



Multi-decadal variations in the cloud optical depth over eastern Mediterranean

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The present work examines the multi-decadal changes in the Cloud Optical Depth (COD) over eastern Mediterranean (32°-42°N, 20°-38°E) during the period 1979-2004. The trends in COD are analyzed over the region using the Modern Era Retrospective-analysis for Research and Applications (MERRA 2D) datasets including COD values for (a) all, (b) low-level (<700 hPa), (c) mid-level (700-400 hPa) and (d) high-level (>400 hPa) clouds. The spatial resolution of the data is 0.5 x 0.75 degrees and a total number of 609 pixels are obtained over the area on monthly basis.

Averaging over the area the COD of all clouds showed a rather neutral trend of ~0.01 per year, indicating a 1.5% increase in COD, while those of low-level clouds exhibited a decreasing trend of -1.59%. On the other hand, the mid- and high-level clouds presented an increasing trend of 17.3% and 19.4%, respectively. Large spatial heterogeneities were revealed in the COD trends, depended strongly on the season. As expected, the COD (all clouds) showed a distinct annual pattern with larger values (~45-55) in winter and lower (~10-20) in summer. Similar seasonal variations were depicted for all the cloud levels.

Furthermore, there was a strong south-to-north gradient of increasing COD values towards north. The year-to-year variability was also significant and correlated well with the North Atlantic Oscillation Index (NAOI) values. Thus, during years with large NAOI values, the COD was lower and drier conditions prevailed over eastern Mediterranean. In the opposite, years with low NAOI values were associated with increased cloud cover and COD.