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Retreat rate of the Israeli coastal cliff and its estimated location at year 2100

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The Israeli coastal cliff extends about 60 kilometers along the Eastern-Mediterranean shores. In past few decades cliff-top inland local retreat-rates of few tens centimeters per year were recorded with a consequent hazard to lifelines and shore-communities. Cliff retreat is a result of wave-impact induced slope-failure events. The Israeli coastal-cliff height rises up to 50 meters. It consists of alternating eolionite and paleosols. These low-strength materials fail along the rather steep slopes of the coastal-cliff. Failed material is deposited at the cliff base and temporarily shields the cliff from wave-impact. When washed by waves in winter-storms, a new failure-cycle begins. In the presented study we estimate the average local retreat-rates (for every few hundred meters) by comparing cliff-top locations in 1945 and 2004 using aerial photos. The 2100 cliff-top location is modeled using the calculated retreat-rates, expected sea-level rise, time constants of failure in the cliff, and anthropogenic activity. Calculated average retreat-rates are less than 0.2 m/year and 0.3 m/year at 65% and 85% of the cliff length, respectively. The temporal window from which retreat-rates were calculated includes only a part of the accelerated recent sea-level rise period and as a consequence the calculated rates are an underestimate of the rates expected toward 2100. To include the effect of the expected up-to 1m sea-level rise by 2100 we refer to a model which considers sea-shore width (waterline to cliff-base) as a few tens of meters and constant. Thus, the above sea-level rise will bring the water line to the cliff base that, as a consequence, will retreat inland tens of meters to keep sea-shore width constant. The expected cliff-top line in the year 2100 is mapped 20-30 meters inland from its current location (at 65% and 85% of the cliff length, respectively) using the estimated retreat rates. This line defines a hazard zone (between the line and the cur-

rent cliff-top) in which without engineering efforts will be lost by 2100. Presently, this zone includes only tens of houses. Most of the houses are concentrated more than 40-50 meters from the cliff top.