

Analyses of Salt marsh Biogeomorphic Response to Sea Level Rise

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Outline

1. Introduction

2. Methods

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Salt marshes are **critical** but **fragile** ecosystems



It is argent to know how salt marsh elevation response to **accelerated sea level rise** (SLR) **in low sediment concentration** environments such as Venice lagoon.

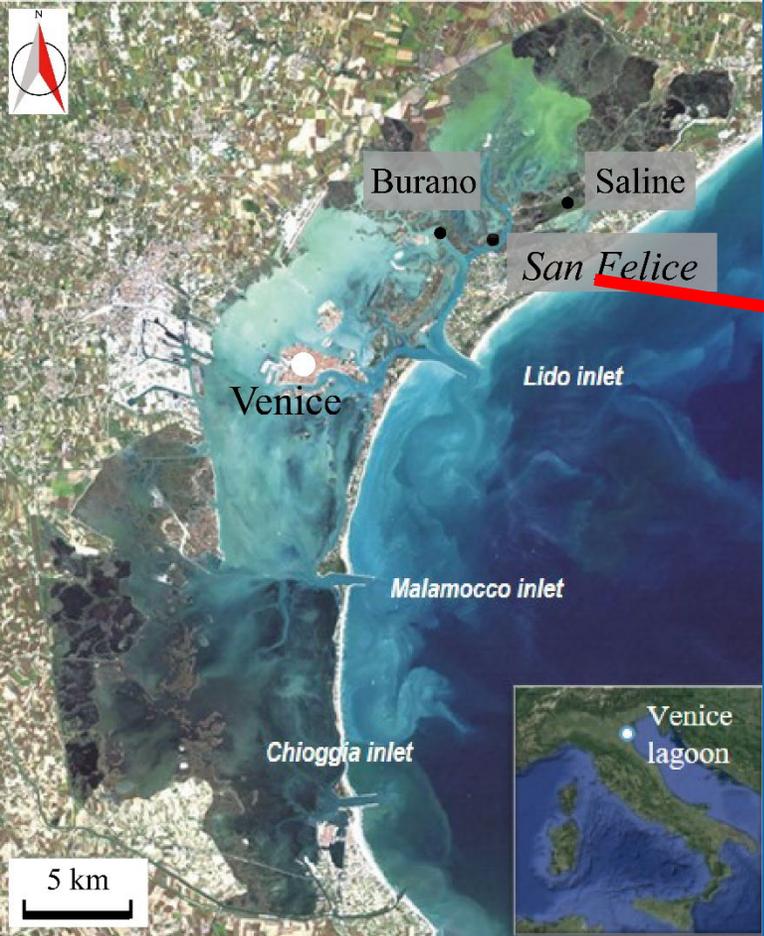


How halophytic **vegetation** response to **accelerated SLR** is also still unclear.

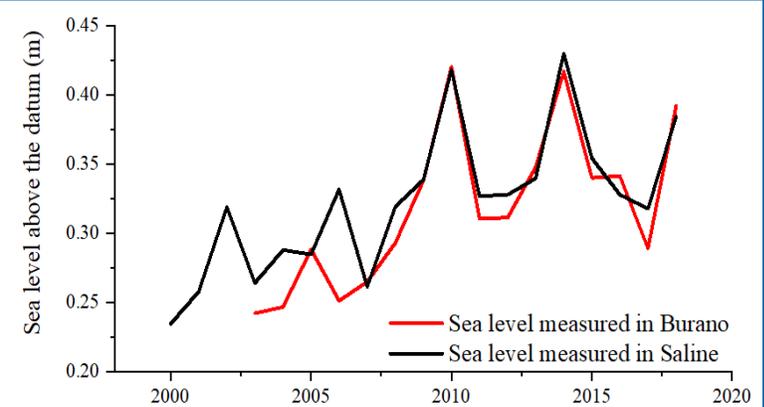


So we conducted **marsh elevation** measurements and **halophytic vegetation observations** on a marsh between 2000 and 2019.



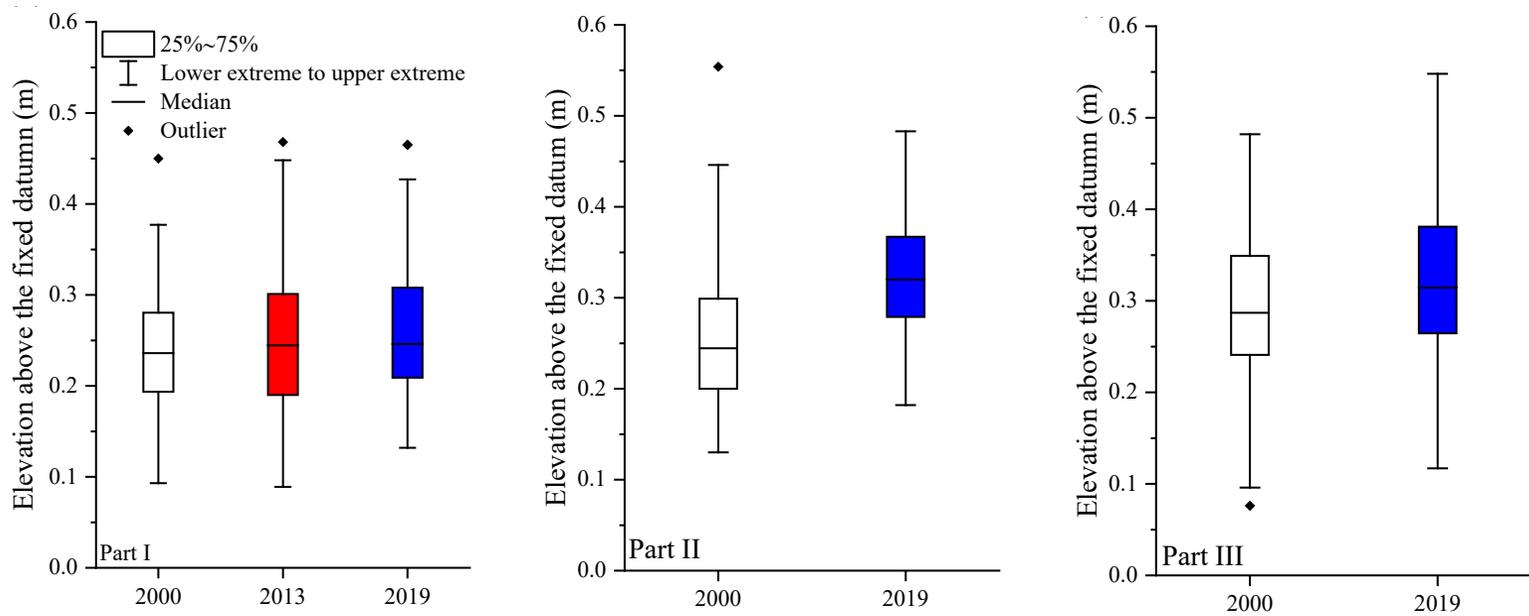


Area $\approx 550 \text{ km}^2$
 Mean water depth $\approx 1.5 \text{ m}$
 Semi-diurnal micro-tidal regime
 Surviving marshes about 47 km^2 , they were 180 km^2 two centuries ago!



Period	Rate of SLR (mm/year)		
	Saline	Burano	Average
2000-2013	7.9	11.5	9.7
2013-2018	-4	-4.6	-4.3
2000-2018	6.3	7.8	7.1

Main species:
Spartina maritima;
Sarcocornia fruticosa;
Limonium narbonense;
Inula crithmoides



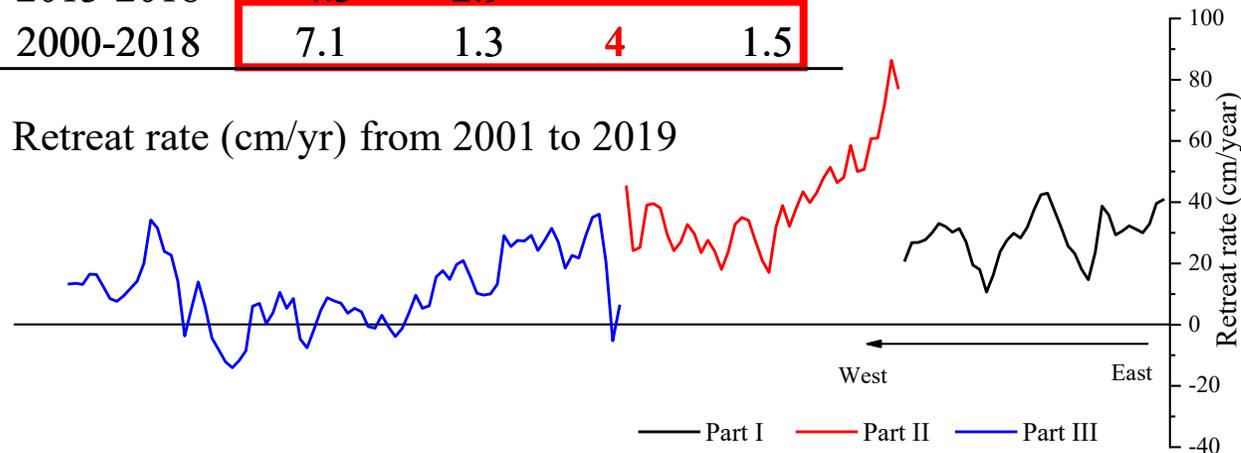
1 The San Felice marsh **lost elevation** relative to MSL between 2000 and 2019. Because salt marsh accretion rates in different parts are lower than the RSLR.

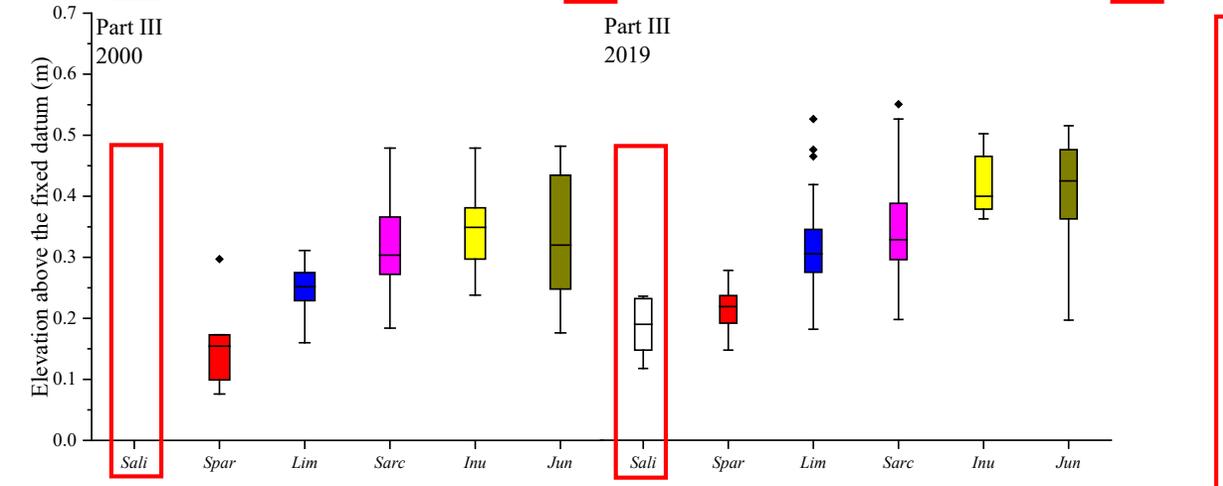
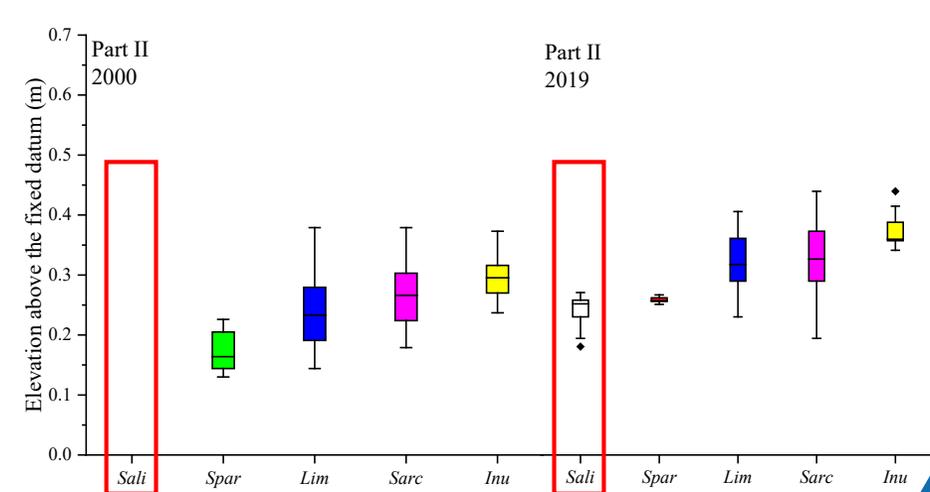
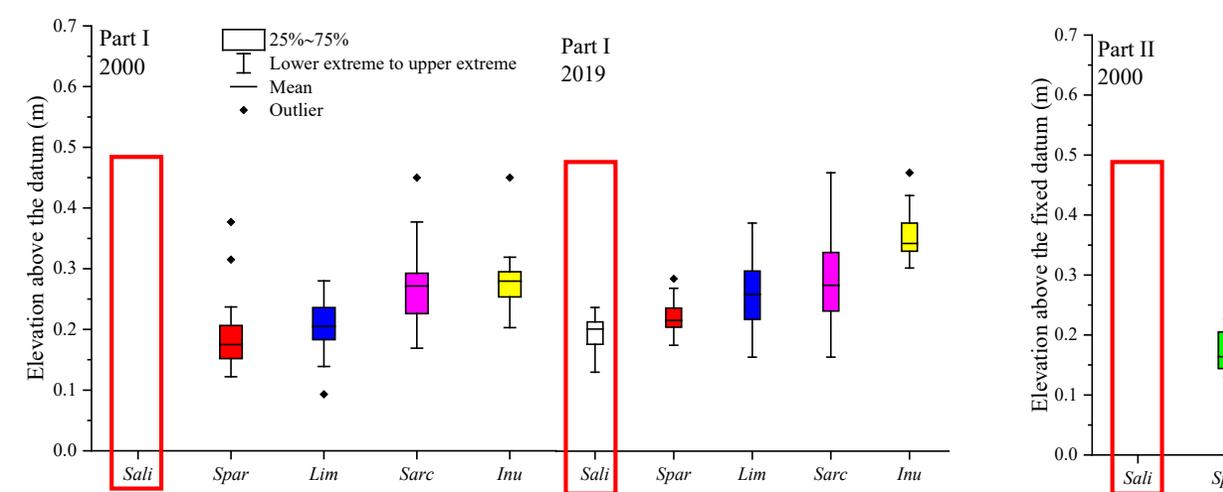
Period	RSLR	Accretion rate (mm/yr)		
	(mm/yr)	Part I	Part II	Part III
2000-2013	9.7	0.7	--	--
2013-2018	-4.3	2.9	--	--
2000-2018	7.1	1.3	4	1.5

Why different parts have different accretion rate??

2 The **marsh accretion** may be related to marsh **boundary retreat**.

Retreat rate (cm/yr) from 2001 to 2019





We can find the **appearance** of **Salicornia** and the **dieback of Spartina** !! This can be attributed to **heatwave event** (Strain et al., 2017).

- 1 Different halophytic vegetation species occupy their preferable elevations and can be characterized by their **ecological niches**.
- 2 The **sequence of vegetation species** with increasing soil elevation did **not change** during the observed 19 years.
- 3 Vegetation migration rates is **varied** by **different species**.

Part	Period	SLR (mm/yr)	Vegetation migration rate (mm/yr)				
		Average	Spar	Lim	Sarc	Inu	Jun
Part I	00-13	9.7	5.7	7.5	-1.6	11.2	...
	13-18	-4.3	1.6	2.0	2.5	0.1	...
	00-18	7.1	2.3	3.1	0.1	3.8	...
Part II	00-18	7.1	5.0	3.7	3.2	3.5	...
Part III	00-18	7.1	3.3	2.7	1.7	2.8	5.4

- 1) The San Felice marsh **lost elevation** relative to MSL between 2000 and 2019: on average, salt marsh accretion rates in different parts are lower than the rate of sea level rise.
- 2) Different halophytic vegetation species are characterized by different **ecological niches** that slightly changed in time.
- 3) The **sequence of vegetation species** with increasing soil elevation did **not change** during the observed 19 years.
- 4) Vegetation migration rates can be characterized as a **species-specific characteristic**. Boundary species like *Juncus* and *Inula* are most sensitive to sea level changes, *Limonium* and *Spartina* are less sensitive to changes while *Sarcocornia* was characterized by delayed migration rates in response to sea level changes.
- 5) The **dieback of *Spartina*** and **invasion of *Salicornia*** are also observed in present study.