



# Science for Environment Policy

## Land use changes in the Mediterranean may be triggering large weather shifts

**Land use changes over the last century in the Mediterranean area may be sparking shifts in weather patterns locally**, across Europe, and around the globe, suggests a new study. The findings bring to light new complexities that can be integrated into climate models and predictions.

The European Commission launched and partially funded<sup>1</sup> several major field studies on weather and climate in the 1970s, following the UN Stockholm Conference on the Environment. The data were collected using methods such as meteorological towers, tethered balloons, and measurements taken via aircraft. During this research, scientists observed a decrease in the frequency of summer storms in the Western Mediterranean Basin. This observation was not a central part of the studies; but now, years later, researchers have re-analysed the data with that detail in mind. This latest analysis was part-funded by the EC's CIRCE<sup>2</sup> project.

The researchers found that the lack of summer storms in the Western Mediterranean Basin starts a series of events leading to the accumulation of water vapour and [air pollutants](#) in layers above the sea, called an Accumulation Mode. This cycle can last several days and reoccur several times a month in the summer. Each cycle ends with severe storms and potential flooding in Central Europe, instead of rainfall in the Mediterranean area. Consequently, this shift results in droughts in parts of the Mediterranean during those summer months.

The researchers conclude that these [weather and climate pattern changes](#) are a result of land use changes along the coasts and mountain regions of the Mediterranean. Starting a century ago and continuing until the present day, marshes have been drained of water and [forests](#) have been felled. [Urbanisation](#) has also resulted in large amounts of [soil](#) being covered with homes, cement and asphalt. This results in less water evaporation, which causes summer storms to move farther inland, instead of dropping their water and recycling it within the coastal Mediterranean system. Intense rains put these areas farther inland at risk from increased [flooding](#), soil erosion and even [water](#) contamination from pollutants held with the water vapour.

Because significantly less fresh rainwater is falling in the Mediterranean and then flowing into the sea, the salinity of the sea can increase. This changes the Atlantic—Mediterranean salinity valve at Gibraltar and can induce intense storms in Atlantic Europe in summer and autumn or even shift weather patterns in the Gulf of Mexico. Another effect stems from cloud layers creating a greenhouse effect and increasing the sea's surface temperature off the Mediterranean coast. This feedback process can resurface months later by causing intense storms on the coast in autumn, spring and winter.

In sum, land use changes in the Mediterranean contribute to harsh fluxes between desertification and flooding in areas of Europe. Coastal regions miss out on rain needed during summer months, increasing desertification, but receive intense storms during autumn, spring and winter. Meanwhile, inland regions experience flooding during the summer. Current models dealing with atmosphere-land-ocean exchanges are not able to take into account of these processes and, as a result, could be projecting false conclusions about weather and climate. The researchers recommend actions such as intense reforestation of destroyed areas, and call for further research to allow for better forecasting of extreme weather events.

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