



A global Perspective on active Volcanoes and Permafrost

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Volcanic activity may favour permafrost aggradation in various ways. Particularly the coverage of pre-existing snow layers or glacier ice during a volcanic eruption by volcanic ash (tephra) or lava flows might cause the formation of massive ground ice in permafrost favourable climates. On a global scale, ice-permafrost-volcano interaction are common on high stratovolcanoes such as in Iceland, Cascade mountains (USA), Andes, Curil islands (Alaska), Kamchatka peninsula (Russia), Jan Mayen island (Norway), Trans Mexican Volcanic Belt or Antarctica. According to the global active volcano list published by the Smithsonian Institute, some 1543 volcanoes have been active globally during the last 10 ka (i.e. Holocene). 663 volcanoes (43%) thereof erupted during the last 2 ka and 413 (27%) have been active since 1900. Volcano edifice altitudes range from -6000 m a.s.l. (submarine volcano) to 6887 m a.s.l. (Ojos del Salado), protruding substantially in permafrost favourable climates. The combination of the global active volcano list and the latitudinal lower limit of permafrost occurrence according to previously published data reveal that some 428 (28%) active volcanoes seem to be underlain by permafrost, most of them are located in the northern hemisphere. On a Northern Hemispheric scale, the Circum-Arctic Permafrost and Ground Ice Map was used for analysing the relationship between the four different classes of permafrost extent estimated in percent area - continuous (90-100%), discontinuous (50-90%), sporadic (10-50%), and isolated (<10%) - and the active volcanoes north of 25°N (n=604). Results show that 247 (41%) volcanoes are probably underlain by permafrost. Most of them fall in the classes of isolated (n=90) and sporadic (n=71) permafrost, followed by the class discontinuous (n=56) permafrost. Only 19 volcanoes seem to fall in class of continuous permafrost. Permafrost of unknown class can be expected on the slopes of additional 11 volcano edifices based on the latitudinal

depending lower limit of permafrost occurrence. The results clearly demonstrate the global relevance of active volcanoes for permafrost occurrence and aggradation.