

WATER RESOURCES

Elsewhere in this overview, a number of consistent changes that are strongly linked to climate observations over the past several decades have been highlighted.

Climate change also impacts the global water cycle¹. This is because atmospheric warming will cause a redistribution of heat around the world, thus altering the water cycle. Evidence is mounting of a changing water cycle that is leading to (a) changes in precipitation patterns and intensity, (b) widespread melting of snow and ice, (c) increase in atmospheric water vapour because of an increase in water evaporation, and (e) changes in soil moisture and runoff. Their manifestation is of course bound to regional differences, with the southern Mediterranean region projected to experience more extreme changes than in Southern Europe².

The strong linkages between the impacts related to prolonged periods of droughts as well as changes in precipitation patterns on a number of local sectors (such as agriculture, health and ecosystem services) have been addressed elsewhere in this overview. Stressed water resources pose adverse effects on a number of economic sectors that lead to adverse societal impacts.

These changes are expected to continue and to adversely affect the way we live.

Salient impacts:

- 1. Climate change has already and will continue to alter, the water cycle, affecting water resource availability.*
- 2. Increased air temperatures lead to higher water temperatures, the rise of which has already been detected in our coastal waters³.*
- 3. Floods are likely to become more common and more intense as regional and seasonal precipitation patterns change, and rainfall becomes more concentrated into heavy events⁴.*
- 4. Increased episodes and duration of droughts are expected to become longer.*
- 5. Local precipitation and runoff are likely to increase.*
- 6. Surface water quality and groundwater quantity will be affected by a changing water cycle.*
- 7. Climate change will place additional burdens on already stressed local water supply and related infrastructure.*

¹ A warmer climate increases evaporation of water from land and sea, and allows moisture to be held in the atmosphere.

² Research shows an expected change in atmospheric circulation over the Euro-Mediterranean region which will tend to move storm tracks northward with the result that dry areas will become drier and wet areas wetter. Semi-arid places will be experiencing longer and more severe droughts from the combination of increased evaporation and reductions in precipitation.

³ This leads to longer periods of summer water stratification, especially in closed bays. Dissolved oxygen in the water is reduced at higher temperatures causing low oxygen stress to aquatic life.

⁴ It may sound self-contradictory, but a warmer Earth produces wetter and drier conditions. Even though total precipitation increases, the regional and seasonal distribution of precipitation changes and more precipitation comes in heavier rains (which can cause flooding) rather than light shower events.

Phenomenon	Coastal waters	Groundwater	Land	Infrastructure
Increased air temperature	Increased water stratification in enclosed bays, leading to increased hypoxia.	Increased water consumption will further stress this resource, resulting in decreased rates of recharge.		Higher temperatures are projected to increase cooling water withdrawals by thermal power plants, needed amongst other things, to sustain water desalinization.
Increased frequency of heat-waves	Greater cooler requirements in summer will increase electricity use, which in turn will require more cooling seawater for power plants.	Increased water consumption will further stress this resource, resulting in decreased rates of recharge.	Expected to lead to an increased water demand for irrigation.	Modification of operational rules, protection of local water resource infrastructure to ensure public safety and reliability of water delivery and to protect the environment.
Increased torrential rains, flooding and severe storms	Increased sediment runoff due to increased incidence of heavy downpours, resulting in blooms of harmful algae and bacteria, especially in semi-enclosed coastal areas.	Changes in the water cycle that reduce precipitation or increase evaporation and runoff would reduce the amount of water available for recharge.		
Sea level rise		Increased saltwater intrusion into coastal freshwater aquifers, leading to an increased output of potable water from desalinization plants.		
Increased sea temperatures				Power generation is reduced due to increased water temperatures and reducing cooling water availability, leading to additional fuel supplies partly needed to increase water desalination by RO plants.