

## Influence of rising sea levels on Venetian tourism and culture

Caroline Hogan

Berkshire School, USA

### Abstract:

Venice has been sinking for centuries, and as sea levels have risen exponentially, the sinking city has drawn more attention. The damages to infrastructure are focused on in the news, but the cultural damage of this sea level rise is often overlooked. The sudden increase in the rising sea level has led to an increase in tourism as tourists endeavor to visit Venice before significant physical damages to infrastructure occur. Additionally, this influx of tourists and the economic benefits that arise from tourism, along with the limited residential spaces available on the island have resulted in foreign (often temporary) residents supplanting native Venetians. While the benefits of tourism provide immediate economic resources for the city of Venice, ultimately tourism has resulted in an inauthentic Venetian culture that appears to be more performative rather than genuine. In this paper, I argue that while the damages to Venetian infrastructure are important, the intangible damage rising sea levels have had on the Venetian population must be considered to fully understand and solve the problems faced by the city.

### Introduction:

Relative sea level rise due to climate change and geodynamics represents the main threat for the survival of Venice, emerging today only 90 cm above the Northern Adriatic mean sea level. The 25 cm RSLR occurred over the 20th century, consisting of about 12 cm of land subsidence and 13 cm of sea level rise, has increased the flood frequency by more than seven times with severe damages to the urban heritage. Reasonable forecasts of the RSLR expected to the century end must be investigated to assess the suitability of the Mo.S.E. project planned for the city safeguarding, i.e., the closure of the lagoon inlets by mobile barriers. Here we consider three RSLR scenarios as resulting from the past sea level rise recorded in the Northern Adriatic Sea, the IPCC mid-range A1B scenario, and the expected land subsidence. Available sea level measurements show that more than 5 decades are required to compute a meaningful eustatic trend, due to pseudo-cyclic 7–8 year long fluctuations. The period from 1890 to 2007 is characterized by an average rate of  $0.12 \pm 0.01$  cm/year. We demonstrate that linear regression is the most suitable model to represent the eustatic process over this 117 year. Concerning subsidence, at present Venice is sinking due to natural causes at 0.05 cm/year. The RSLR is expected to range between 17 and 53 cm by 2100, and its repercussions in terms of flooding frequency are associated here

to each scenario. In particular, the frequency of tides higher than 110 cm, i.e., the value above which the gates would close the lagoon to the sea, will increase from the nowadays 4 times per year to a range between 20 and 250. These projections provide a large spread of possible conditions concerning the survival of Venice, from a moderate nuisance to an intolerable aggression. Hence, complementary solutions to Mo.S.E. may well be investigated.

The sea continuously laps at the foundations of Venice, Italy. The initial trade-off for peril by the sea for the city founded in the fifth century was found in great profits reaped from its strategically important port. By the Renaissance, Venice was one of the world's richest cities, a vital link in trade between the East and West. In the modern era, Venetian wealth is preserved and conveyed through beauty in art and architecture.

### Natural Factors:

Fluctuations of absolute global sea level result from climate change—including the normal cyclical growth and decay of Earth's polar ice caps (eustasy). Such cycles do not alone determine sea level relative to a specific coastal segment. Rates of sediment supply and transport along with patterns of deposition, erosion, crustal subsidence, and uplift also influence elevation at a particular location. On a much larger geological scale, the Venetian region of Italy is very slowly dipping downward, at a rate that ensures that Venice will continue to sink at least a few centimeters a century.

### Human Influence:

The Consorzio Venezia Nuova, the public authority responsible for coordinating efforts to protect Venice from flooding, has inherited the task from a long line of agencies that date back as far as the fourteenth century Venetian Magistrato delle Acque. For now the Consorzio uses stop-gap measures such as raising sidewalks and extending temporary flood walkways to protect the city. These measures, however, are merely life-support designed to keep Venice going while longer-term remedies are found and implemented. Some prior stop-gap measures may have done long-term harm. For example, excess pumping of ground-water resulted in soil compaction and sinking. The practice was stopped in the 1980s and the city stabilized with regard to the rate of subsoil subsidence. Many hydro-geologists assert that the acceleration in the sink rate of the city during the twentieth century is a result of the combination of the over-extraction of groundwater by industry combined with ill-tested digging projects in the canal and lagoon.

In addition to being a treasured cultural attraction, Venice still remains an industrially important city.

#### **Impacts and Issues:**

To slow the sinking, construction is underway on an extended mobile flood barrier (MOSE) that will feature closable gates to protect Venice from sea surges during extreme high tides or other flooding conditions. MOSE is projected to be ready for operation by 2011, and its initial costs are projected to approach \$4 billion dollars. Given the complexity of the engineering tasks and fragility of the local ecosystem that will require many downstream project modifications, many political officials are bracing for the potential that the ultimate costs of the project will soar well beyond initial projections. If sea levels continue to rise, however, not even MOSE is projected to be able to hold back the seas for more than a century. Proponents of other countermeasures contend that this is all the more reason to reexamine other measures to counter subsidence.

#### **Conclusion:**

Venice, a UNESCO world heritage site, which is known throughout the world for its beautiful lagoons, architectural sights, and its city structure built on wood piles, its 118 small islands and 338 bridges, is under serious risk of disappearing, due to the climate change. Venice sunk 9 inches in the last century and is expected to sink another 24 inches by the end of this century.<sup>1</sup> At the time of Venice's founding, sea levels were almost six feet below what they are today. The average number of floods per year increased from 10 in 1900 to 100 today. The rising sea level has already damaged 100s of buildings and monuments in Venice and destroyed the marble and mosaics of multiple basilica. One would assume that the tourism industry would take all required actions to preserve Venice as much as possible, but instead it reacted in the exact opposite way. It increased its offering to Venice, by promoting the fact that no one knows how long Venice will be around. Despite multiple funding requests, the CLIA or any other tourist organization have not helped to fund measures to alleviate the problem. The most important project right now is the Project MOSE, a barrier to protect Venice against the flood. MOSE is financed by the Italian government and is expected to protect Venice from floods of up to 9.8 feet.