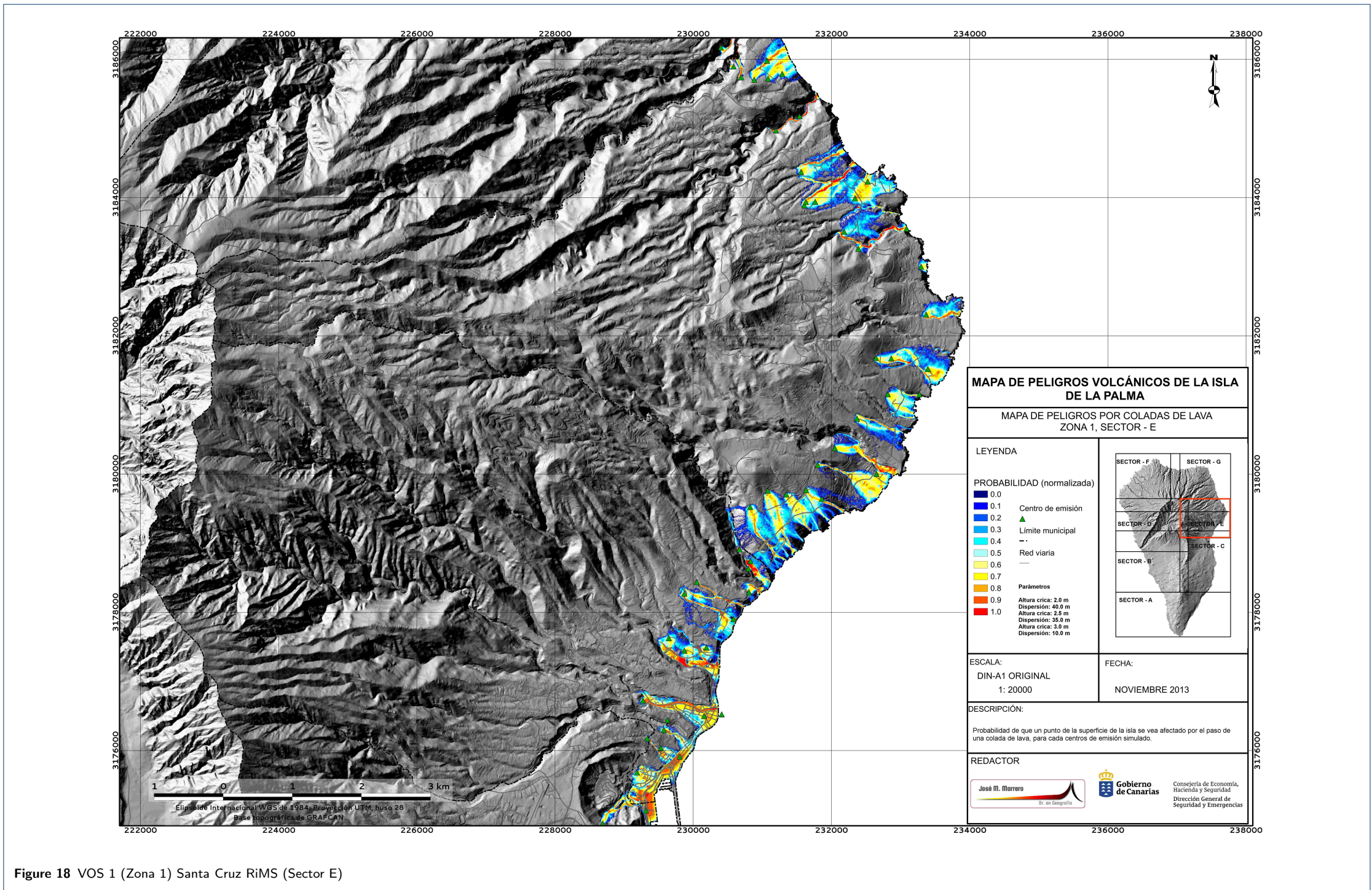


Figure 18 VOS 1 (Zona 1) Santa Cruz RiMS (Sector E)

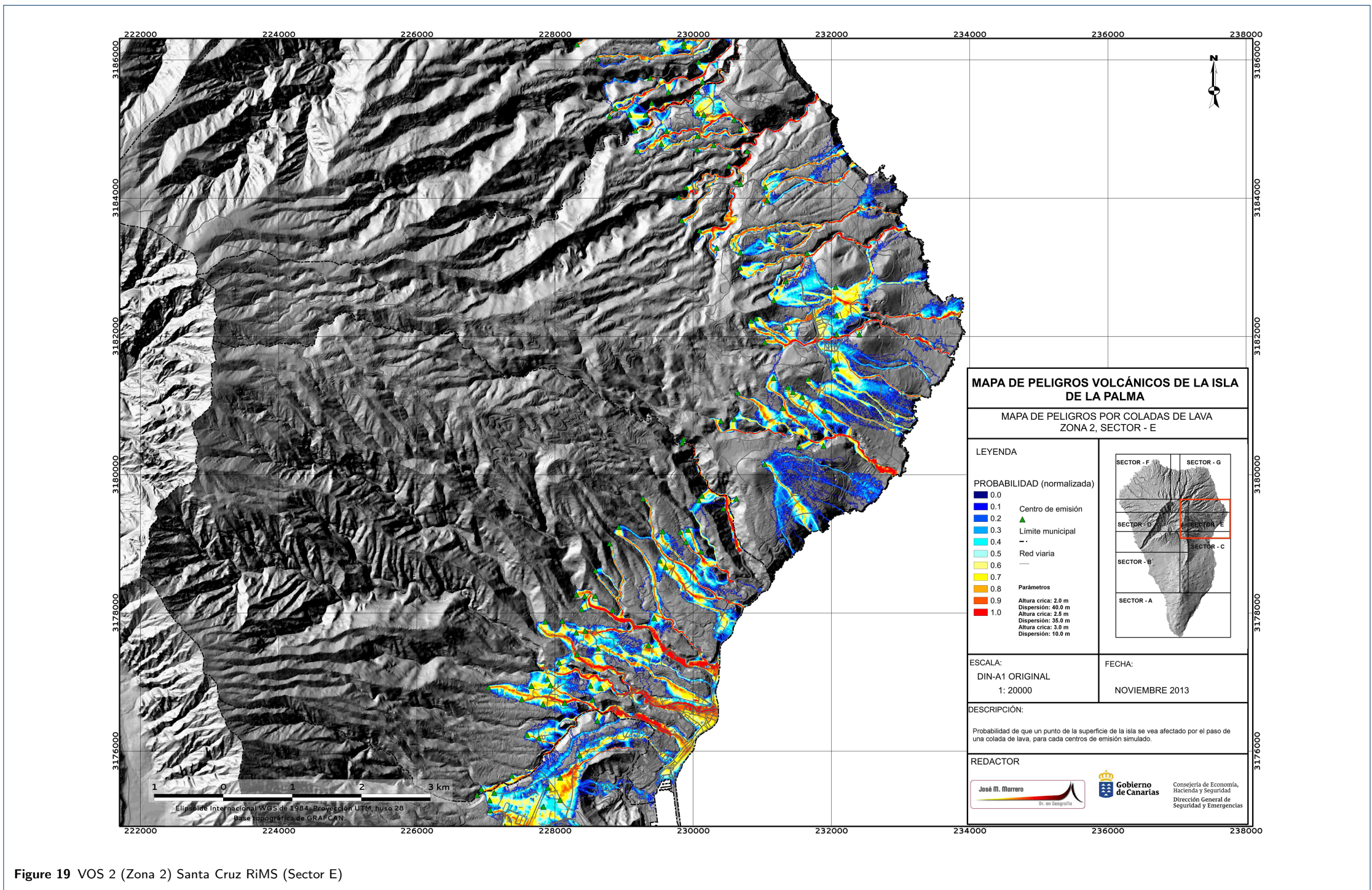


Figure 19 VOS 2 (Zona 2) Santa Cruz RiMS (Sector E)

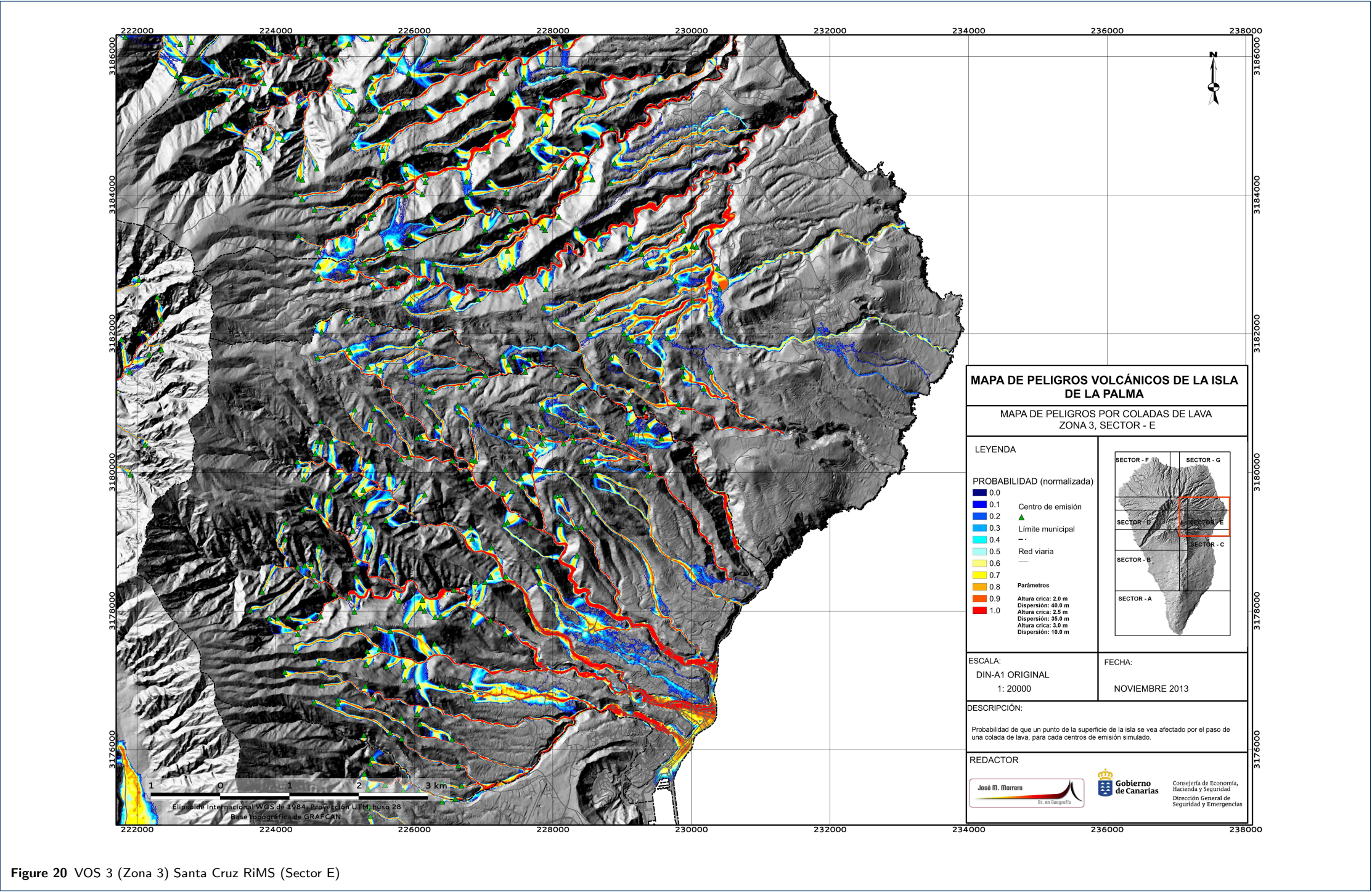


Figure 20 VOS 3 (Zona 3) Santa Cruz RiMS (Sector E)

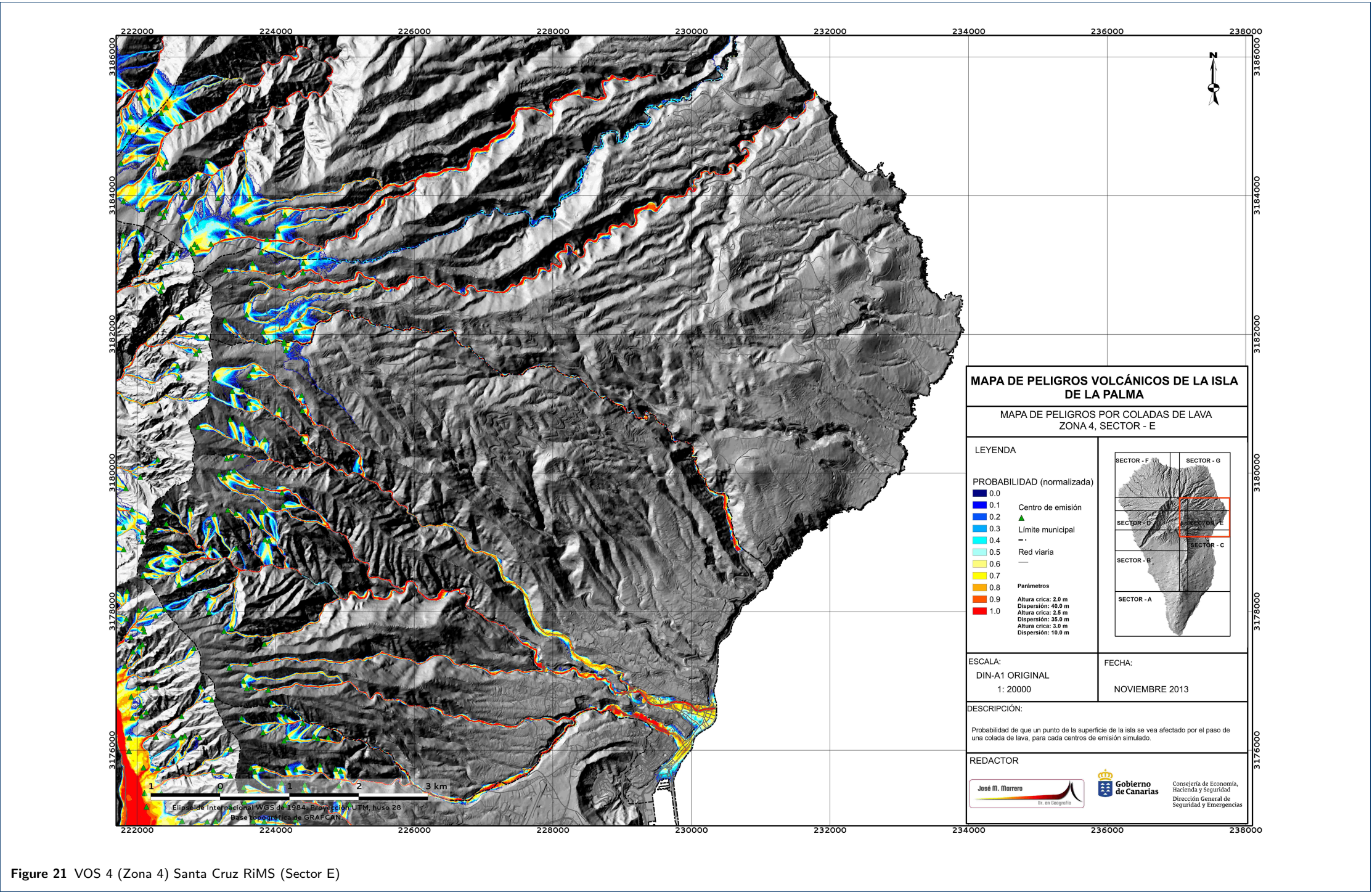


Figure 21 VOS 4 (Zona 4) Santa Cruz RiMS (Sector E)

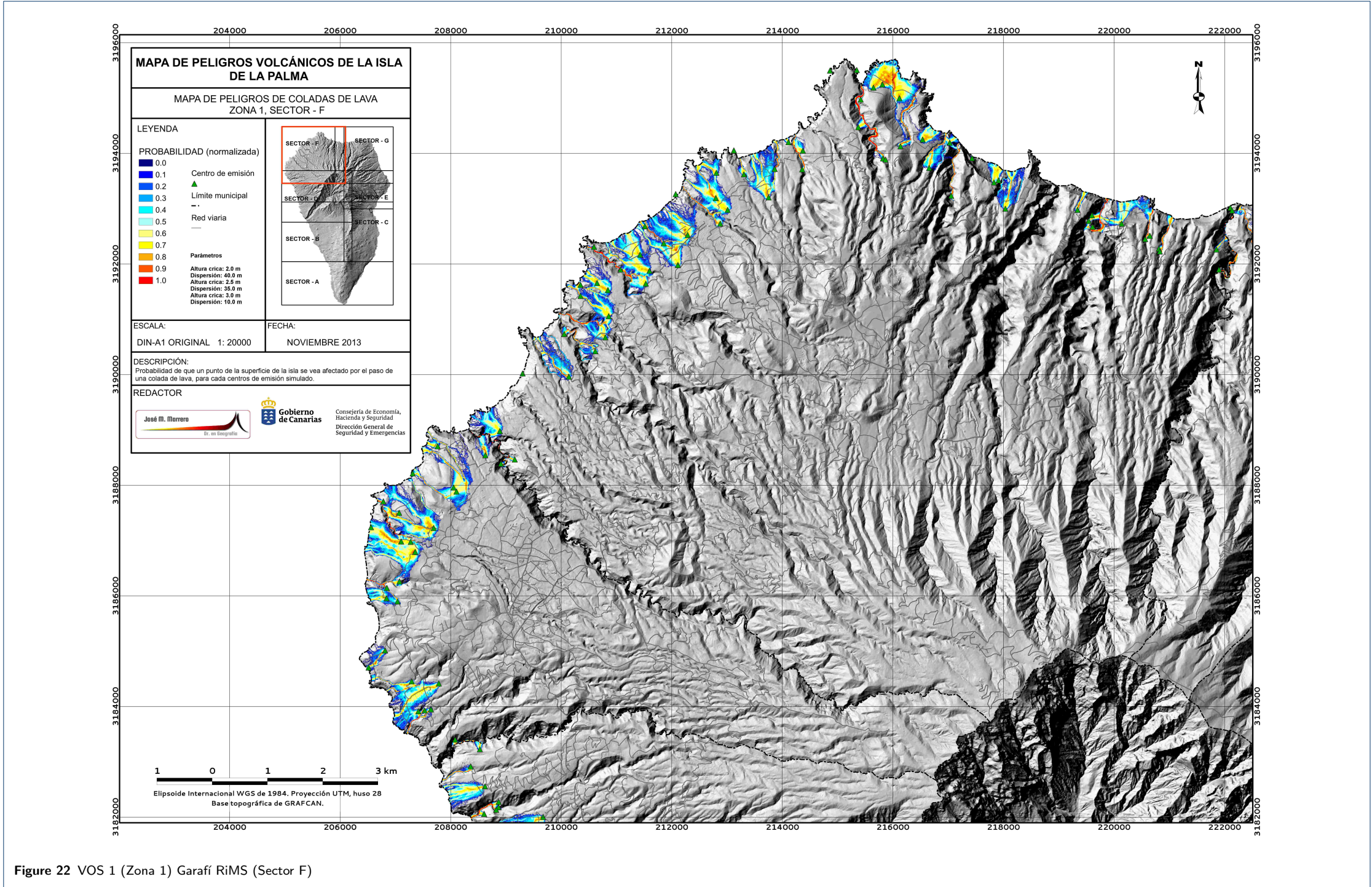


Figure 22 VOS 1 (Zona 1) Garafí RiMS (Sector F)

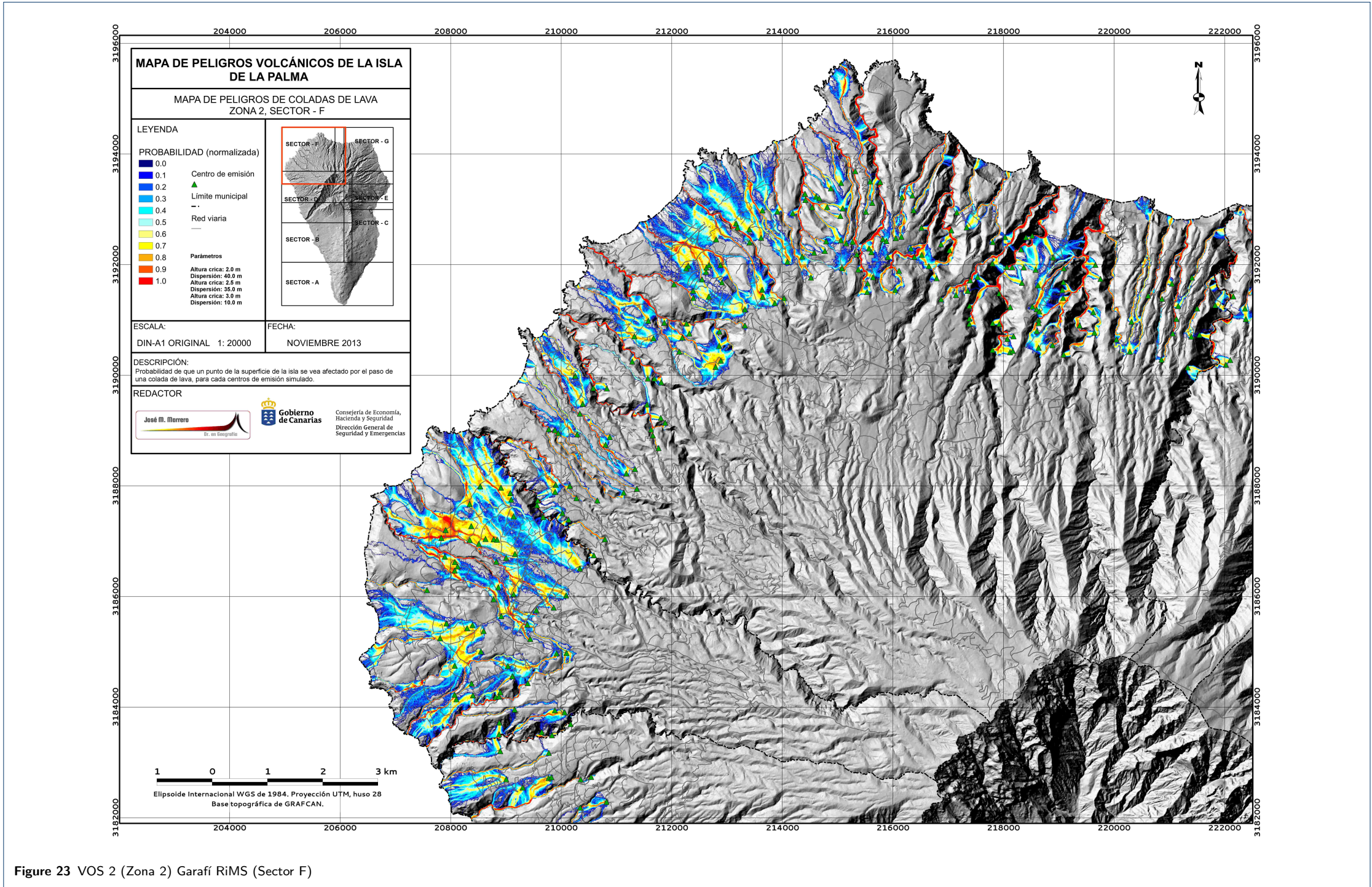


Figure 23 VOS 2 (Zona 2) Garafí RiMS (Sector F)

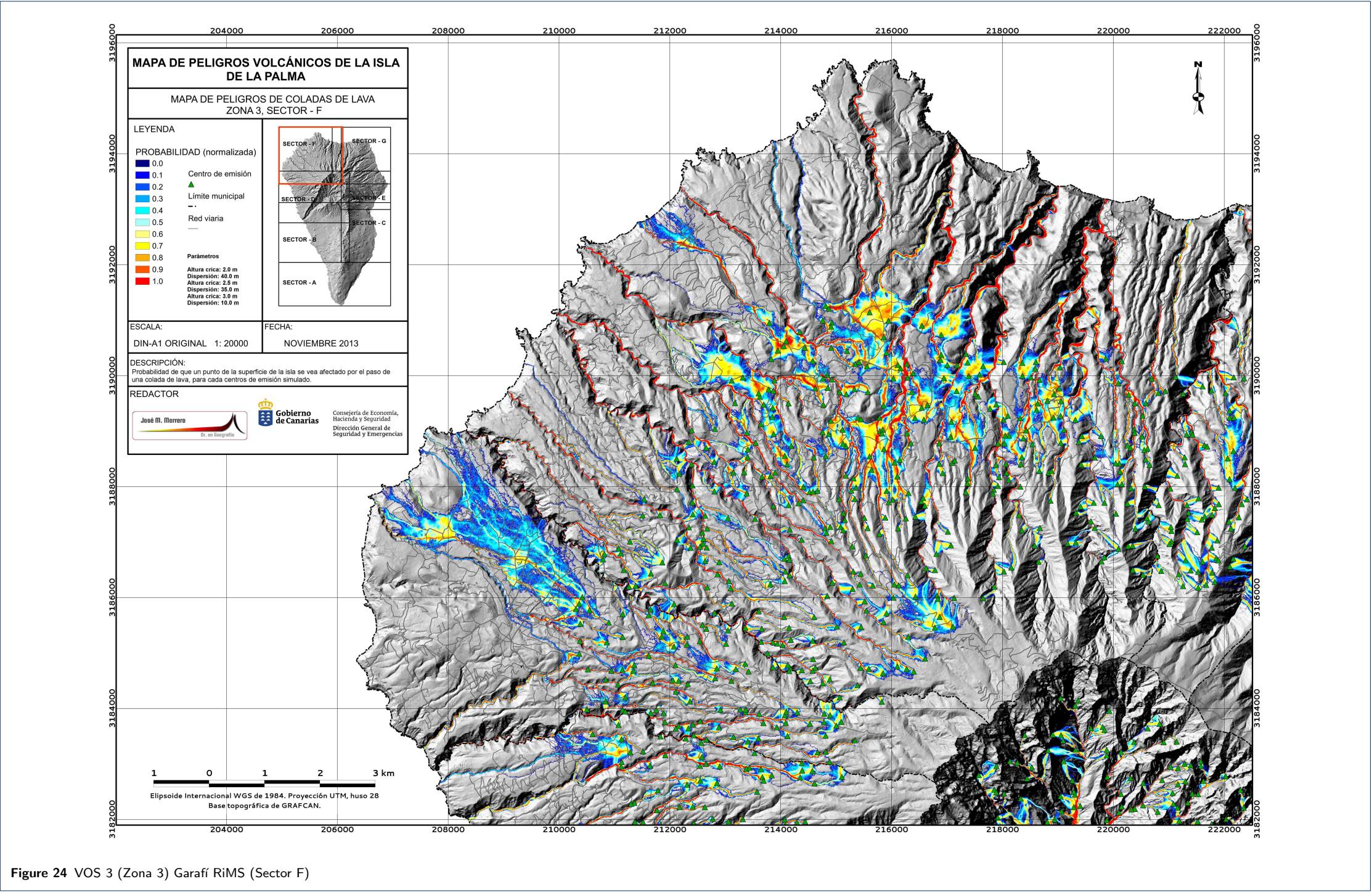


Figure 24 VOS 3 (Zona 3) Garafí RiMS (Sector F)

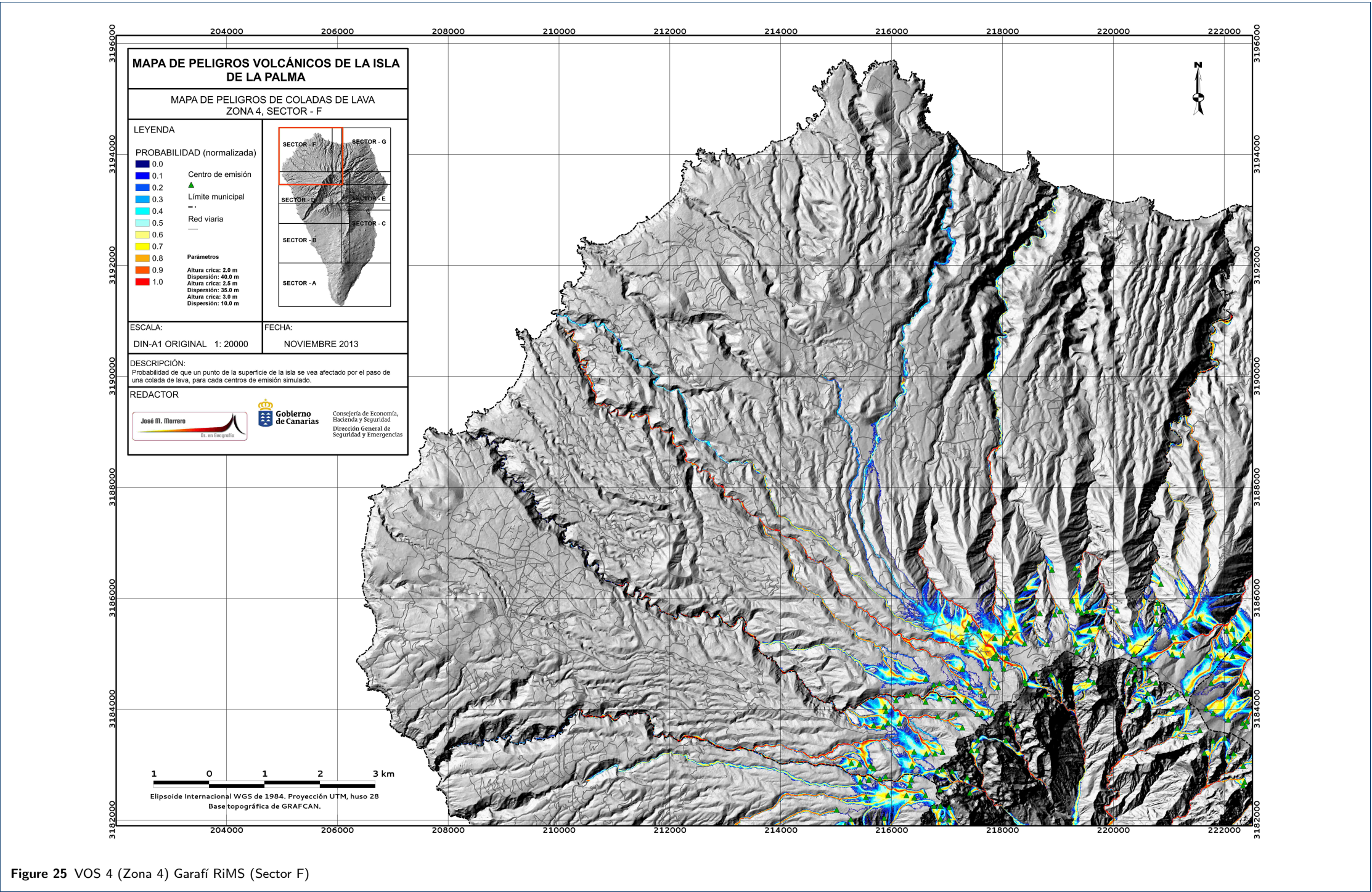


Figure 25 VOS 4 (Zona 4) Garafí RiMS (Sector F)

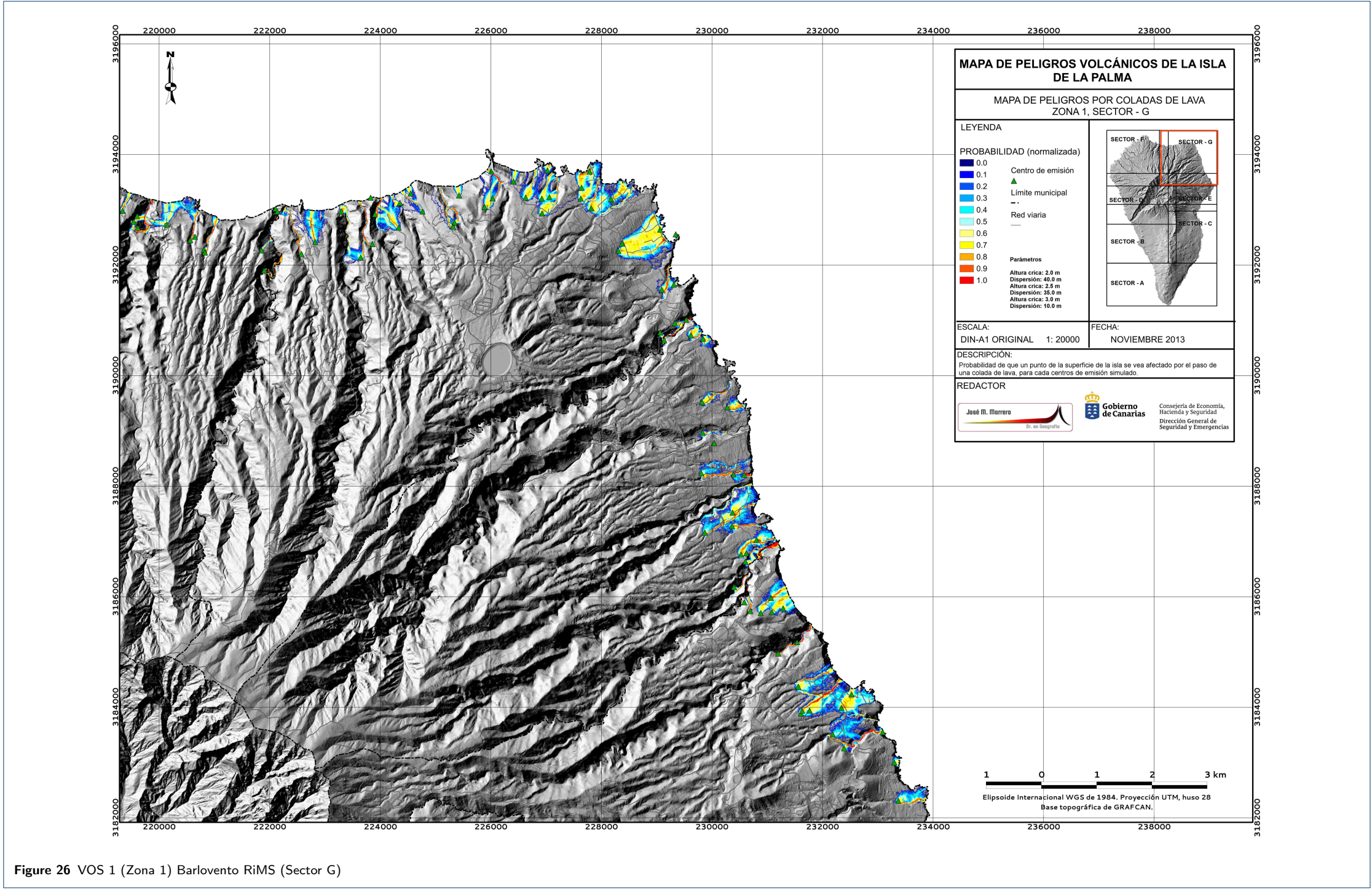


Figure 26 VOS 1 (Zona 1) Barlovento RiMS (Sector G)

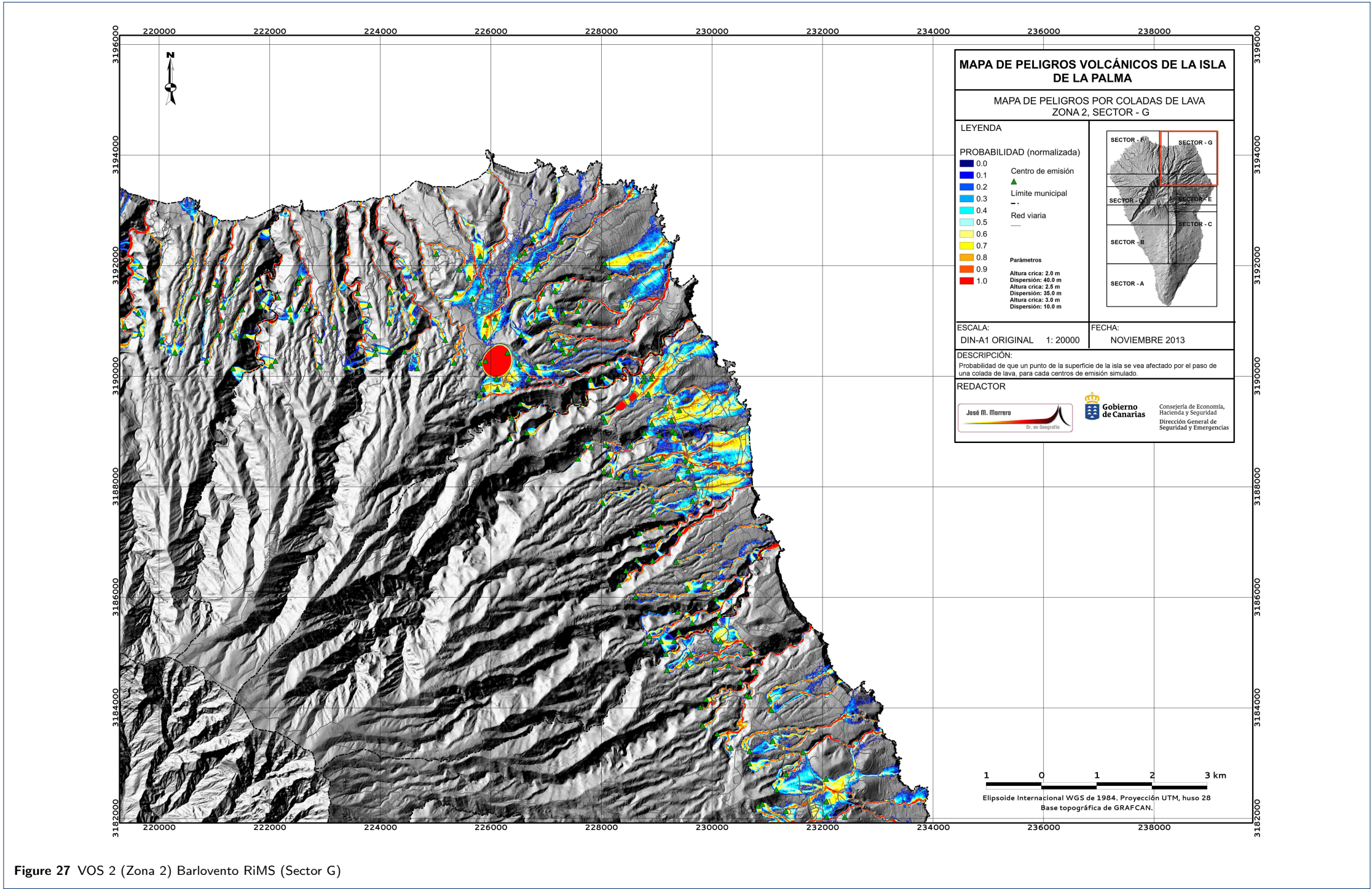


Figure 27 VOS 2 (Zona 2) Barlovento RiMS (Sector G)

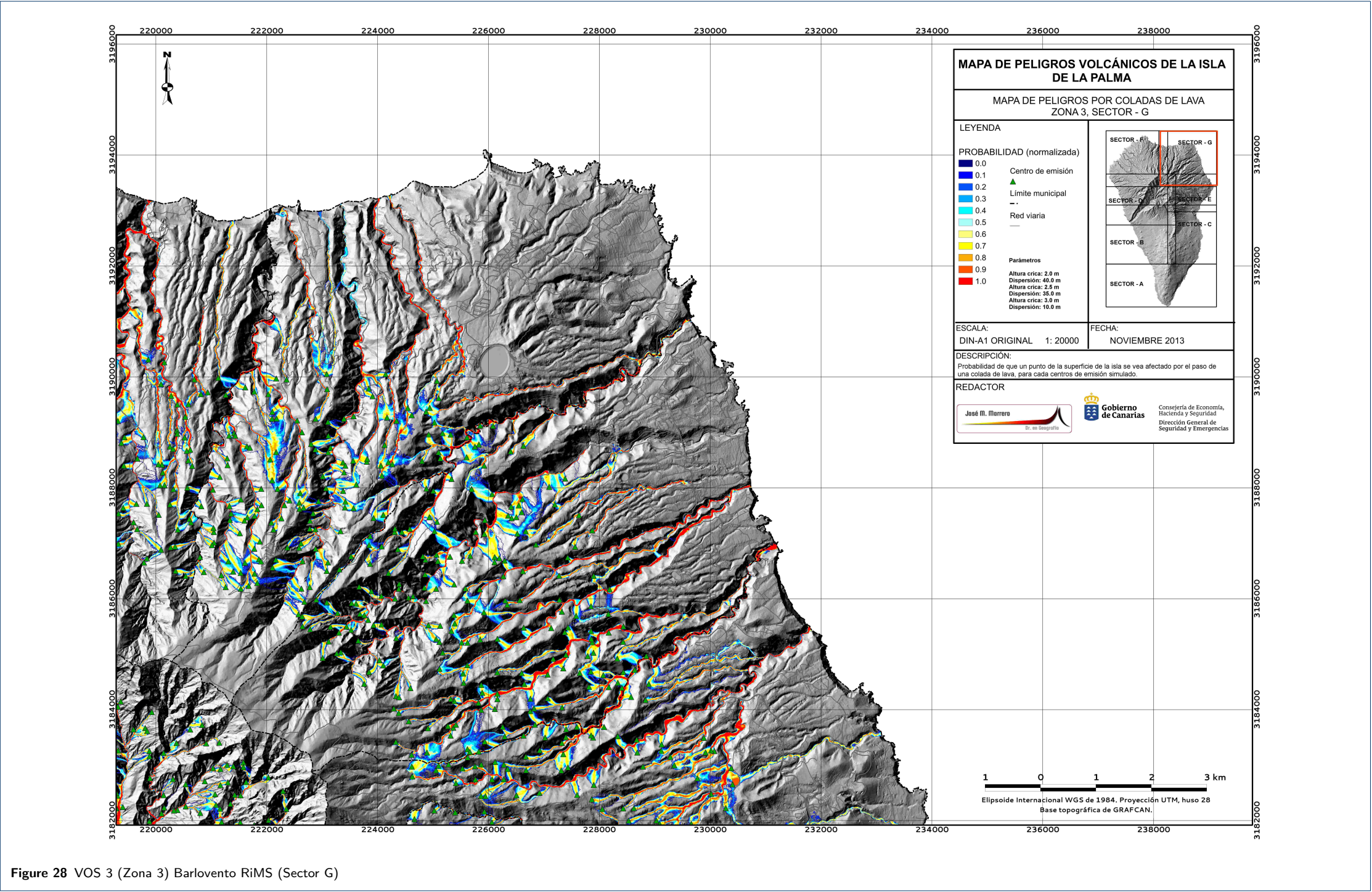


Figure 28 VOS 3 (Zona 3) Barlovento RiMS (Sector G)

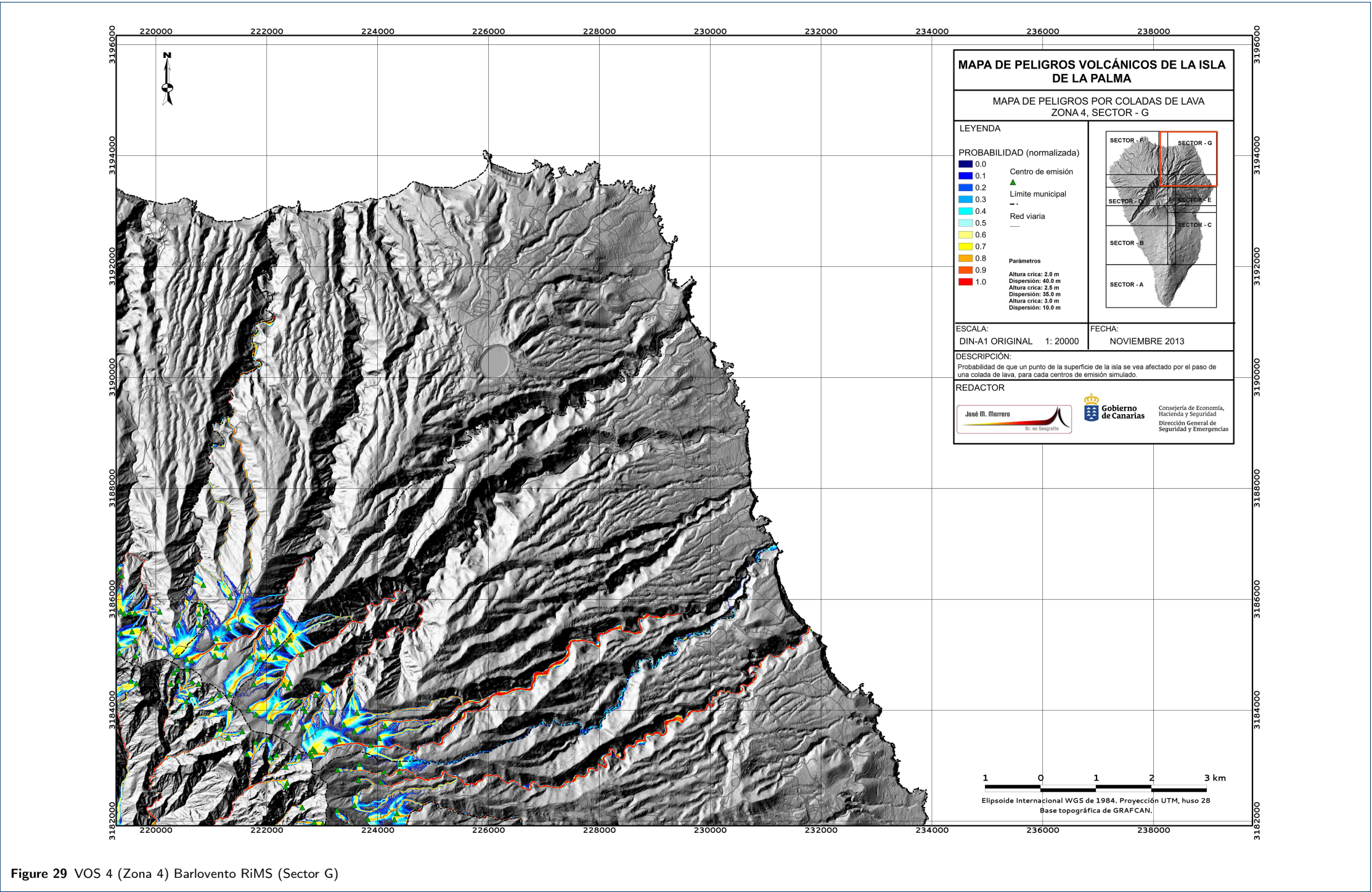


Figure 29 VOS 4 (Zona 4) Barlovento RiMS (Sector G)

2 Pyroclastic flow hazard maps

Here we present 6 hazard maps from Fuencaliente RiMS related with pyroclastic flows and the three VOS where such volcanic hazard could be expected.

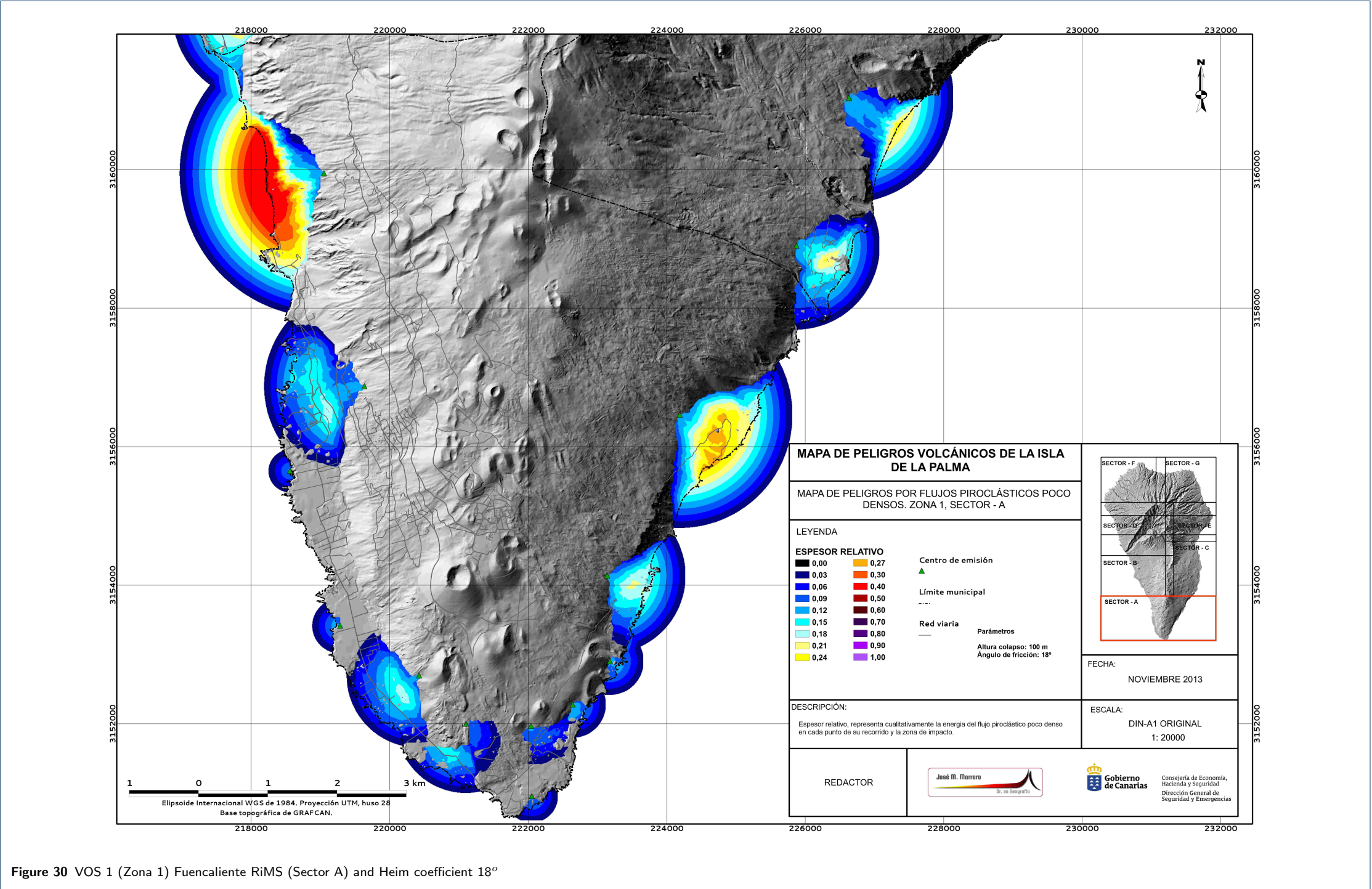


Figure 30 VOS 1 (Zona 1) Fuencaliente RiMS (Sector A) and Heim coefficient 18°

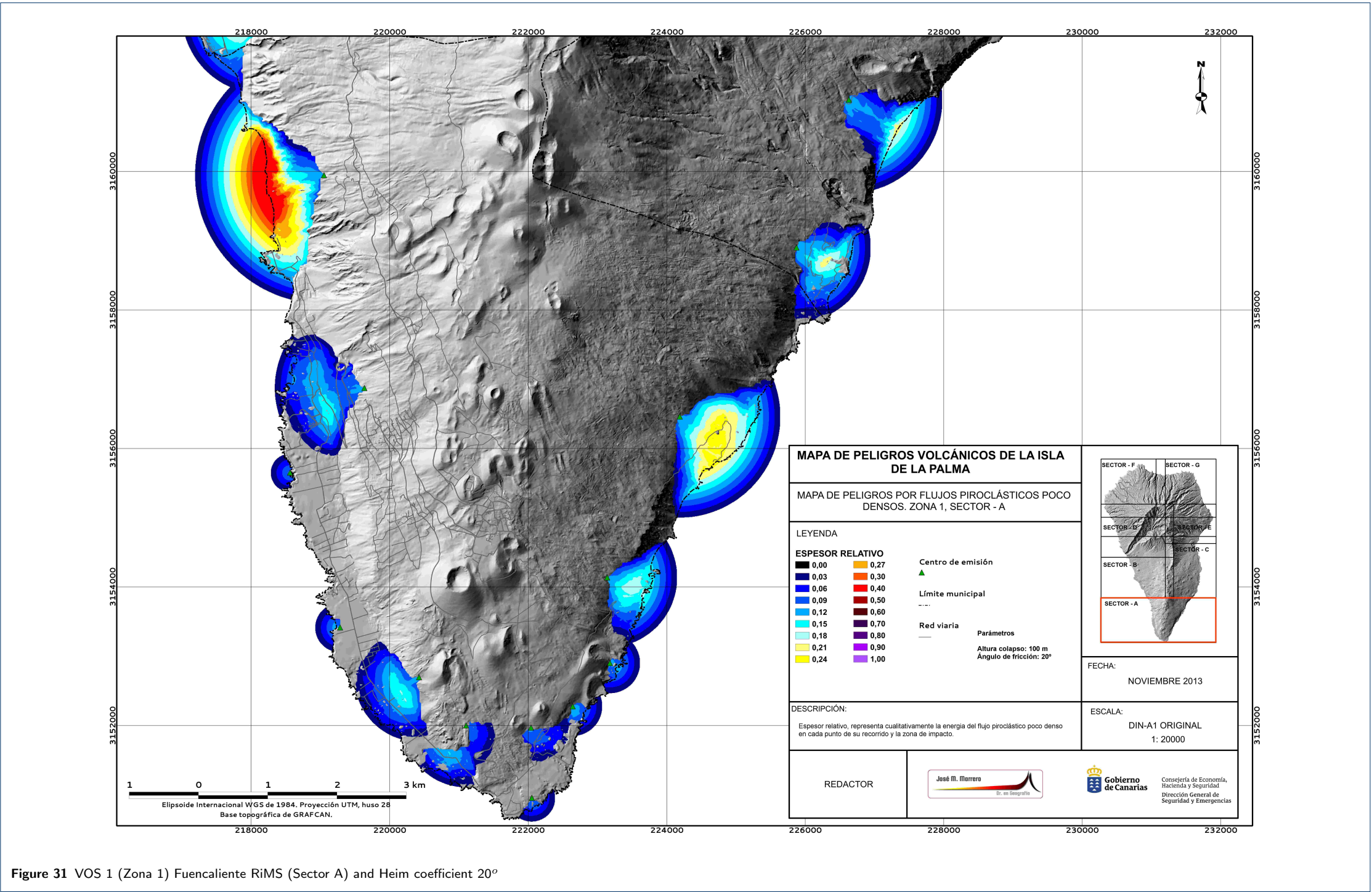


Figure 31 VOS 1 (Zona 1) Fuencaliente RiMS (Sector A) and Heim coefficient 20°

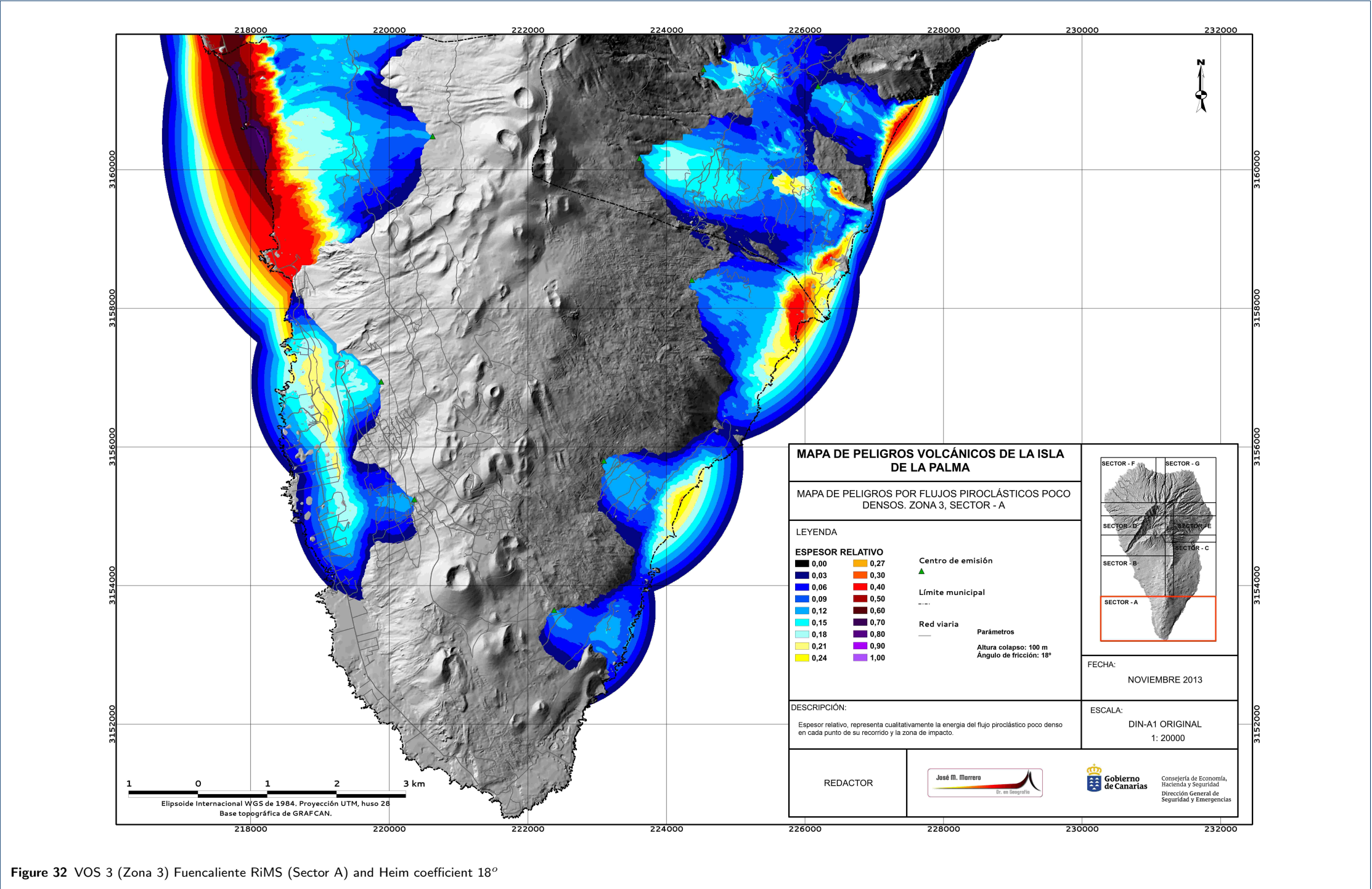


Figure 32 VOS 3 (Zona 3) Fuencaliente RiMS (Sector A) and Heim coefficient 18°

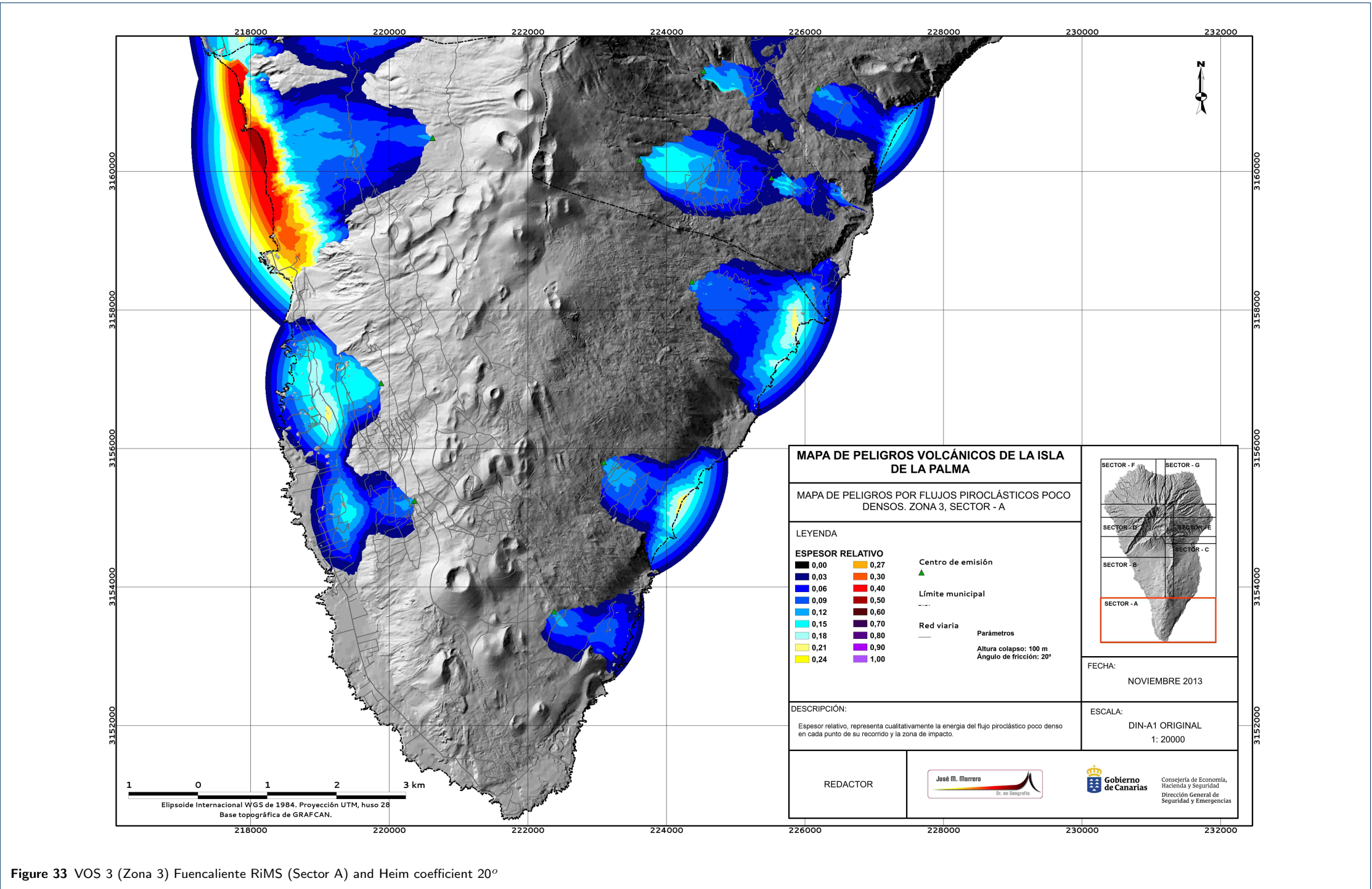


Figure 33 VOS 3 (Zona 3) Fuencaliente RiMS (Sector A) and Heim coefficient 20°

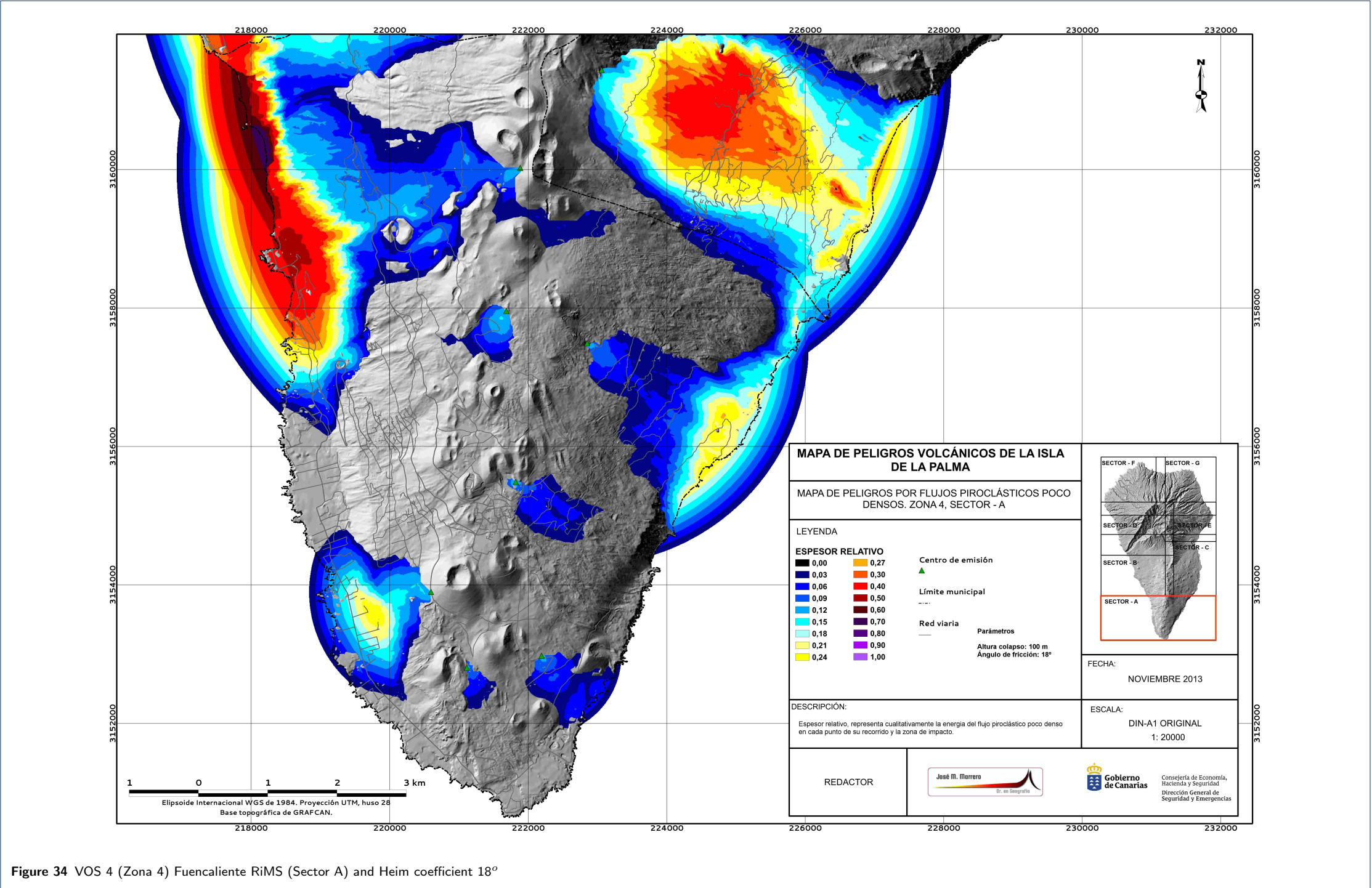


Figure 34 VOS 4 (Zona 4) Fuencaliente RiMS (Sector A) and Heim coefficient 18°

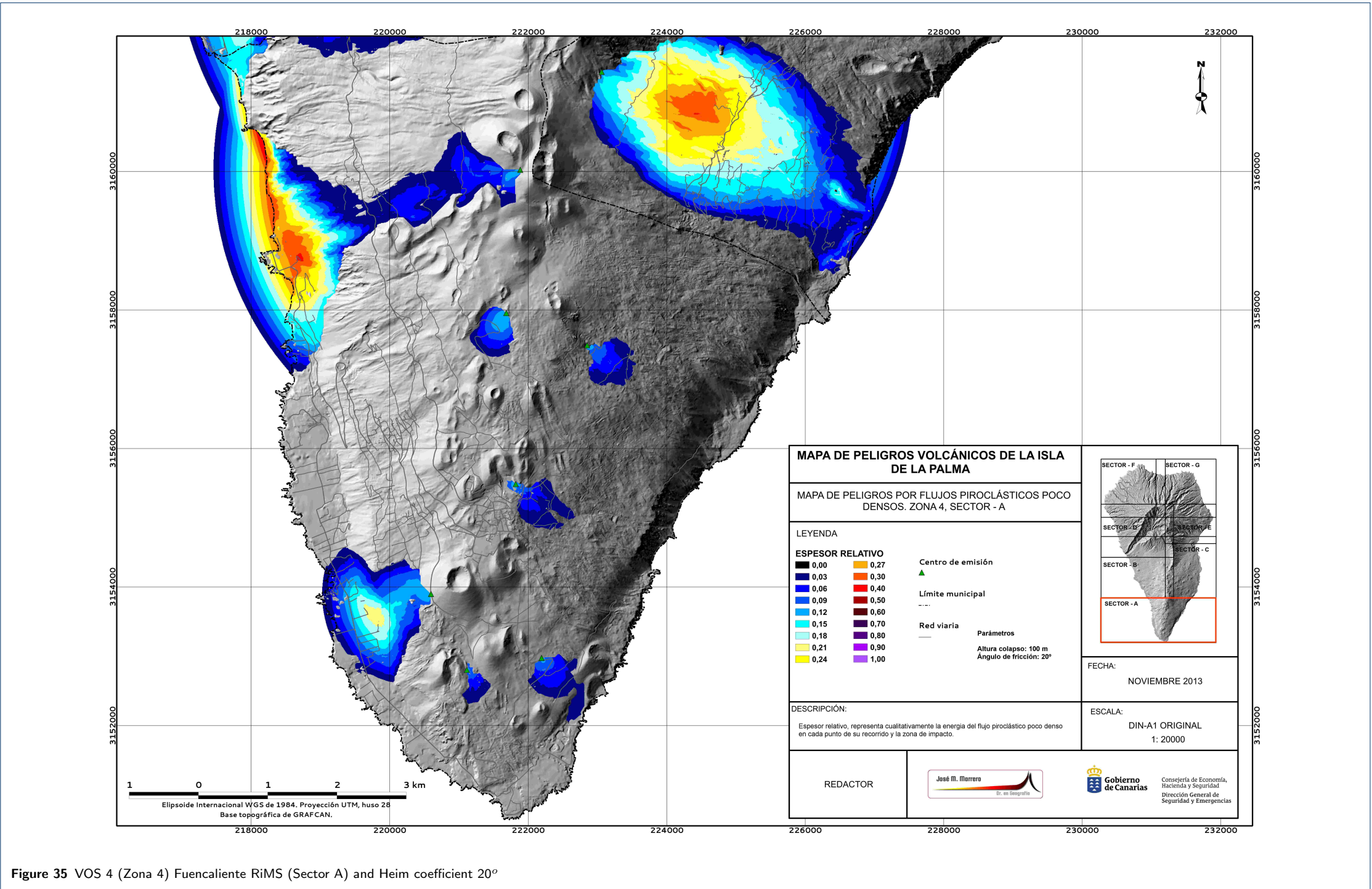


Figure 35 VOS 4 (Zona 4) Fuencaliente RiMS (Sector A) and Heim coefficient 20°

3 Ash fall hazard maps

Here we present the 3 developed maps following different strategies and according to the Expected Eruptive Scenarios (EES).

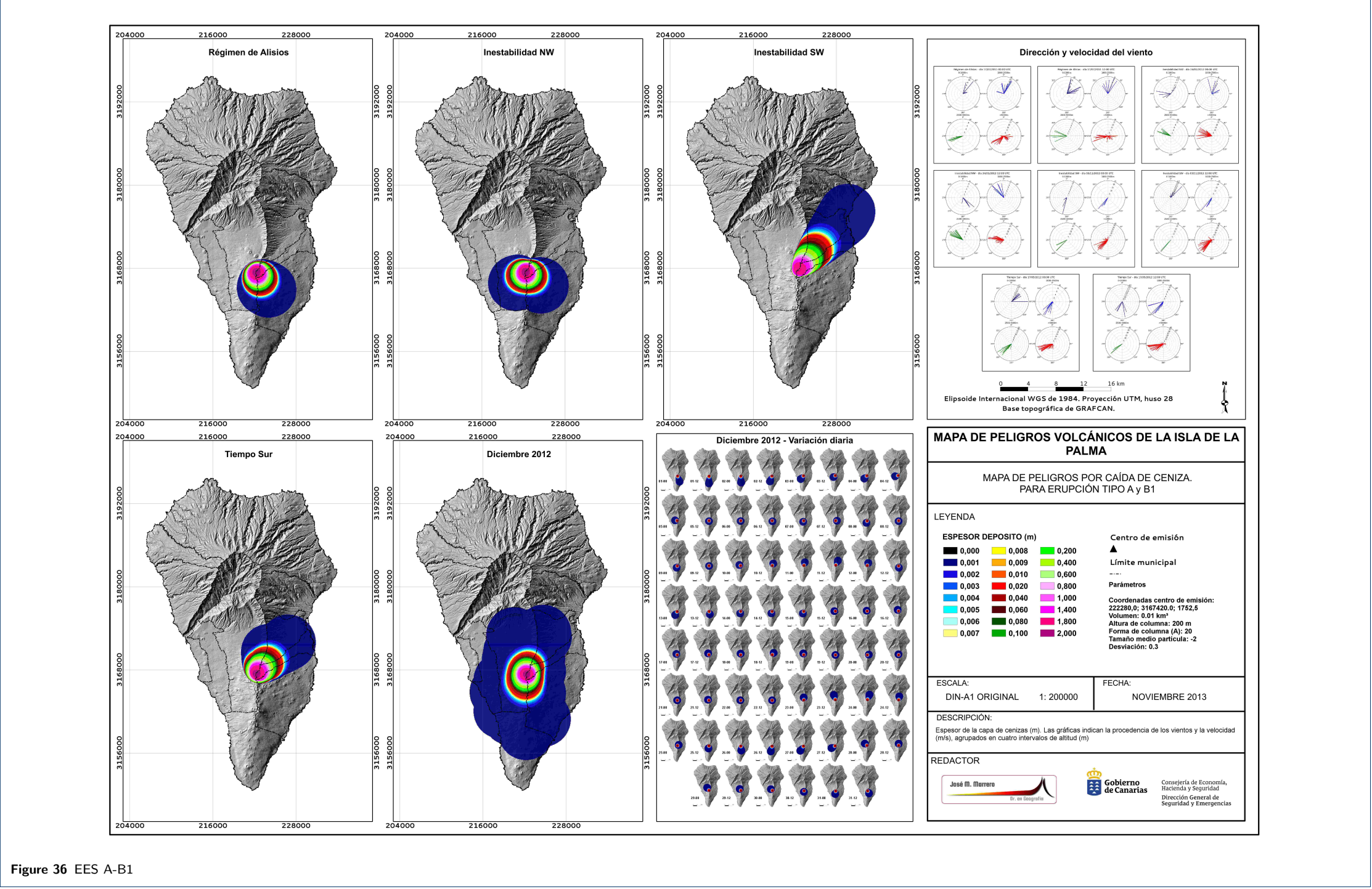


Figure 36 EES A-B1

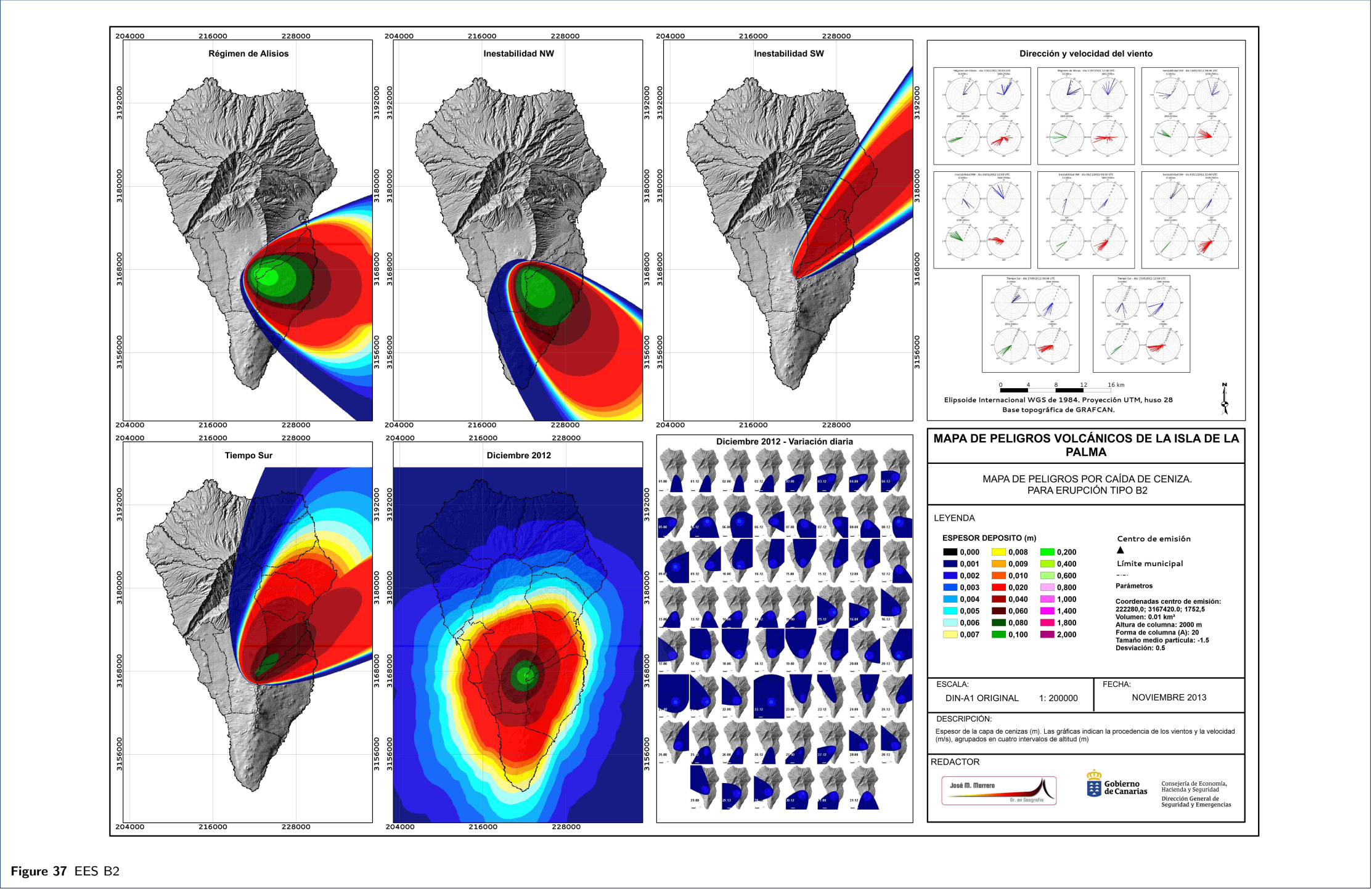


Figure 37 EES B2

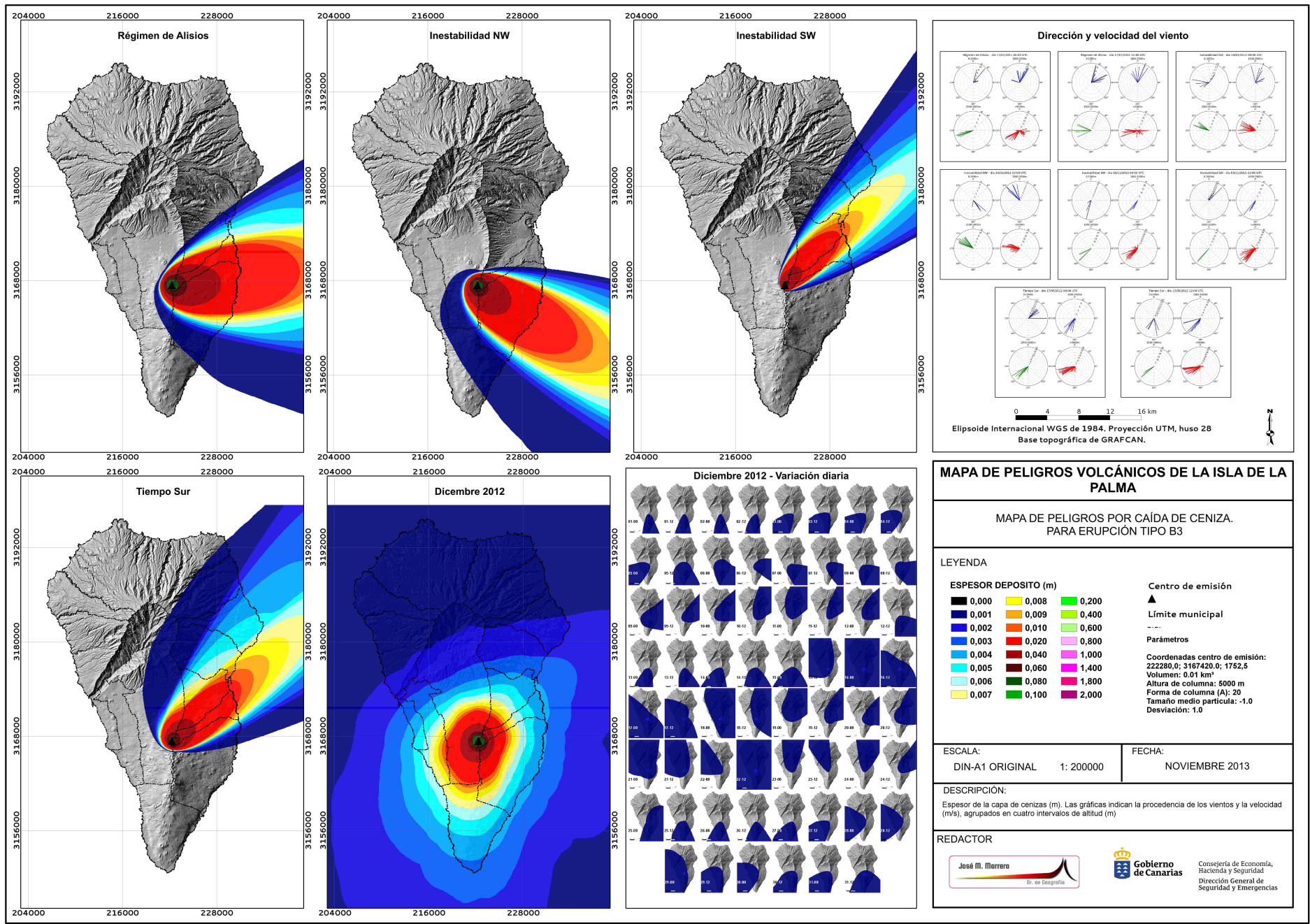


Figure 38 EES B3