



The DEAD SEA VALLEY as a trap for Saharan dust transported by west winds, based on COSMO-ART high-resolution modeling

Pavel Kishcha (1), Bernhard Vogel (2), Max Bangert (2), Ulrich Schaettler (3), Boris Starobinets (1), and Pinhas Alpert (1)

(1) Tel Aviv University, Department of Geosciences, Tel Aviv, Israel (pavel@cyclone.tau.ac.il), (2) Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany, (3) Deutscher Wetterdienst (DWD), Offenbach, Germany

The Dead Sea is a unique place on the Earth which is located at approximately 400 m below sea level. It is surrounded by the Judean Mountains to the west and by the Moab Mountains to the east. The Dead Sea Valley is quite often affected by Saharan dust intrusions. It is also characterized by changeable meteorology, particularly by unsteady winds blowing along the valley. High-resolution modeling was used for studying Saharan dust transport over this region with complex topography and unsteady winds. It was the purpose of the current study to determine space – time variations of Saharan dust over the Dead Sea Valley using the COSMO-ART model with 3-km resolution. This was carried out for the extreme dust event observed on March 22, 2013, when PM10 measurements in the Dead Sea Valley showed surface dust concentration exceeding $6,000 \mu\text{g m}^{-3}$. An intensive low-pressure system, centered over the Eastern Mediterranean, created favorable conditions for dust transport by south-west winds from the Eastern Sahara into the Eastern Mediterranean and particularly into Israel and Jordan. In the middle of the dust event, when the low-pressure system shifted eastward, dust was transported by strong west winds towards the Dead Sea Valley, across the Judean Mountains. It is reasonable to suggest that the greater the height of the Judean Mountains - the lower the dust concentration on the downwind slope of the mountains, in the Dead Sea Valley. The high-resolution COSMO-ART model shows the opposite result: the greater the height of the Judean Mountains - the higher the dust concentration in the Dead Sea Valley. COSMO-ART shows that the height of the Judean Mountains leads to high dust concentration of over $15,000 \mu\text{g m}^{-3}$ in the Dead Sea Valley. We analyzed east-west cross-sections of dust concentration and topography at different latitudes across the Dead Sea Valley. Our analysis showed that, over the North of the Dead Sea Valley, where the height of the Judean Mountains is greater than over the South of the Dead Sea, the surface dust concentration was correspondingly higher than that over the South of the Dead Sea Valley. This happens only for dust which is initially blocked by the Judean Mountains. The dust, which is being transported at levels essentially higher than the Judean Mountains, can sail across without difficulty. Model performance was evaluated by comparing both modeled surface dust concentration and basic meteorological parameters with available PM10 and meteorological measurements. During the aforementioned extreme Saharan dust event, the high-resolution COSMO-ART model was capable of producing reasonable space-time distribution of surface dust concentration in the Dead Sea Valley.