

WAVE:SPICE

Warnings and Alerts during Volcanic Emergencies: Scientific Practice Informed by Community Experience

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Drama and Reassurance in Warnings of Eruptions

The WAVE:SPICE Consortium

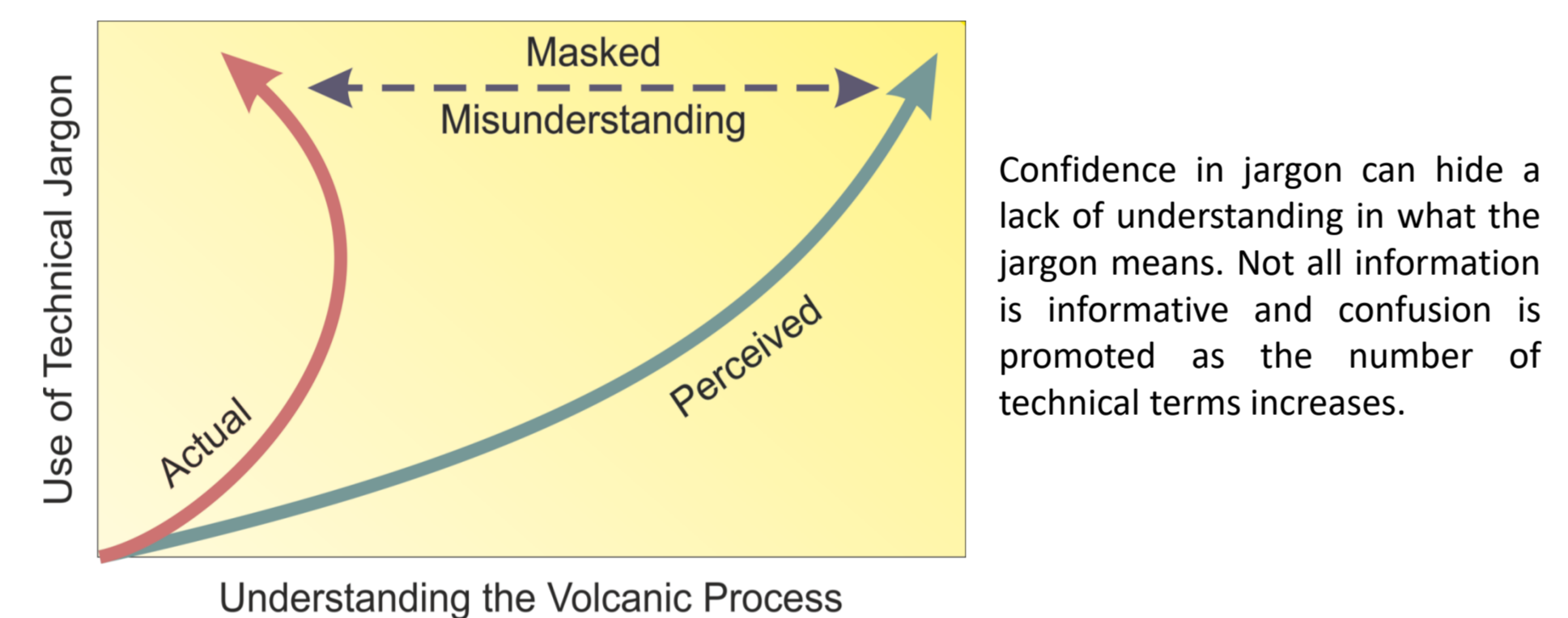
1. Warnings of eruption

Warnings of eruption alert communities of imminent danger and how best to respond. The task is especially challenging at large calderas, which may enter several episodes of unrest before an eruption occurs [Acocella et al., 2015]. The episodes without eruption promote myths and misunderstanding about how volcanoes behave.

Case Study: Authorities on Vesuvius.

Written answers to a questionnaire showed confidence with technical jargon for describing volcanic hazards. Afterwards, one respondent casually remarked that a pyroclastic flow would take 2-3 hours to reach his home, 5 km from the summit. The comment showed that his mental image had been of a lava flow.

The scientific interviewer admitted: "we didn't check and they didn't ask. What we thought had been perfect understanding turned out to be no understanding at all."



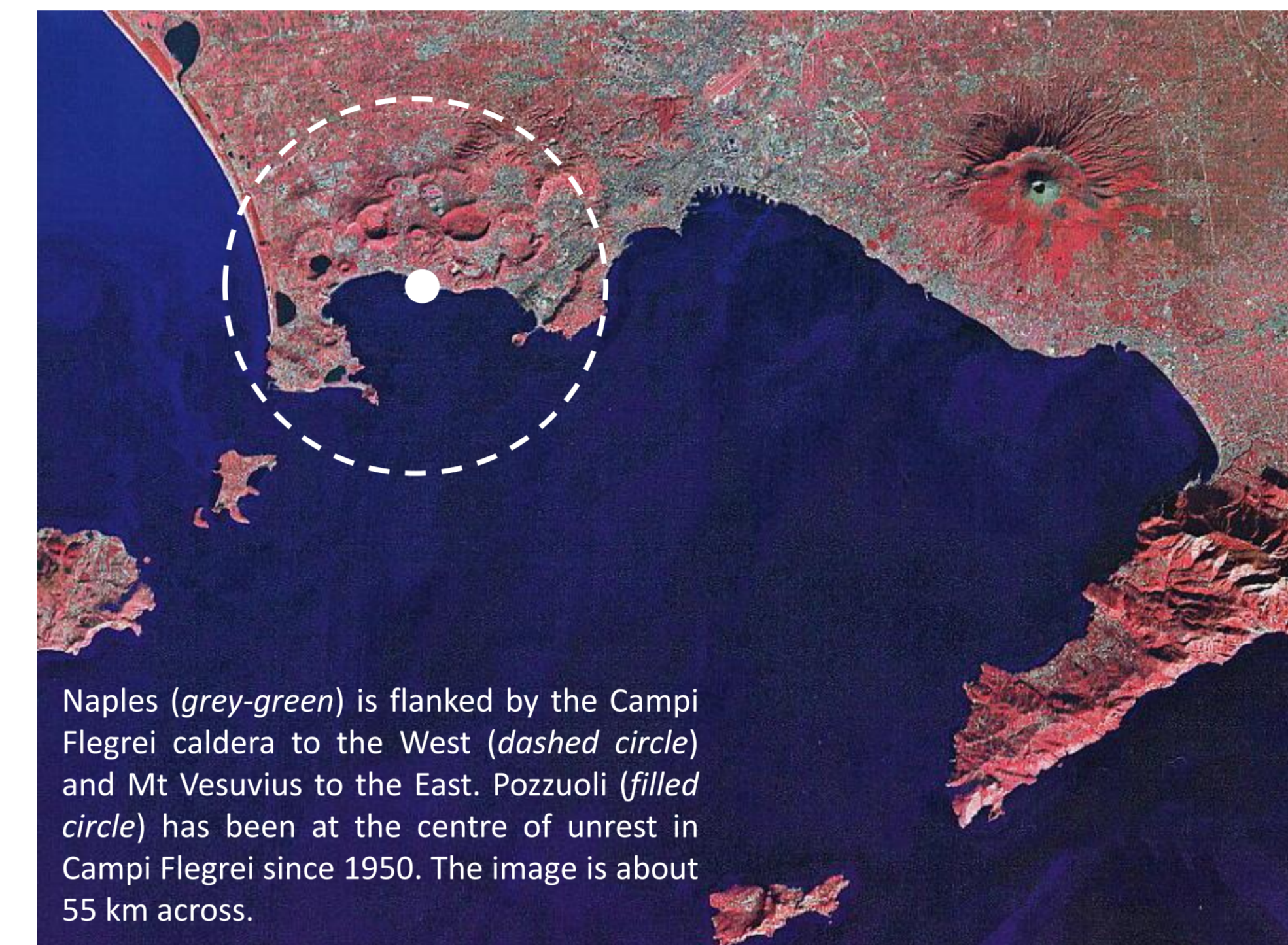
2. Masked misunderstanding

Conventional methods for dispelling myths teach communities about how volcanoes work and how to understand technical jargon. Information flows in a top-down progression from specialists to the public. Volcanological information is assumed to have been understood and accepted. This is a fundamental mistake. Misunderstandings can pass unrecognised, because non-specialists learn volcanological terms without appreciating their meaning and so give the false impression that specialist information has been properly understood.

Case Study: Public in Campi Flegrei.

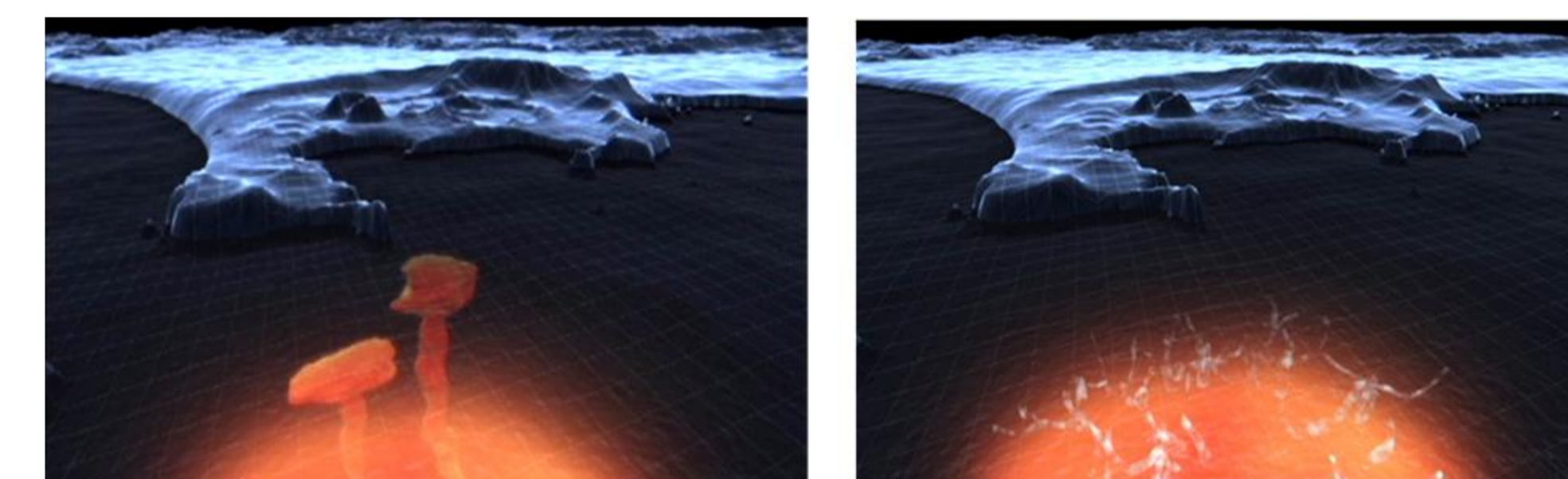
The last eruption in Campi Flegrei occurred in 1538. Its style evolved from hydromagmatic, with pyroclastic surges, to magmatic lava fountaining. The eruption produced Monte Nuovo, a cone 133 m high and 700 m across.

In casual conversation, a hotel owner knew that the eruption had occurred several centuries ago, adding that "it was like a geyser ... it sent water everywhere."



3. Explaining the invisible

Our Case Studies reveal misunderstanding about what happens after magma reaches the surface. They occur despite the wealth of films, documentaries and online videos about eruptions. Warnings that a volcano is reawakening face the added challenge of explaining what happens before magma erupts, when it is still hidden underground.



What is deforming Campi Flegrei? The upward movement of magma (left) or gas (right) or both? (Pre-production images, Pioneer Productions (2010))

4. A restless caldera

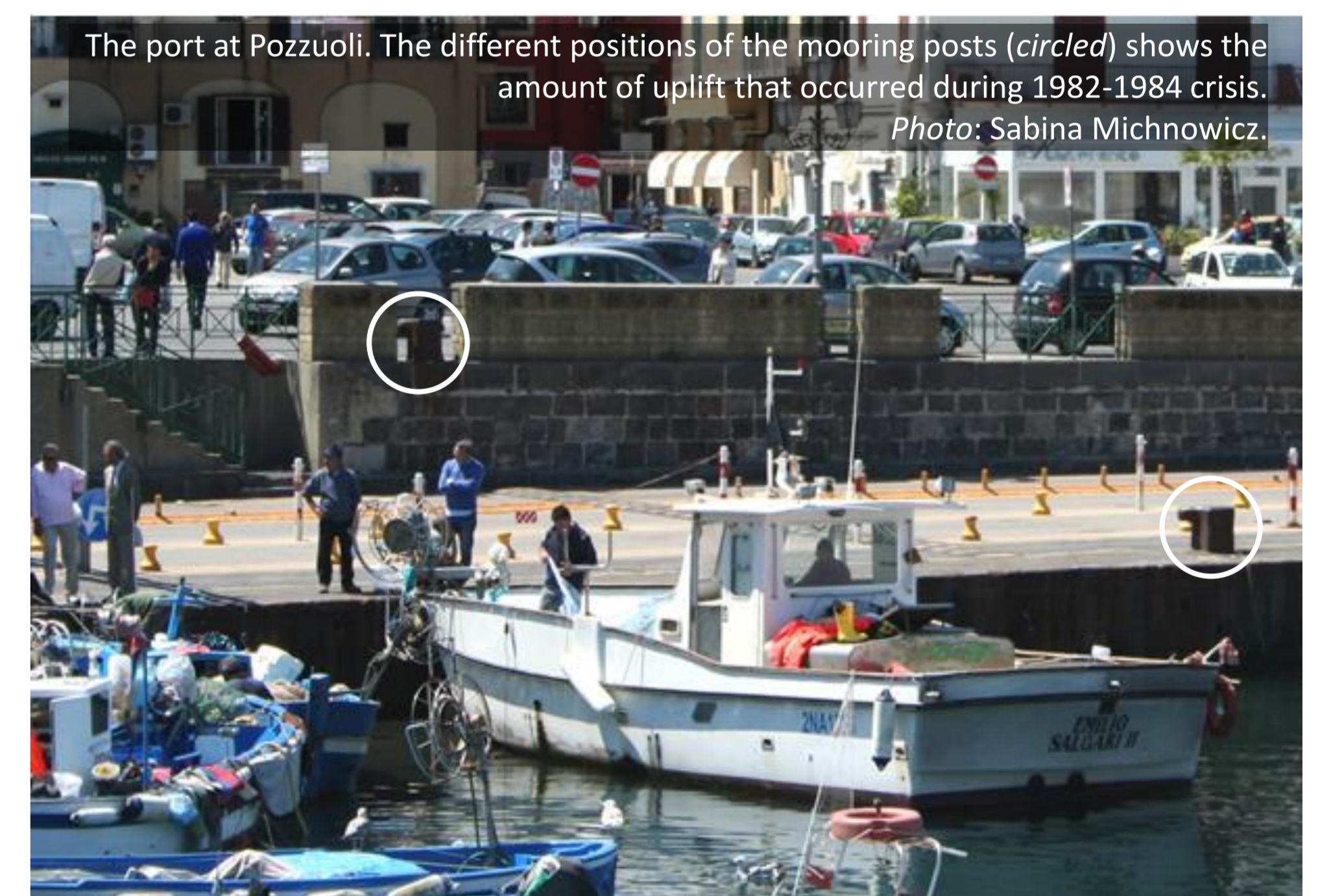
Campi Flegrei is a classic example. The caldera supports a population of 360,000 people immediately west of Naples, in southern Italy. It has shown renewed unrest since the 1950s, in the form of local earthquakes and uplift of the ground by several metres [Del Gaudio et al., 2010]. The unrest is the first since the volcano last erupted in 1538 [Bellucci et al., 2006].

An unresolved question is how much of the unrest is being driven by the intrusion of magma or by the accumulation of magmatic gas [Kilburn et al., 2017; Chiodini et al., 2021]. When the debate spills into the popular media, it confuses mental pictures about what is happening underground.

5. Dramatic intervention

Masked misunderstandings emerge in casual conversation, when speakers are relaxed and describe their views in popular language. We suggest that warnings would be more effective if presented directly in plain language, without technical jargon – in other words, specialists must learn the vocabulary of their audience, not the other way around.

Participatory theatre is the natural medium for engaging in spoken dialogue [Boal, 1979]. It brings together stakeholders who rarely meet as a matter of course and so lack occasions to share their opinions equally and spontaneously. Engagement with each other's narratives fosters new levels of critical thinking and provides the basis for a common vocabulary [Bishop, 2012] – in our case, for describing how volcanoes prepare to erupt.



6. What next?

Our WAVE:SPICE consortium has brought together community associations, theatre practitioners and volcano scientists to compare narratives of unrest at Campi Flegrei. Our aim is transform abstract concepts of subsurface processes into tangible mental pictures that can be shared by all stakeholders.

Campi Flegrei is an excellent test volcano because it is in unrest today; educational outreach programmes are well established; cultural associations and local theatre groups are active within the community; and three generations bring the collective experience of emergencies since the 1970s. The methodology is not restricted to Campi Flegrei and we welcome opportunities for collaborating on similar initiatives elsewhere.