Venice – sustainability and the impacts of the flood protection barriers

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Venice and the Lagoon

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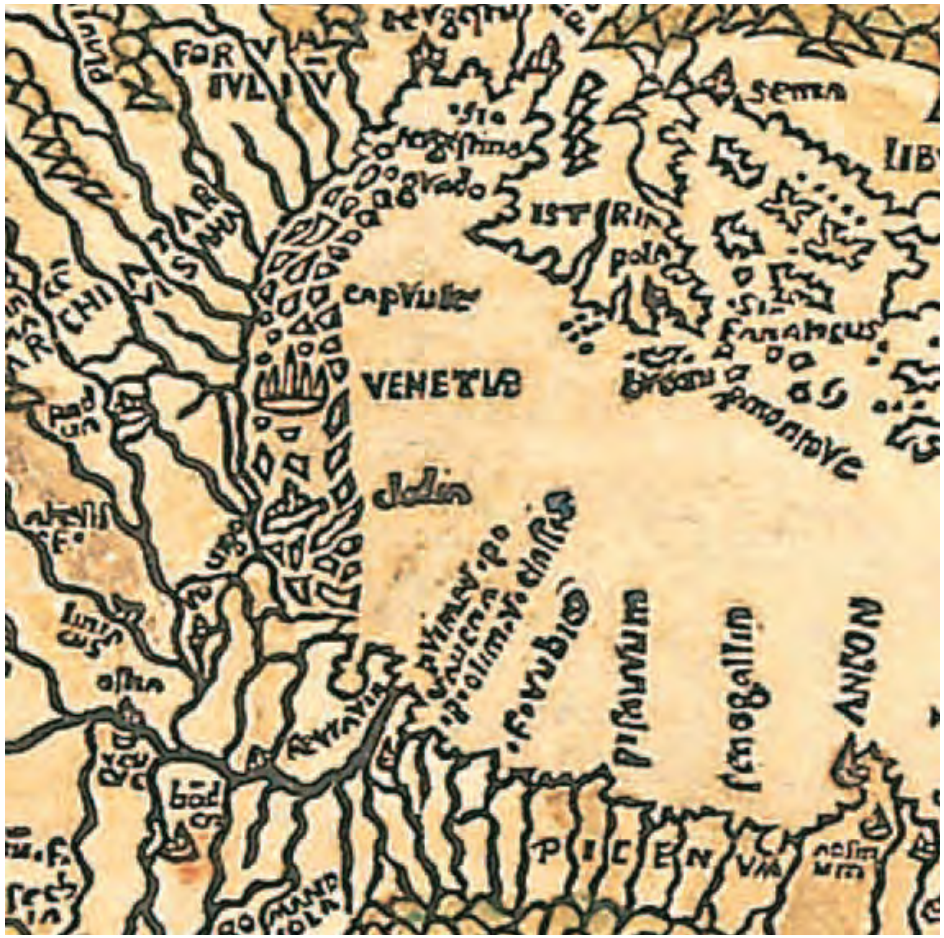
Historical lagoon



16th Century

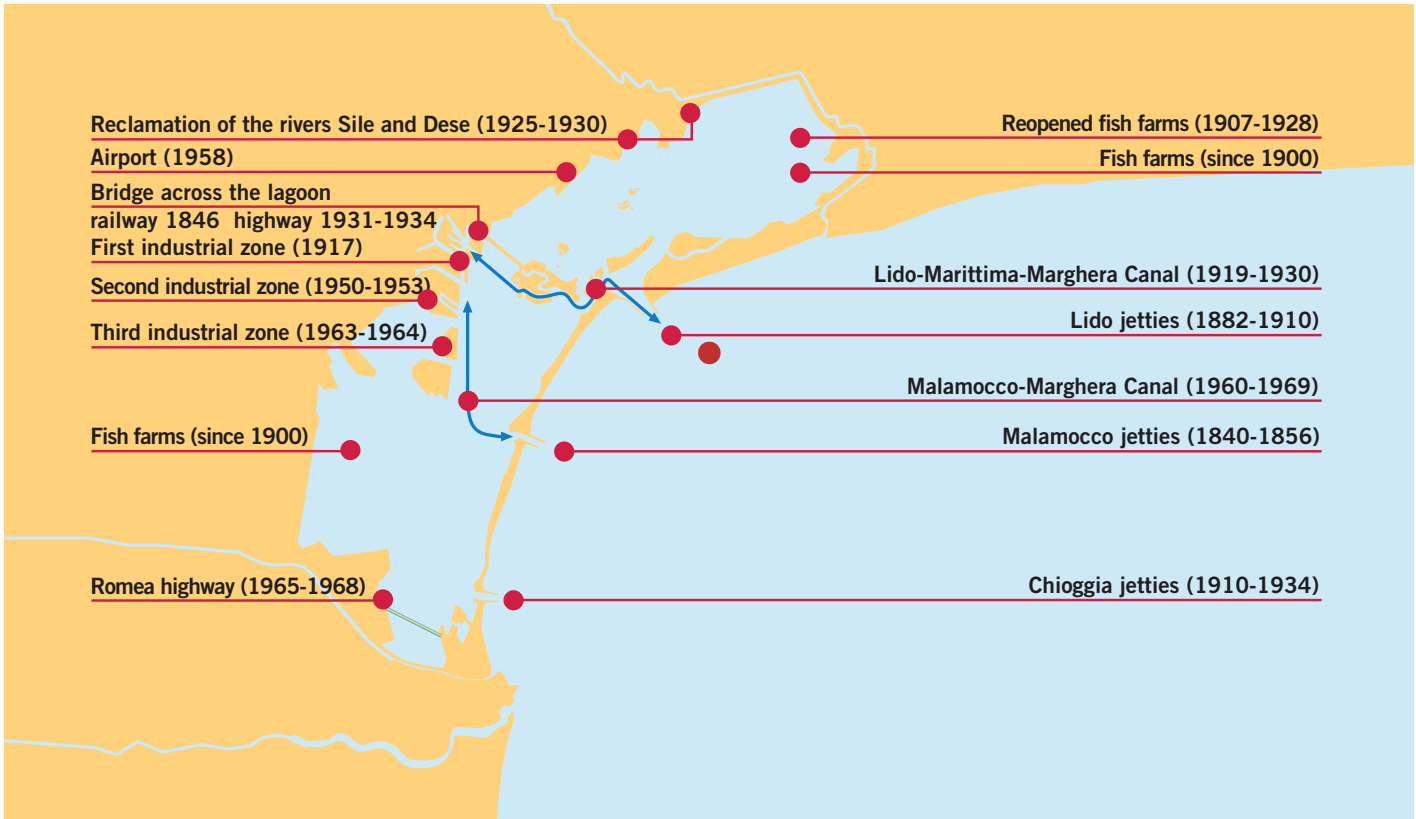
Historical lagoon

Vestri 1709

18th Century

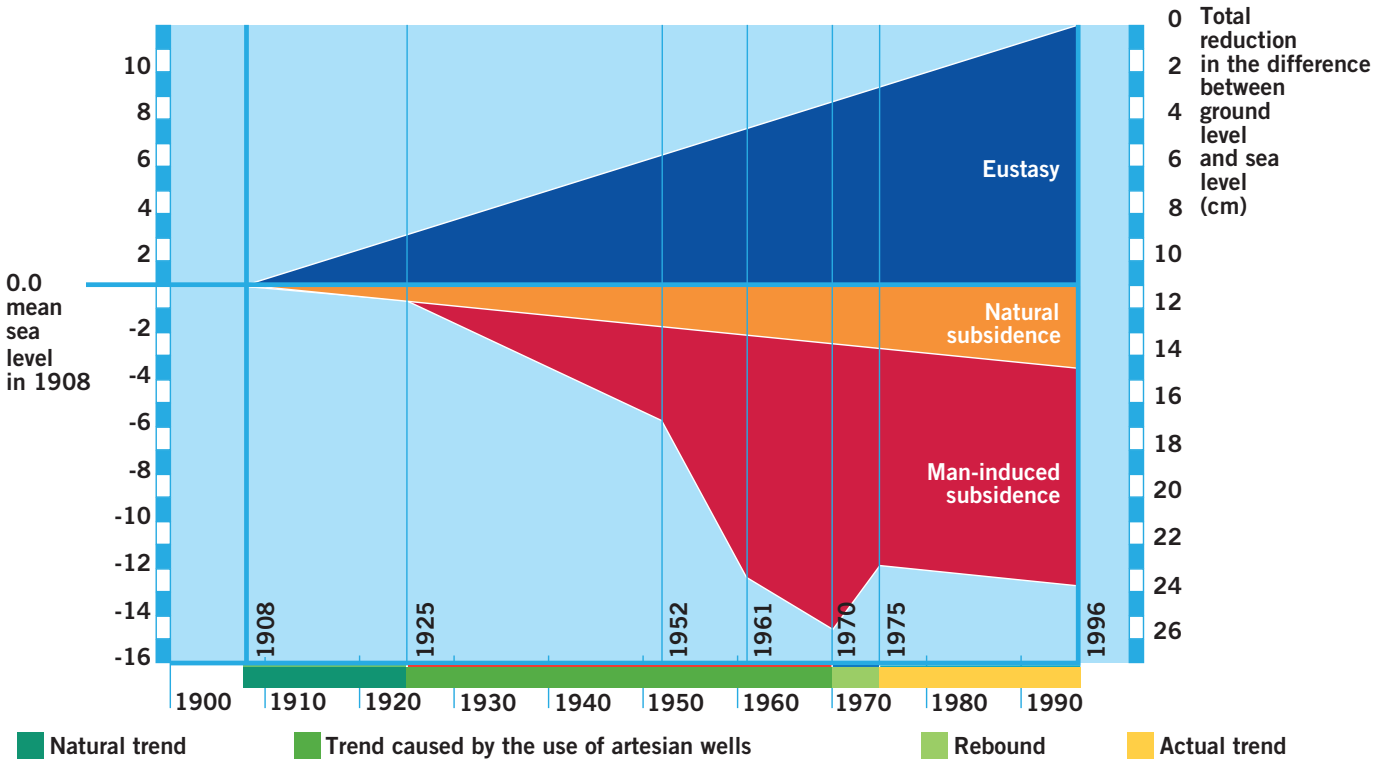
Human intervention

19th – 20th Centuries



Local mean sea level

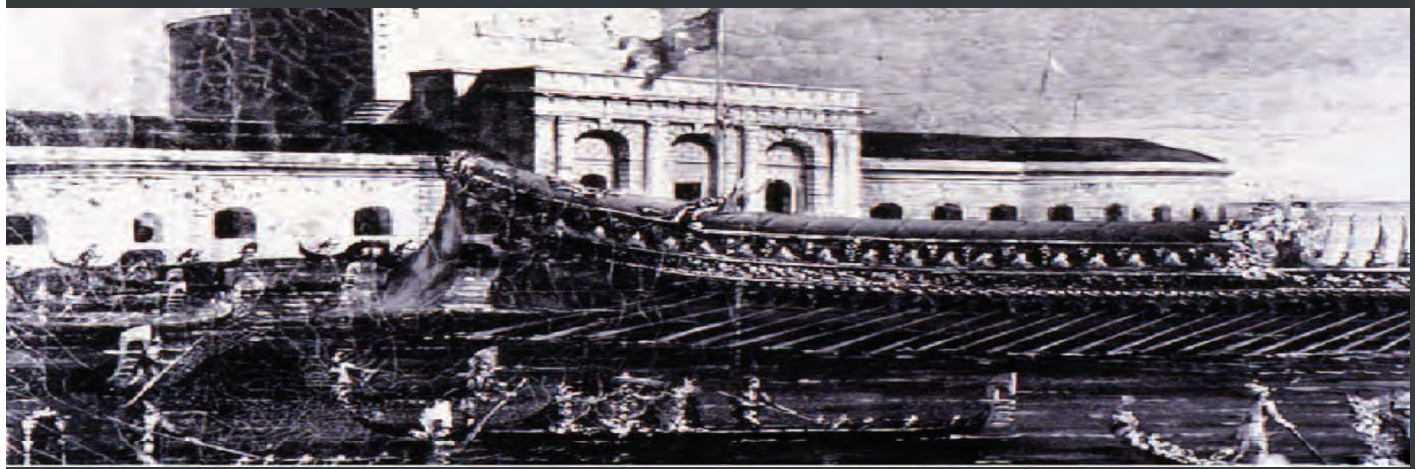
Eustatic change and subsidence



Subsidence

FORTE DI SANT'ANDREA

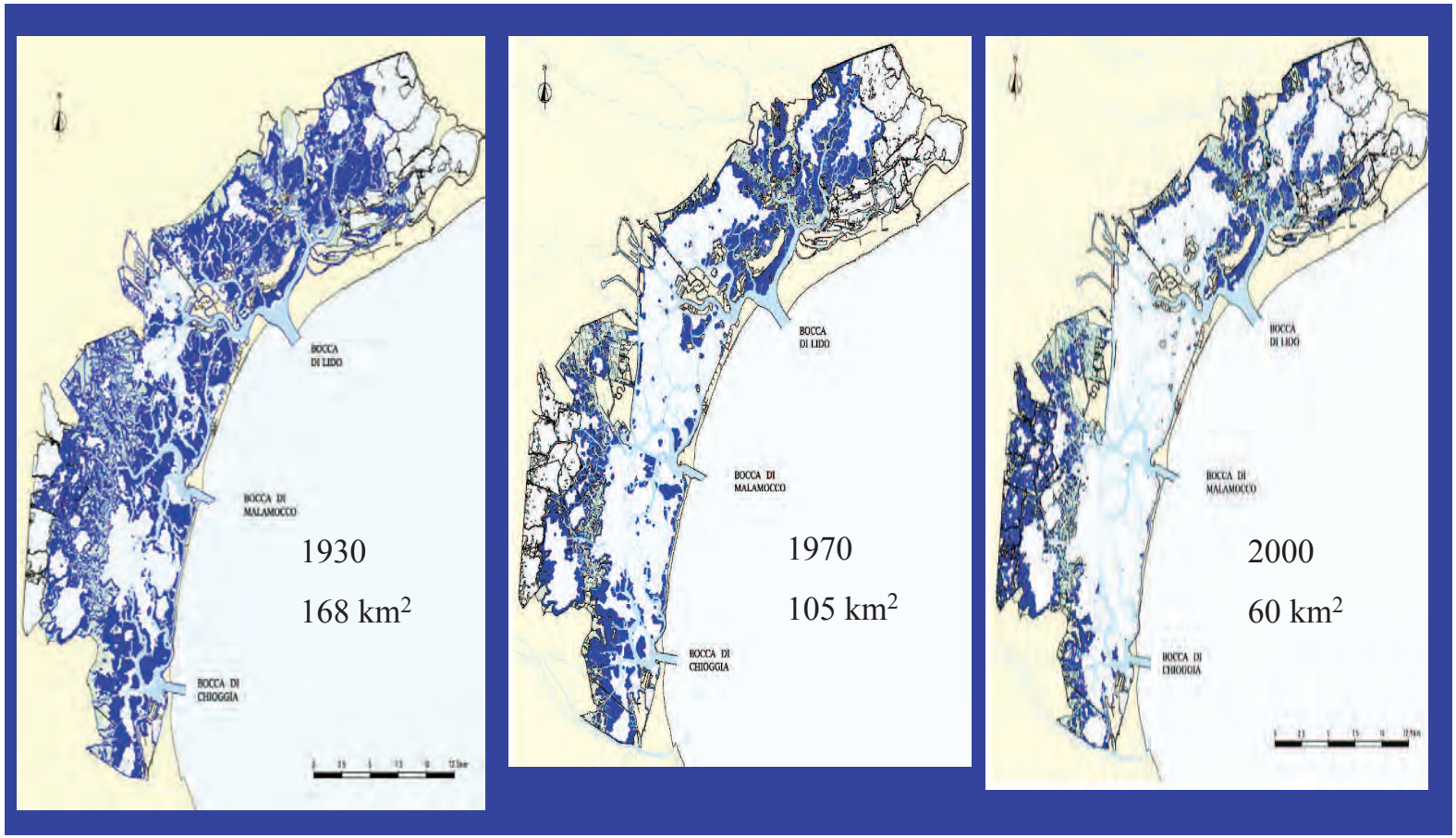
Canaletto (1730 ca)



Lagoon habitats

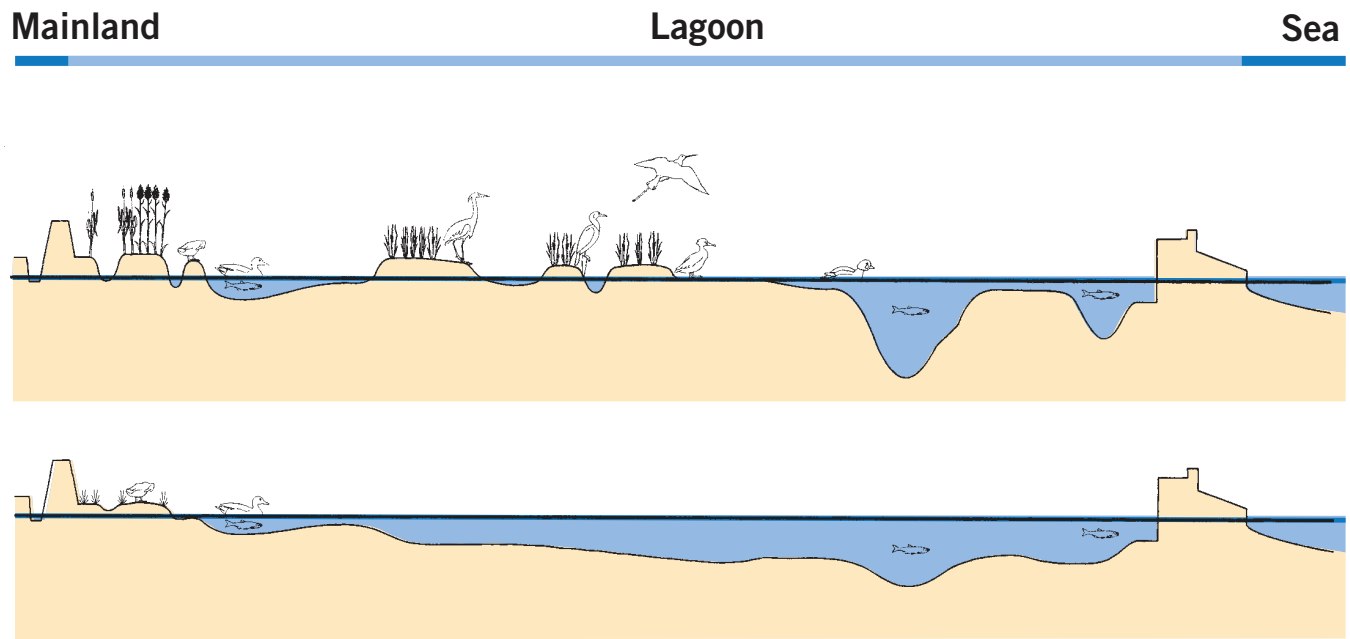
Intertidal habitat

Loss due to subsidence and RSLR



Lagoon becomes a bay

Changes to morphology



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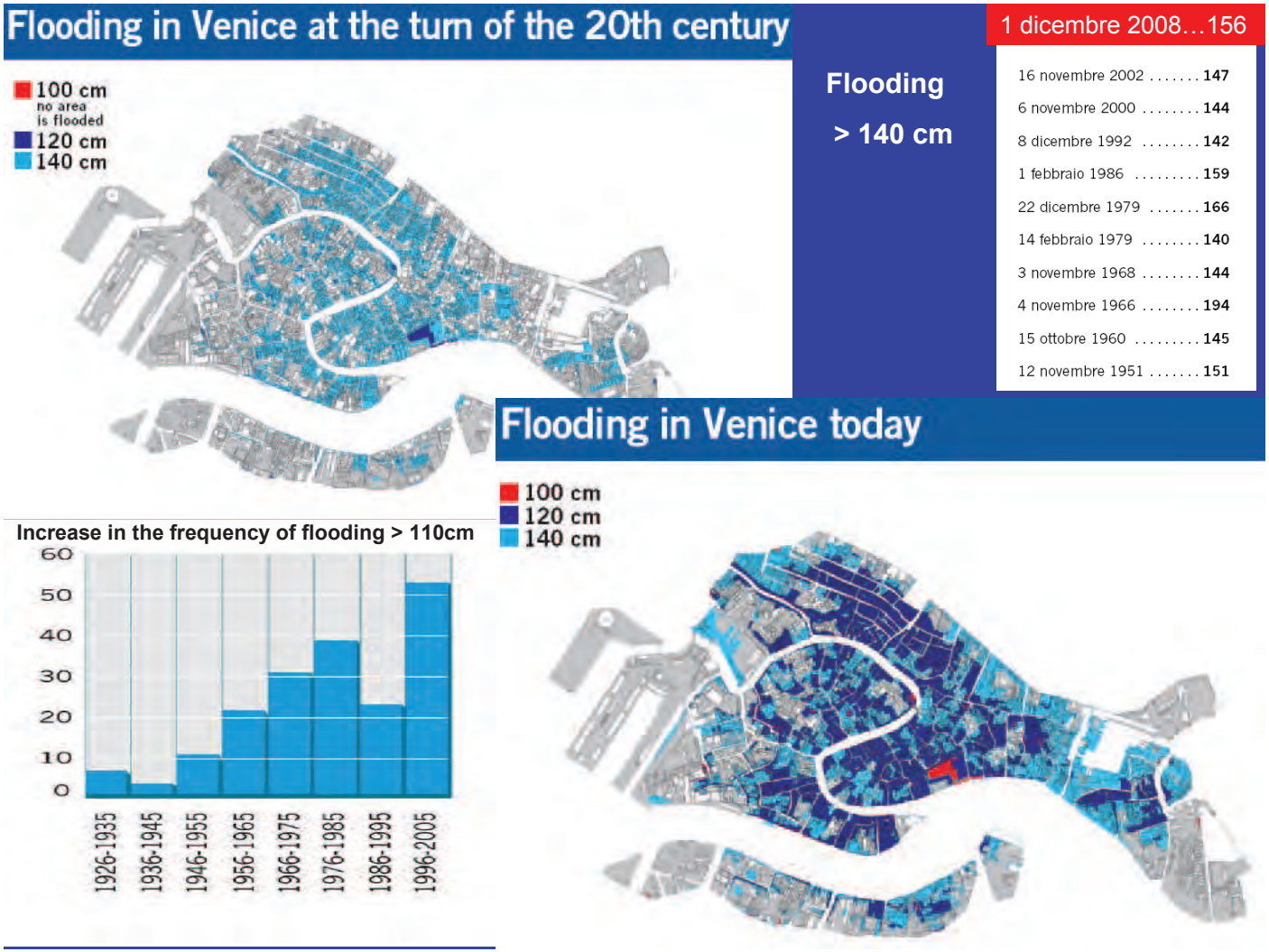
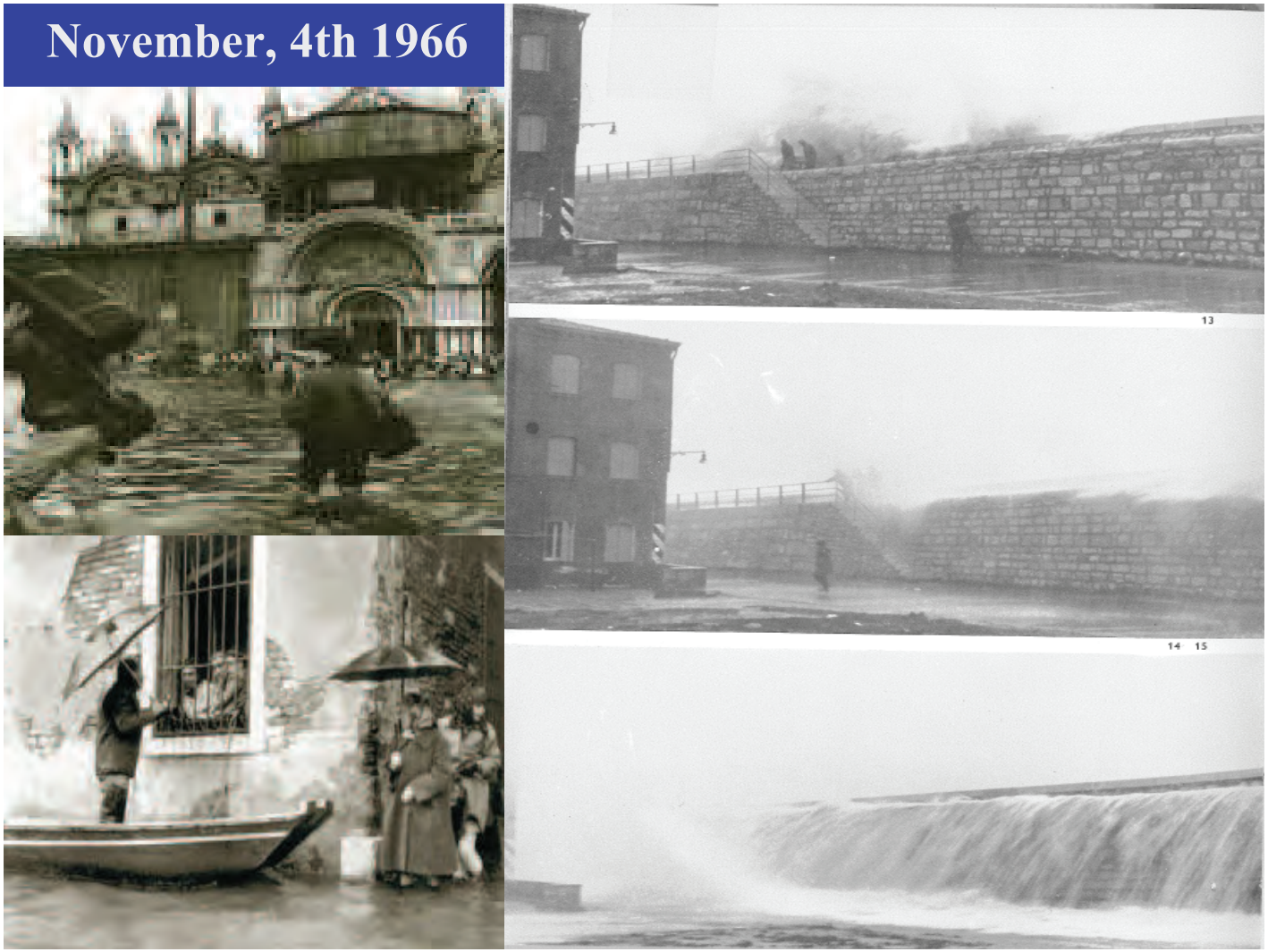
Flooding


Flooding in Venice at the turn of the 20th century
100 cm
no area
is flooded
120 cm
140 cm
Flooding
> 140 cm
1 dicembre 2008…156
16 novembre 2002 147
6 novembre 2000 144
8 dicembre 1992 142
1 febbraio 1986 159
22 dicembre 1979 166
14 febbraio 1979 140
3 novembre 1968 144
4 novembre 1966 194
15 ottobre 1960 145
12 novembre 1951 151
Flooding in Venice today
100 cm
120 cm
140 cm
Increase in the frequency of flooding > 110cm
60
50
40
30
20
10
0
1926-1935
1936-1945
1946-1955
1956-1965
1966-1975
1976-1985
1986-1995
1996-2005

Storm surge



Flooding

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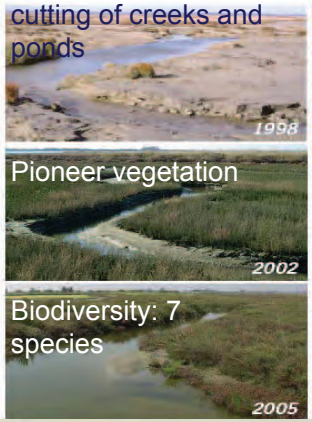
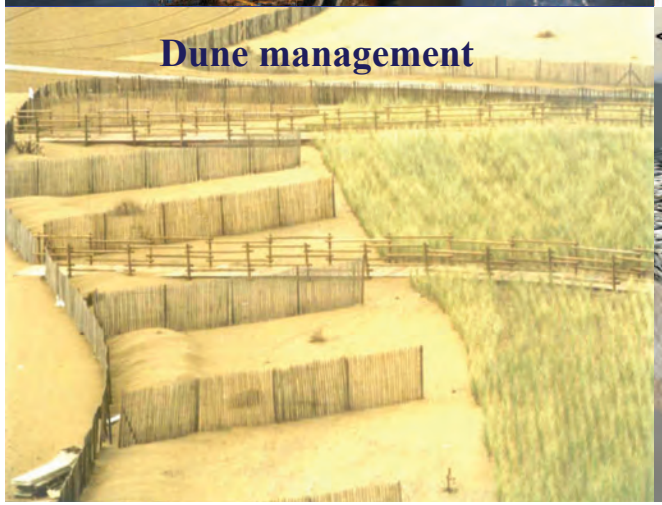
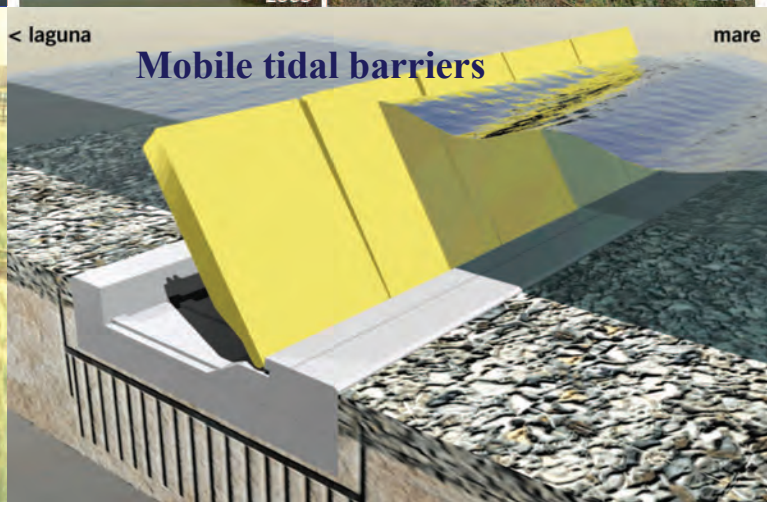
Adaptation

Range of safeguards

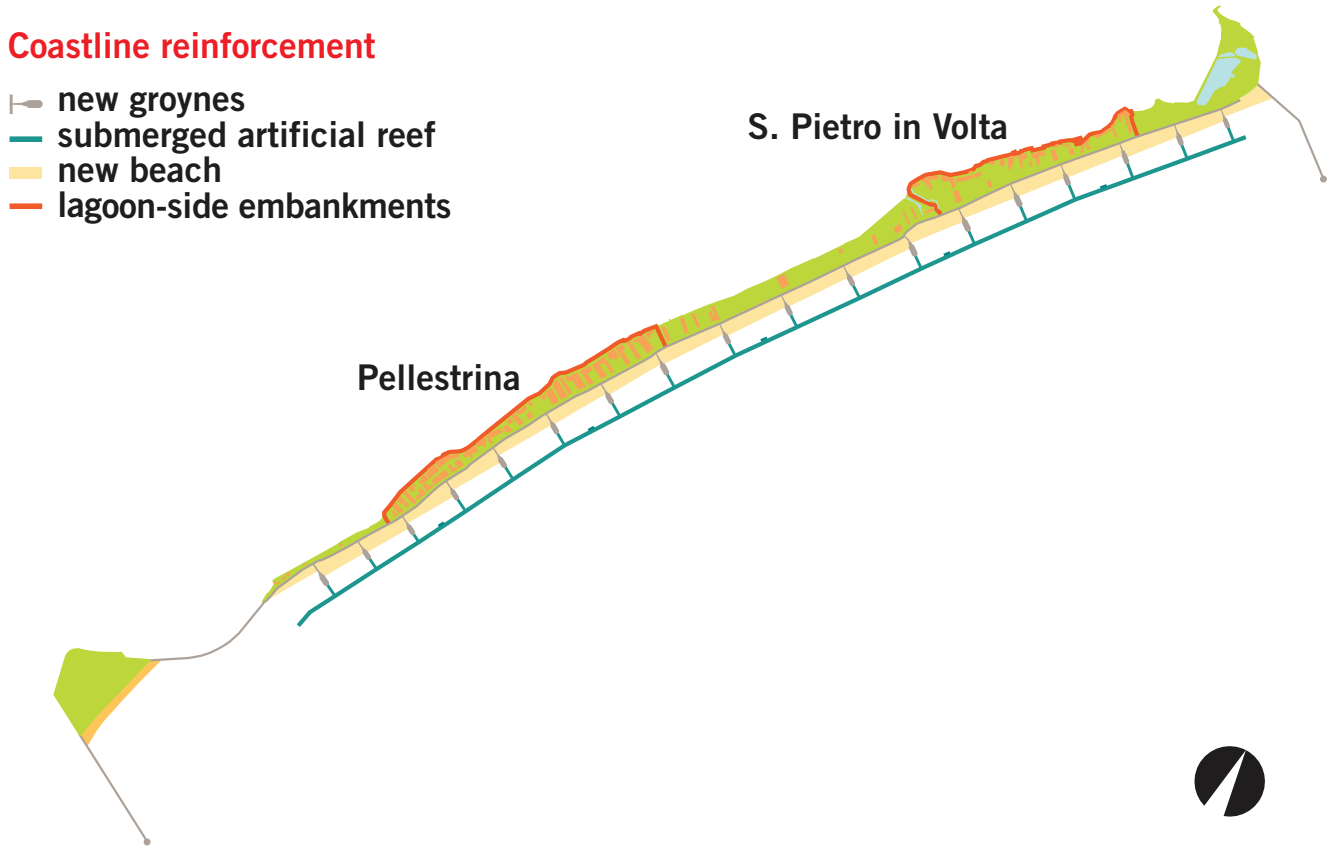






Reinforcement of the litoral

Reinforcement of the litoral

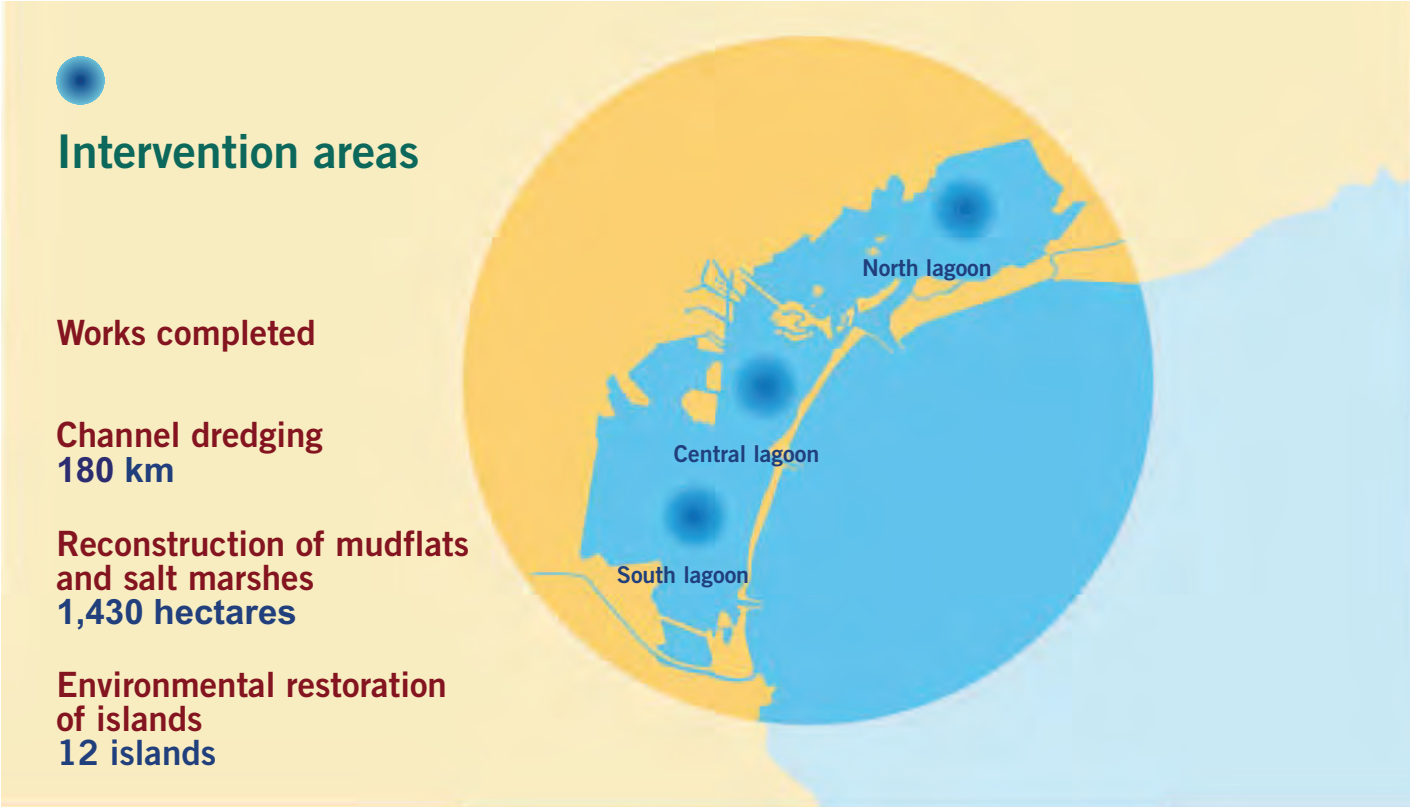


Pellestrina littoral

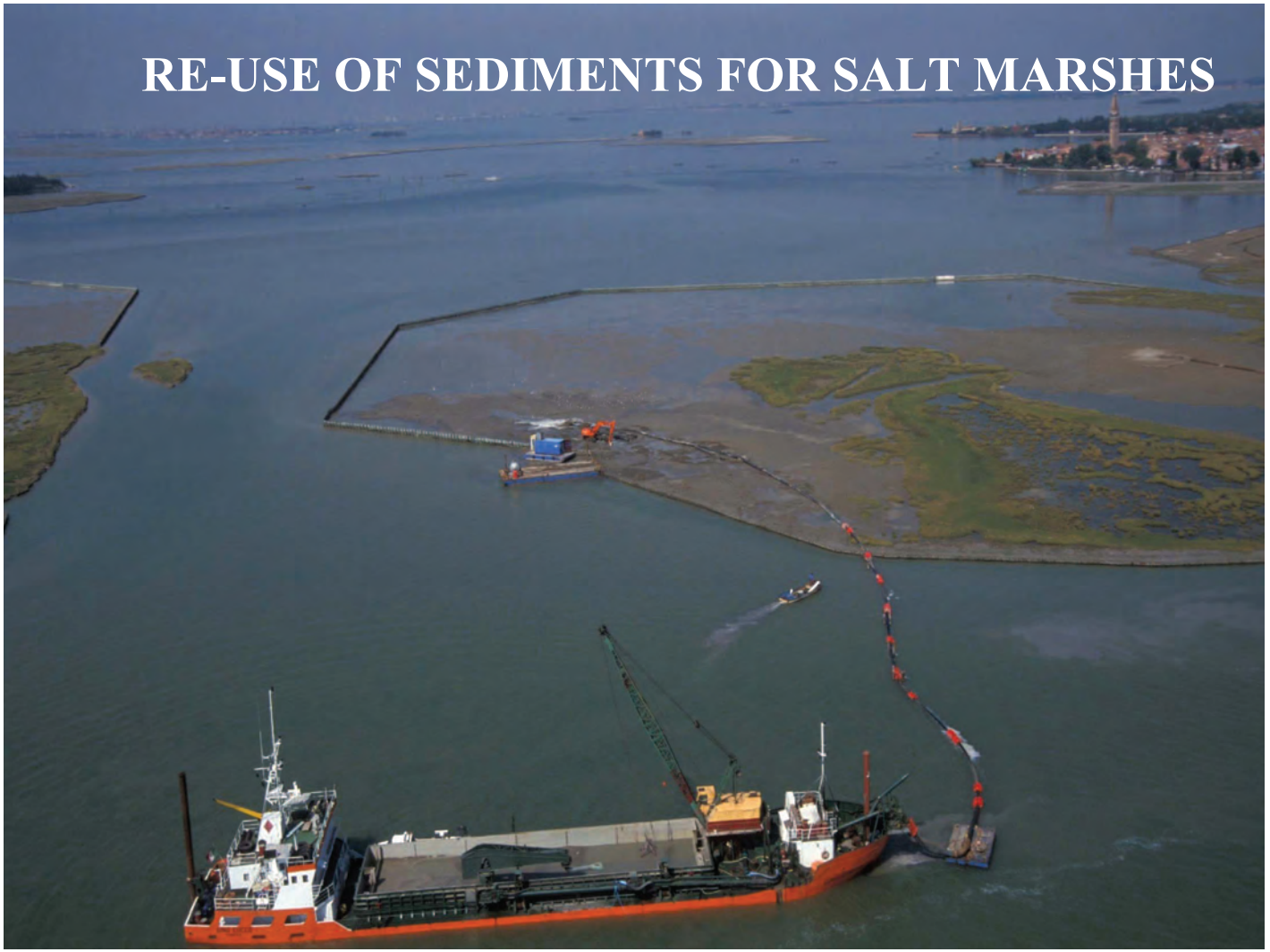
Before

After

Recovery of morphology



Environmental restoration



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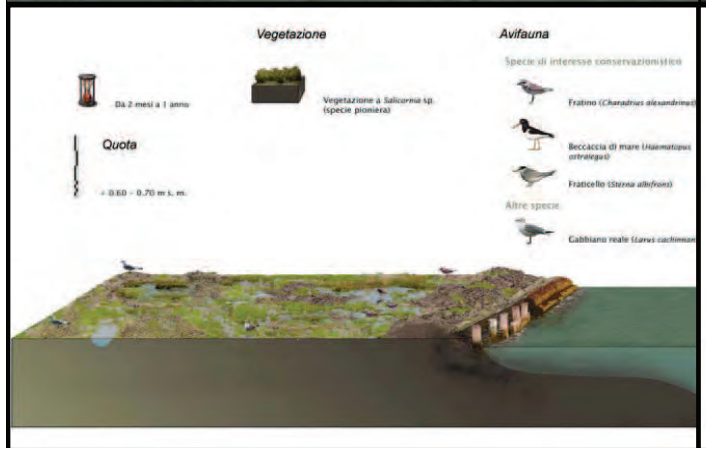
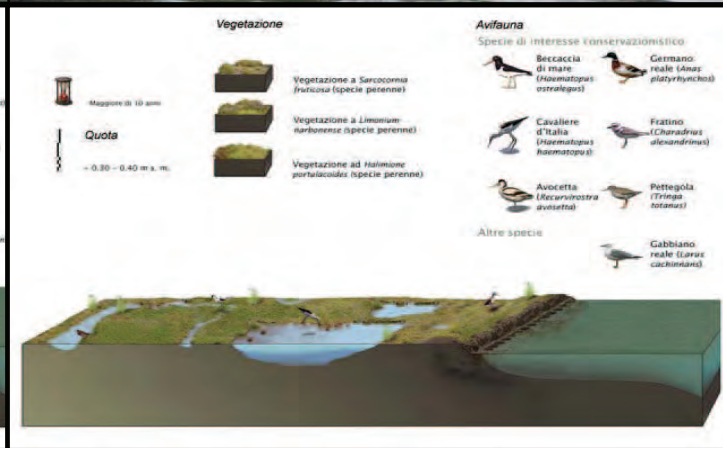
Environmental restoration

Salt marsh evolution





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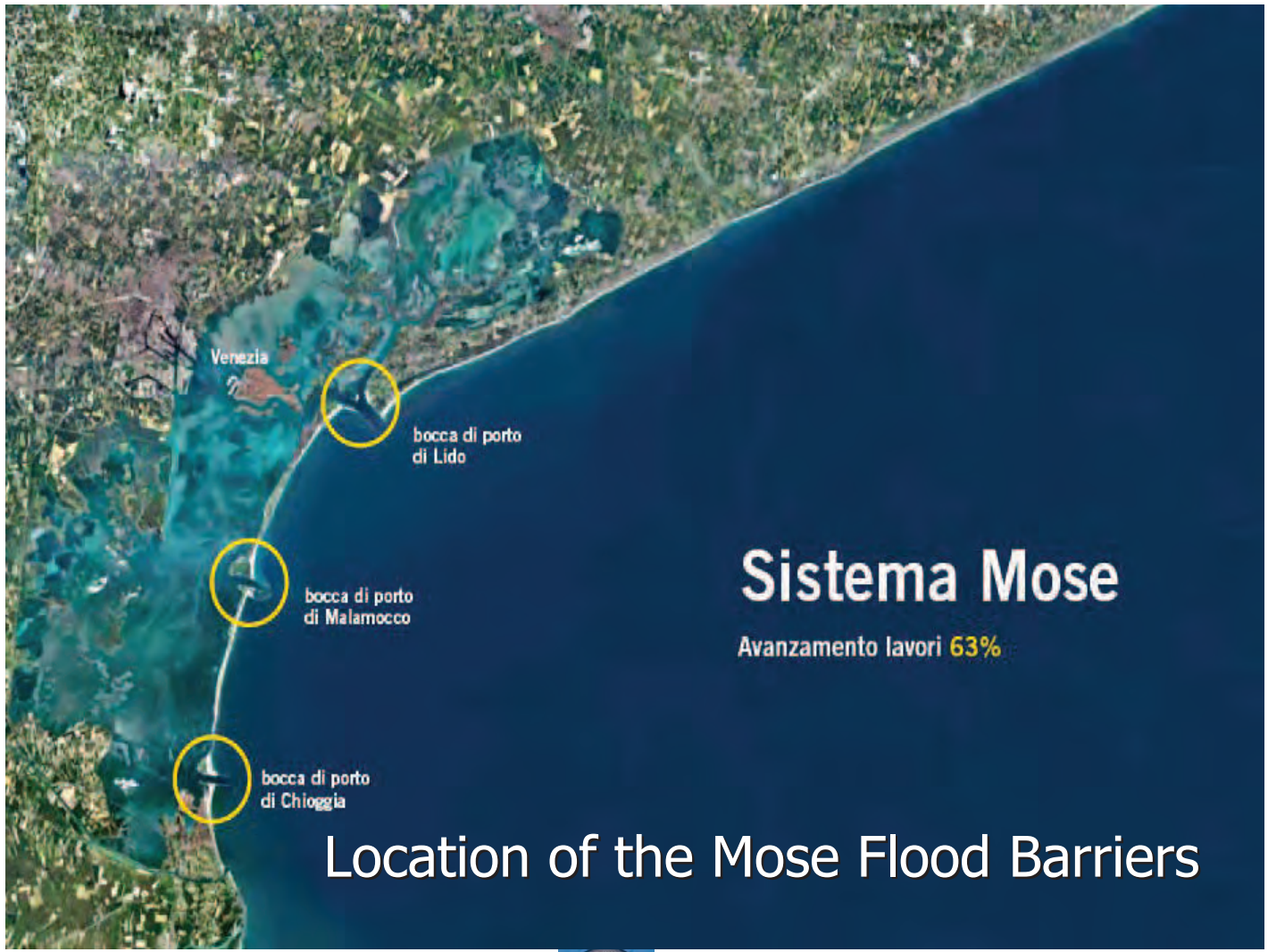
MOSE

Modulo Sperimentale Elettromeccanicon



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MOSE

THE MOSE FLOOD BARRIERS

• rows of gates installed in the bed of the inlets; 78 gates (Lido 21+20;Malamocco 19; Chioggia 18)

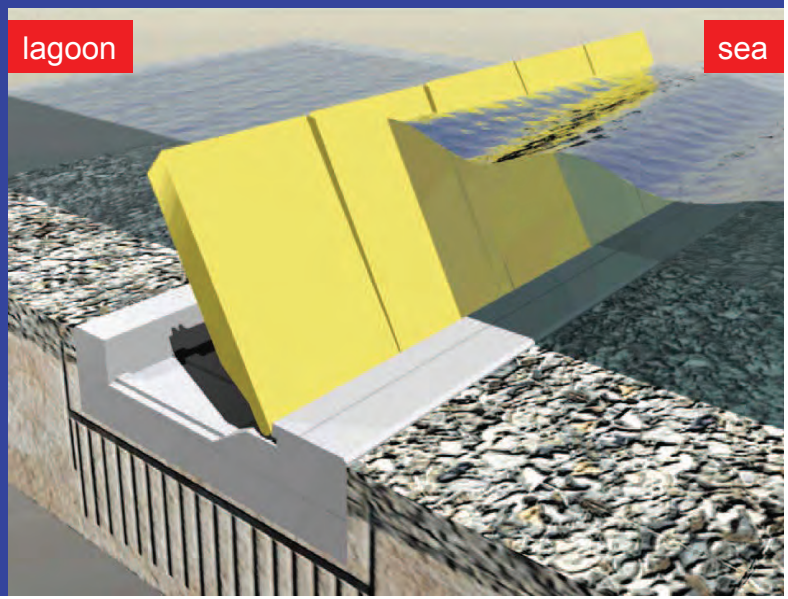
•"mobile" gates because in normal tidal conditions they are full o water and rest in their housing structures "caissons" on the seabed; emission of compressed air empties the gates of water until they emerge

Each gate

• box-like metal structure attached to the concrete caisson in which it is housed by means of two hinges

• 20 m wide with a variable height and width according to the depth of the inlet channel

• average inlet closing time is from 4 to 5 hours



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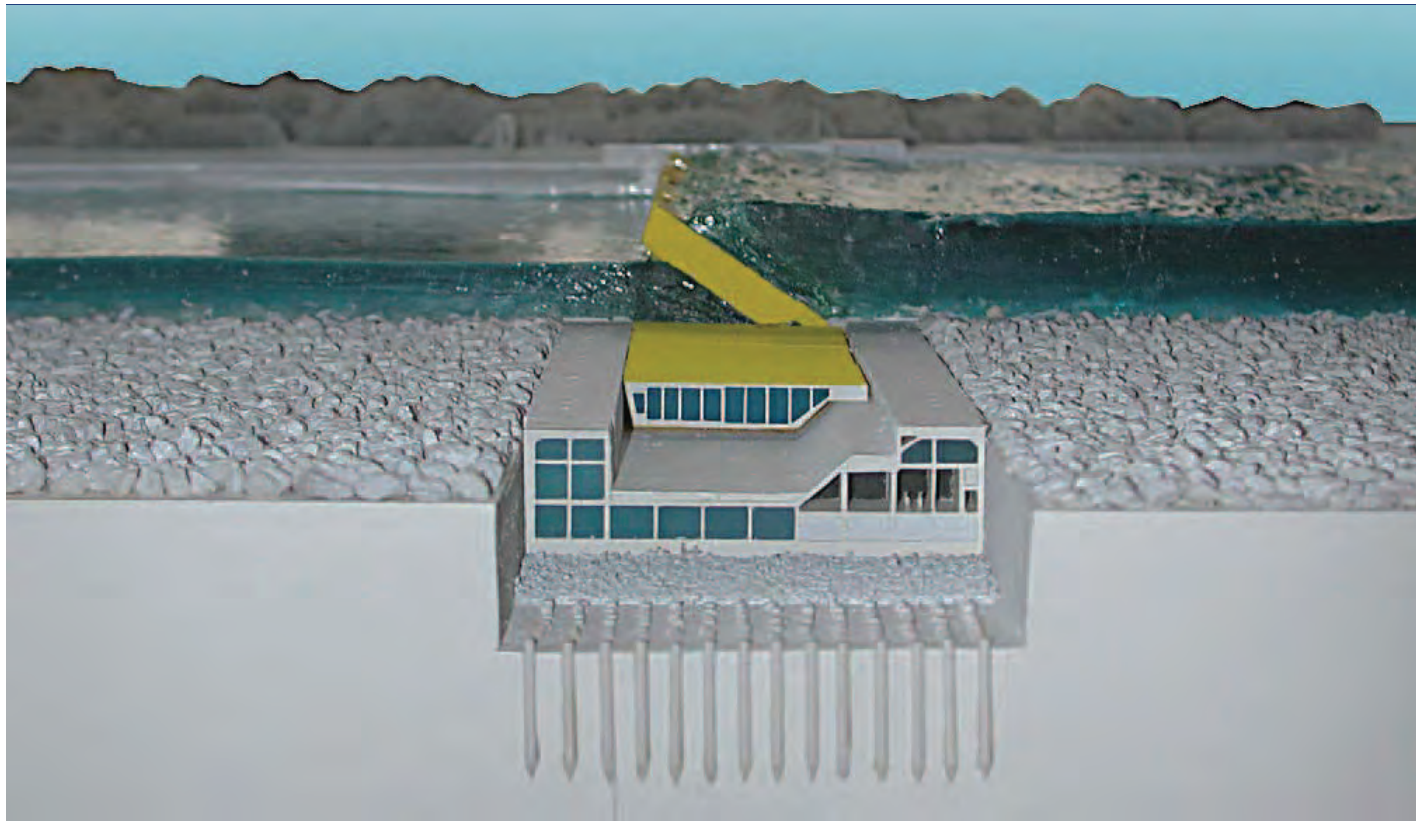
Gates



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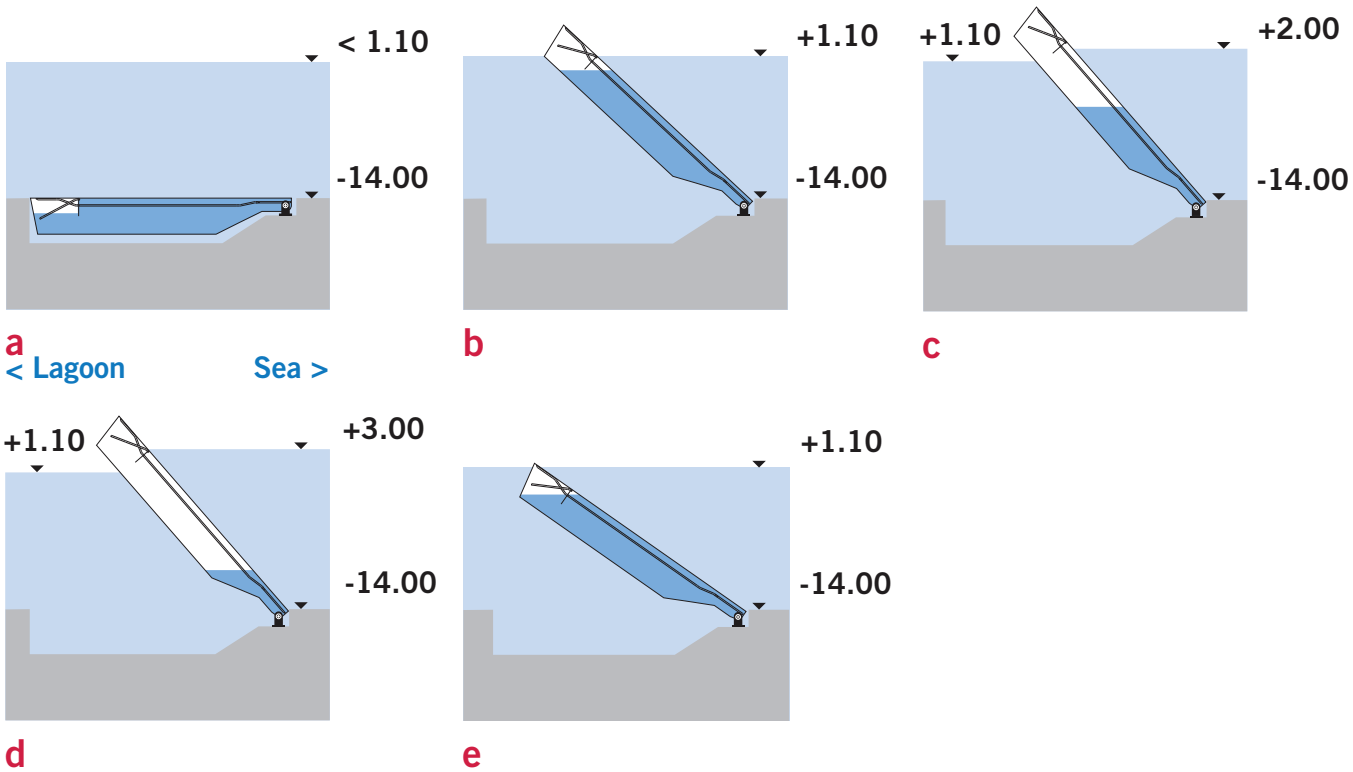
Operation



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Hinge system

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Lido inlet - new construction

The new lay-out after realization of the Mose System

1. Refuge haven with lock
2. Row of gates (Lido - Treporti)
3. New island between the rows of gates
4. Row of gate (Lido - S. Nicolò)
5. New configuration of the south bank
6. Breakwater

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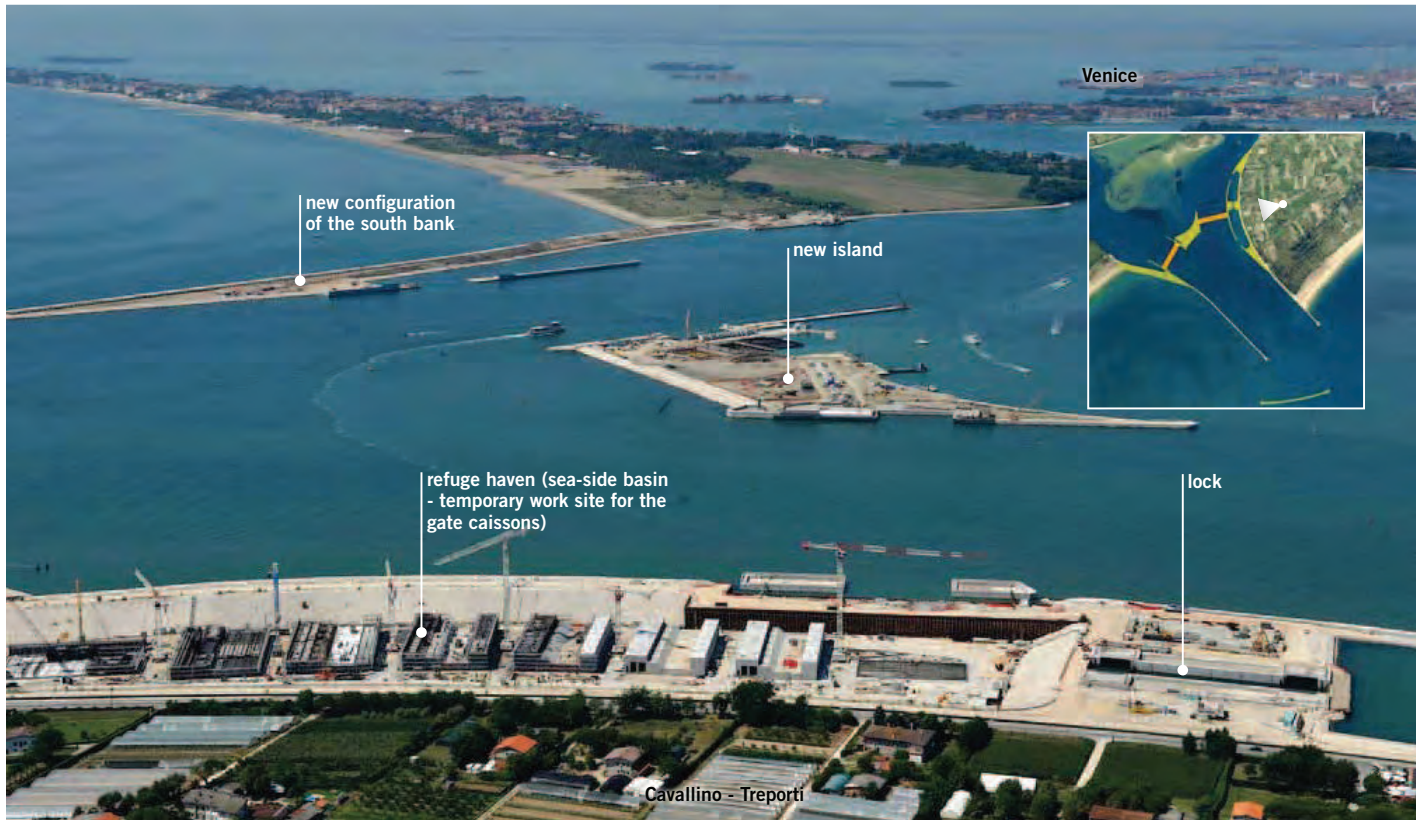
Lido inlet



Arsenale

Control centre

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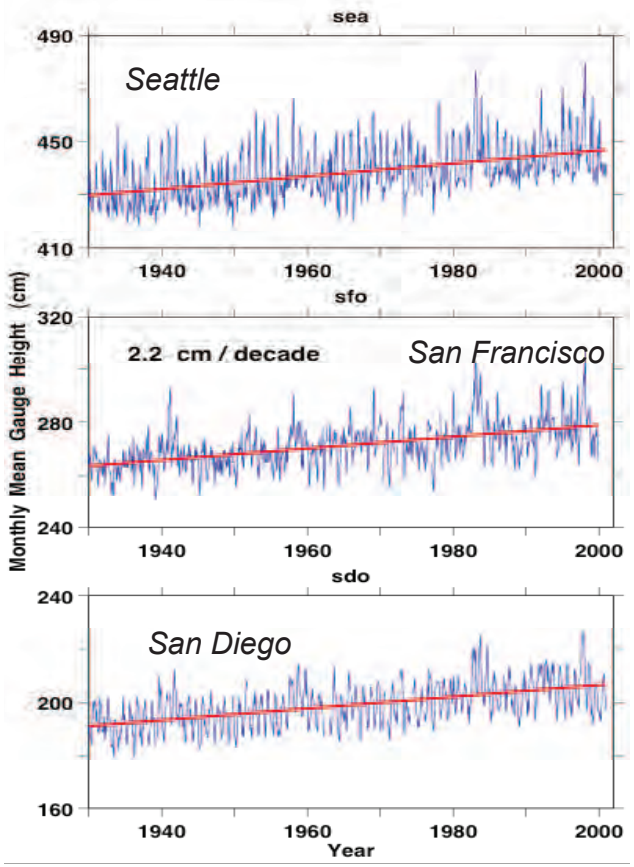
Arsenale

Restoration

Climate change

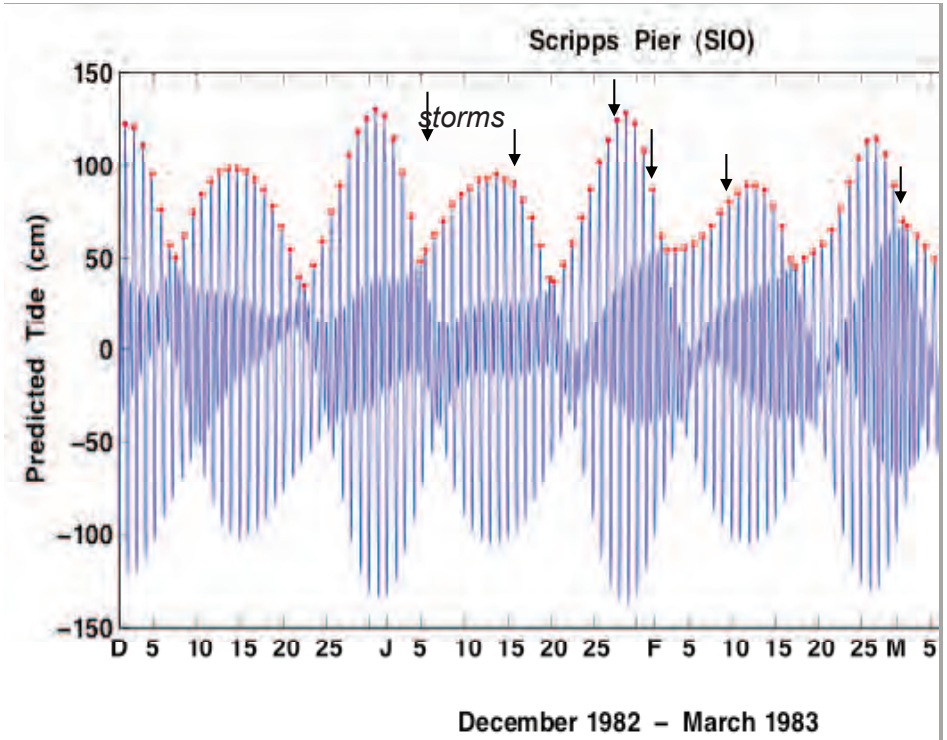
Sea level rise



2 cm/decade – consistent with estimates of global SLR

High tide + storms

Winter 1983

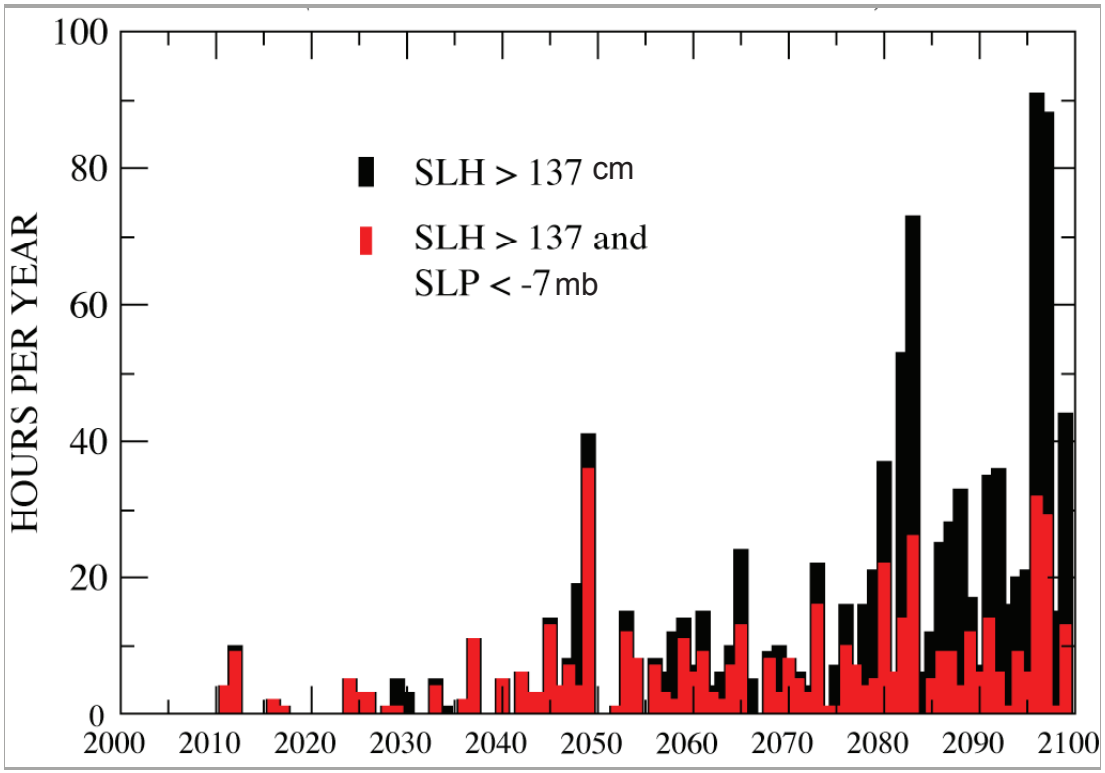


High tide levels vary by about 1 m

Highest storm-forced level = 28 cm

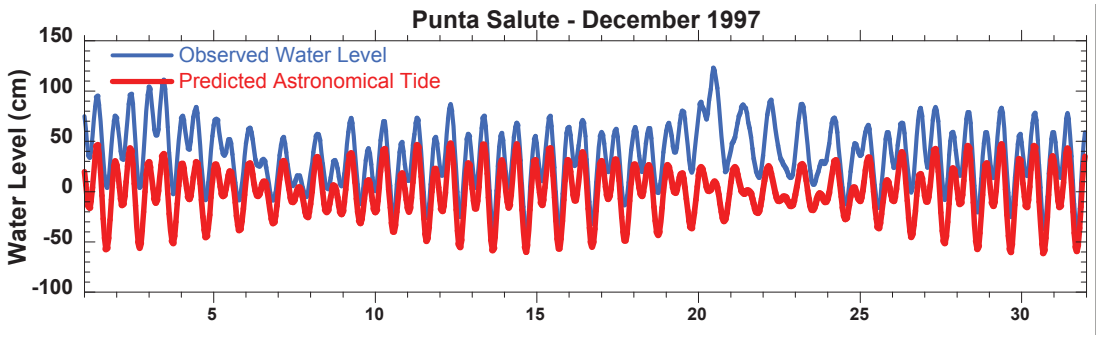
Sea level rise predictions

San Francisco hourly sea level



Under projected global warming, such as in the GFDL A2 simulation sea level rises considerably by 2100, in this scenario by approximately 0.9m.

Venice tides



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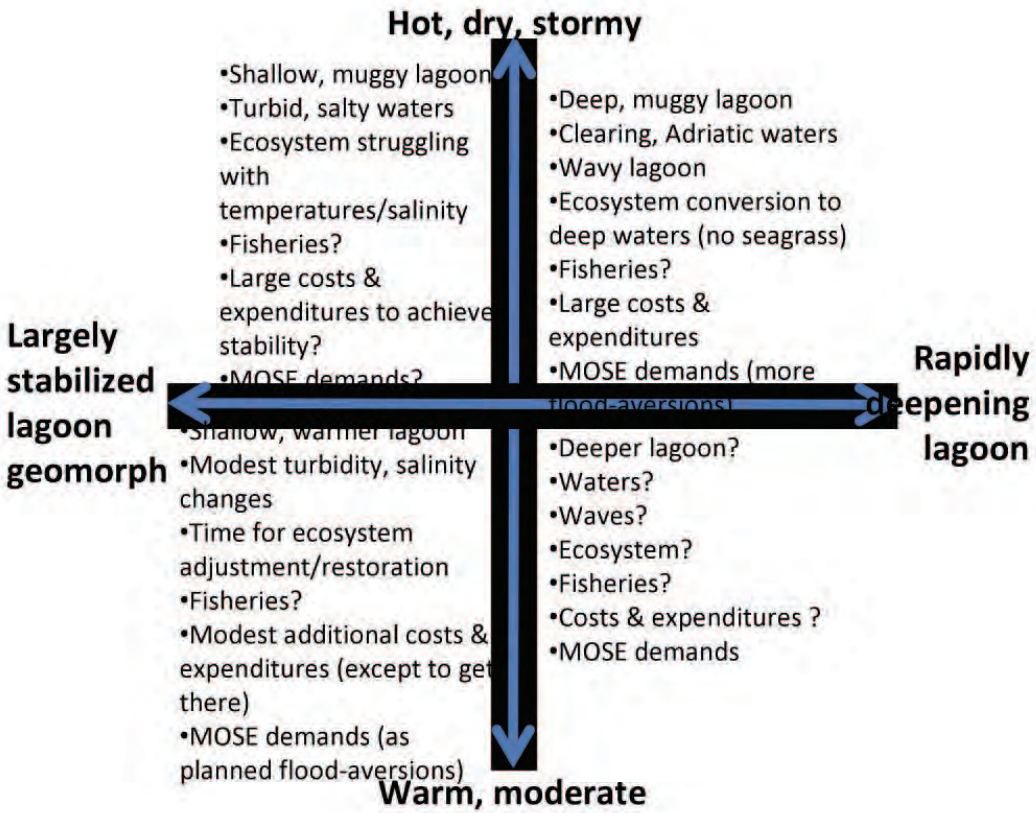
Vulnerability chart



A tool for assessing vulnerability

Science-based management

- Assessment

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- Assessment
  - monitoring of physical, chemical properties

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  - monitoring of biological components

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  - commit to regular schedule

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- Impacts of climate change on all of the above

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The Venice Conference:

Improving the capacity to assess and to adapt to climate change in urban coastal regions

September 12 – 15, 2011

Venice, Italy

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