SCIENCES & BIOENGINEERING SCIENCES

The Research Group
Geography

has the honor to invite you to the public defence of the PhD thesis of

Roos M. J. van Wees

to obtain the degree of Doctor of Sciences

Title of the PhD thesis:
Quantification and analogue modelling of the erosional evolution of composite volcanoes

Supervisor:
Prof. dr. Matthieu Kervyn (VUB)
Co-supervisors:
Assoc. prof. dr. Gabor Kereszturi (Massey University, NZ)
Dr. Daniel O'Hara (VUB)

The defence will take place on
Tuesday, October 7, 2025 at 4 p.m.

VUB Etterbeek campus, Pleinlaan 2, Elsene,
Learning Theatre, Learning & Innovation Center (LIC)

The defence can be followed through a live stream:
Teams Link

Members of the jury

Prof. dr. Philippe Huybrechts (VUB, chair)
Prof. dr. Benoît Smets (VUB)
Dr. Maria Cristina Zarazua Carbajal (VUB)
Prof. dr. Margaret Chen (VUB)
Prof. dr. Benjamin van Wyk De Vries (Université Clermont Auvergne, FR)
Dr. Loraine Gourbet (GFZ, DE)

Curriculum vitae

Roos van Wees obtained a Master degree in Quaternary Geology at Lund University, Sweden, including an exchange in Iceland for volcanology courses. She later worked as a lab assistant and published a paper from her MSc thesis. Her PhD was conducted in the framework of the FWO-funded Evolve project analysing the erosion of composite volcanoes. As part of her PhD she published one first author paper and is co-author of two publications. She attended multiple scientific conferences, conducted a research exchange in New Zealand, and contributed to teaching of practical's, field excursions, and science outreach events with primary school children.

Abstract of the PhD research

Composite volcanoes evolve through alternating active phases of eruptions and inactive phases of degradation. Once they become extinct, erosion dominates as the long-term process. However, the complex eruptive history and limited dating data makes it difficult to analyse erosion dynamics of natural volcanoes. This PhD thesis addresses this issue by studying the erosional evolution of stratovolcanoes using morphometric parameters together with analogue laboratory models.

The first step in quantifying morphometry is to select the most suitable DEM (Digital Elevation Model), resolution, and a reproducible method to delineate the edifice. Results show that boundary delineation, and to a lesser extent DEM resolution, exert a greater influence than DEM type on morphometric parameters. Applying a slope threshold improves consistency across manually drawn boundaries.

To complement this framework, analogue modelling experiments with a rainfall simulator were performed to investigate the long-term degradation of cones with different slopes and with and without summit craters. The results show that cratered cones produce faster and wider drainage basins. All cone types eventually reached an equilibrium state where morphometric values converge, complicating the estimation of volcano age based on morphology, especially for older volcanoes.

Finally, relationships between morphology and last eruption ages were tested in Indonesia and Japan. In Indonesia, tectonic and reflectance data explained most age variability, while in Japan morphology was the most dominant indicator of age.

This thesis provides methodological framework for volcano morphometric characterisation, enhances the understanding of the relationship between age and volcano geomorphology, and provides insights into the impact of initial volcano shape and erosional stages. These findings enable more accurate and consistent assessment of volcanic landscapes, helping to interpret volcano morphology in terms of long-term erosion and associated hazards.