Climatic determinants of peatland development in South-Florida

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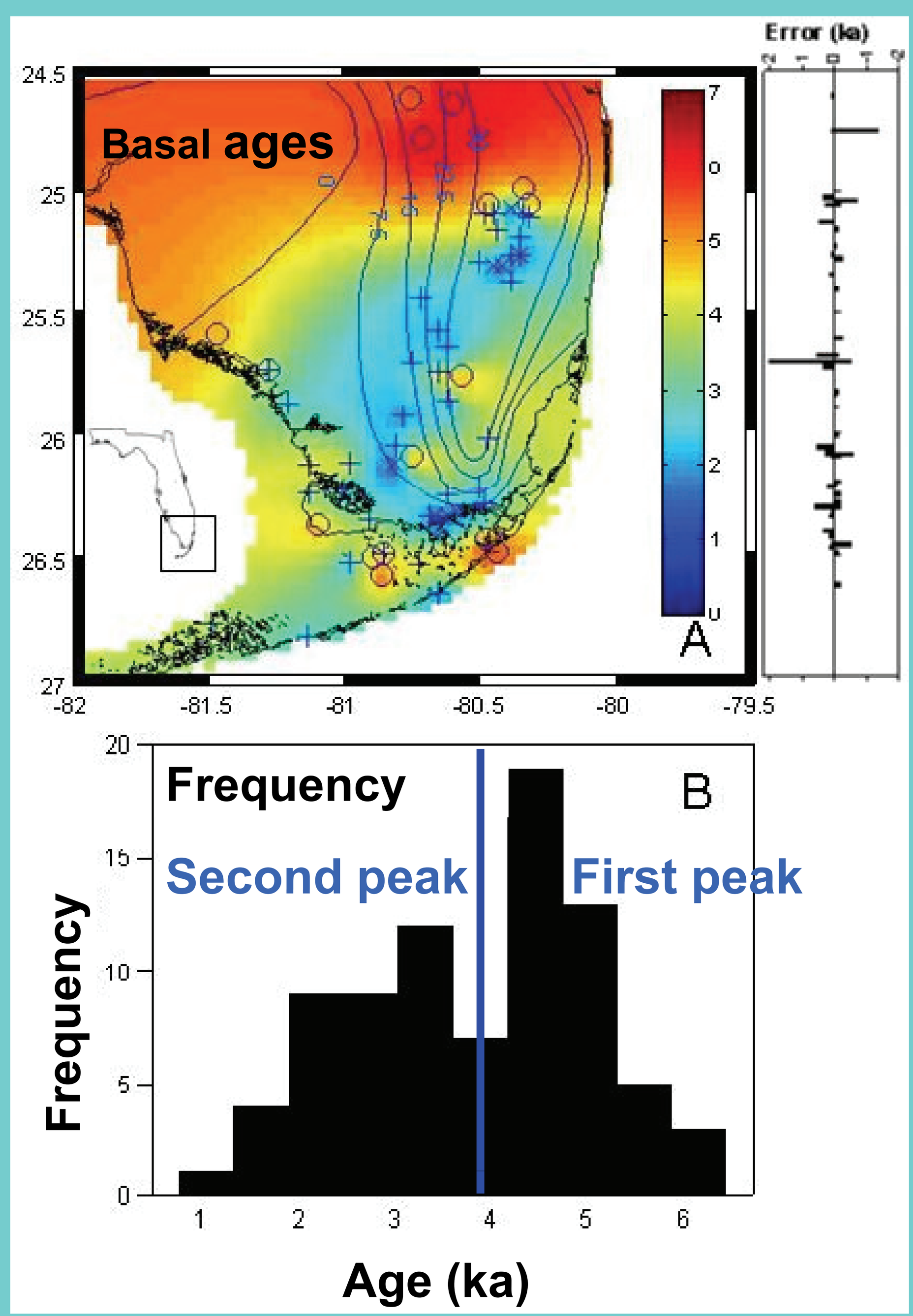
DATA: Basal-ages of Florida peatlands



***A: Survey of basal ages of peat** cores. Colors show krigged basal ages in ka BP. Locations: o>=4.5 ka BP, * between 3.6-2.0 ka BP, + <=2.0 ka BP. Lines are isohypes of net recharge (cm.year-1).*

***B: Distribution of basal age** of the cores, with two clear distinct peaks.*

What can we learn from Florida peat development?

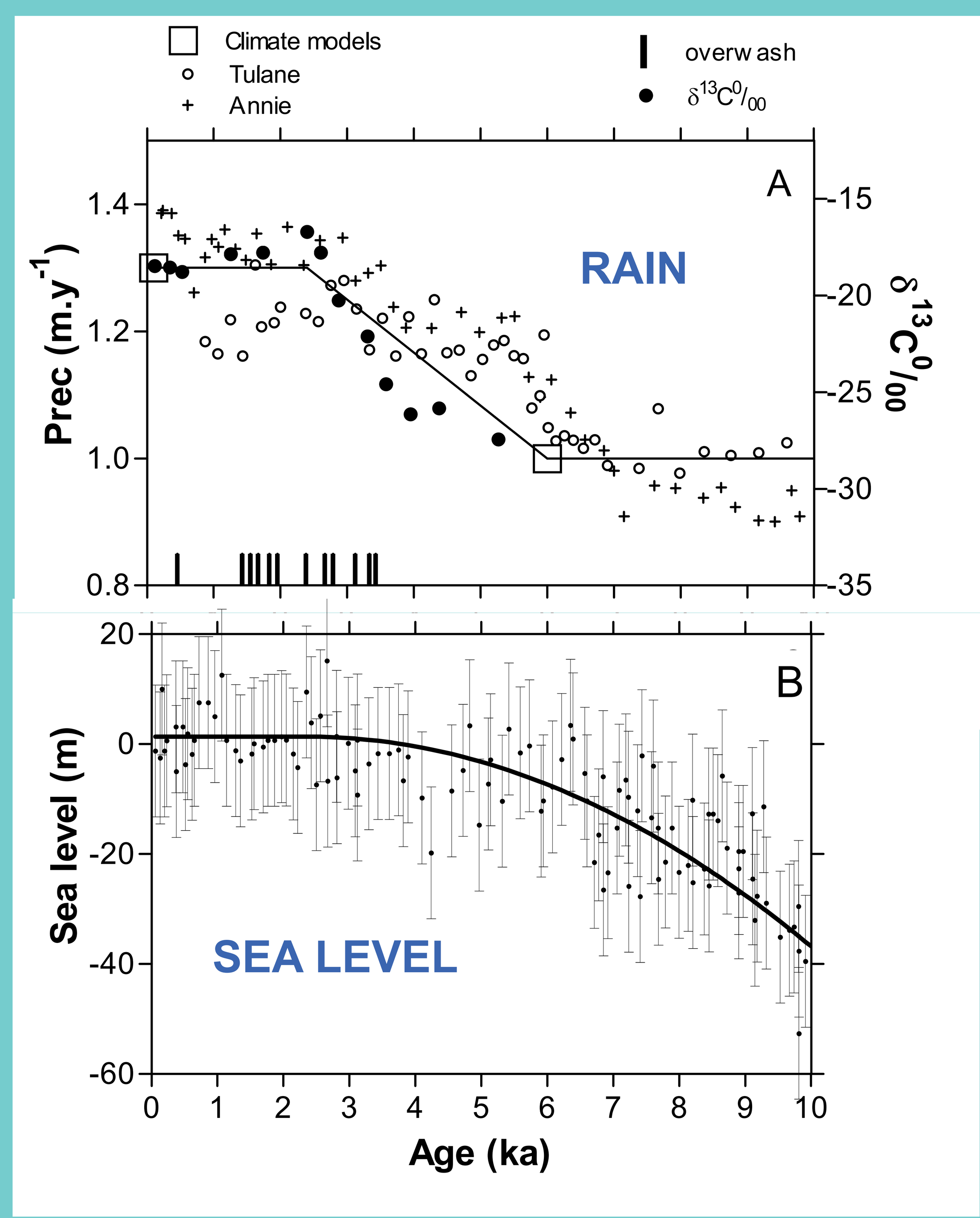
HYPOTHESES

1. The start of the peat initiation has been triggered by the increase in rain during the Holocene (6 ka)

2. The start of the peat initiation has been triggered by the sea level rise.

3. The second peak of peat initiation is caused by increase in climate variability around 4.0 ka. This will highly influence the non-linear nature of peat accumulation and peat decomposition

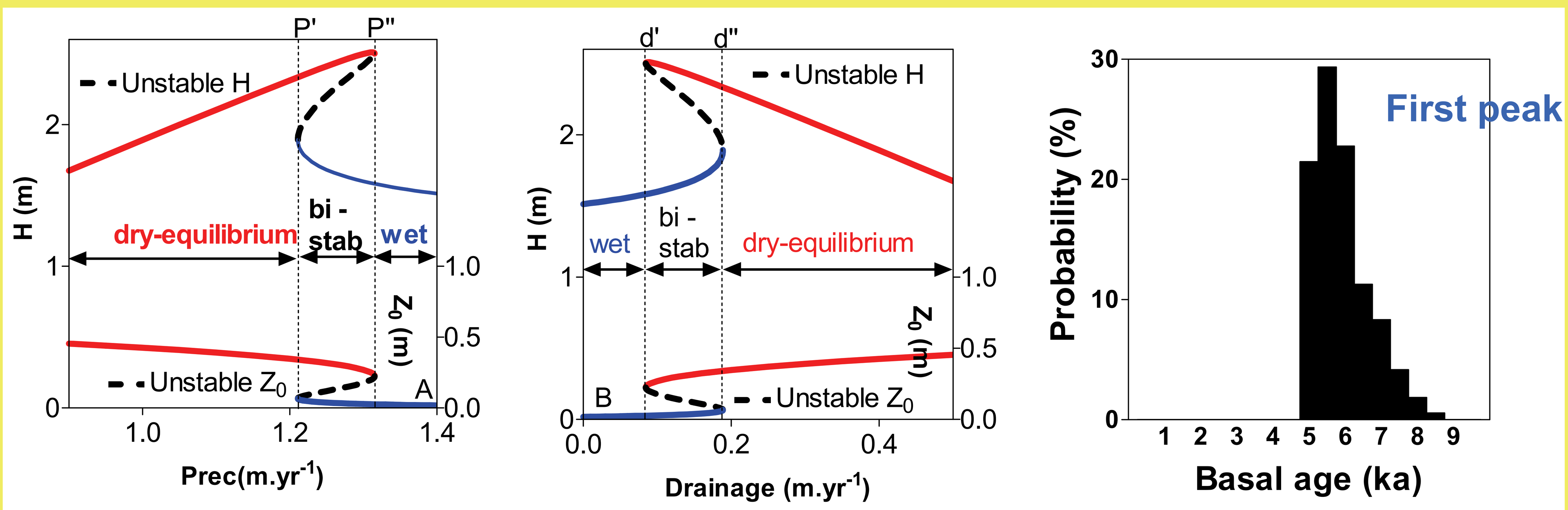
FORCING DATA



***A: Reconstructions of precipitation** based on data of Filey et al. (2001), Liu and Fearn (2000) and Donders et al. (2011) (pollen)*

***B: Sea level reconstruction** from Sidall et al. (2003)*

Results: Model of peat accumulation and peat decomposition (Hilbert et al. 2000)



Simulated sensitivity of drainage and precipitation on peat accumulation.

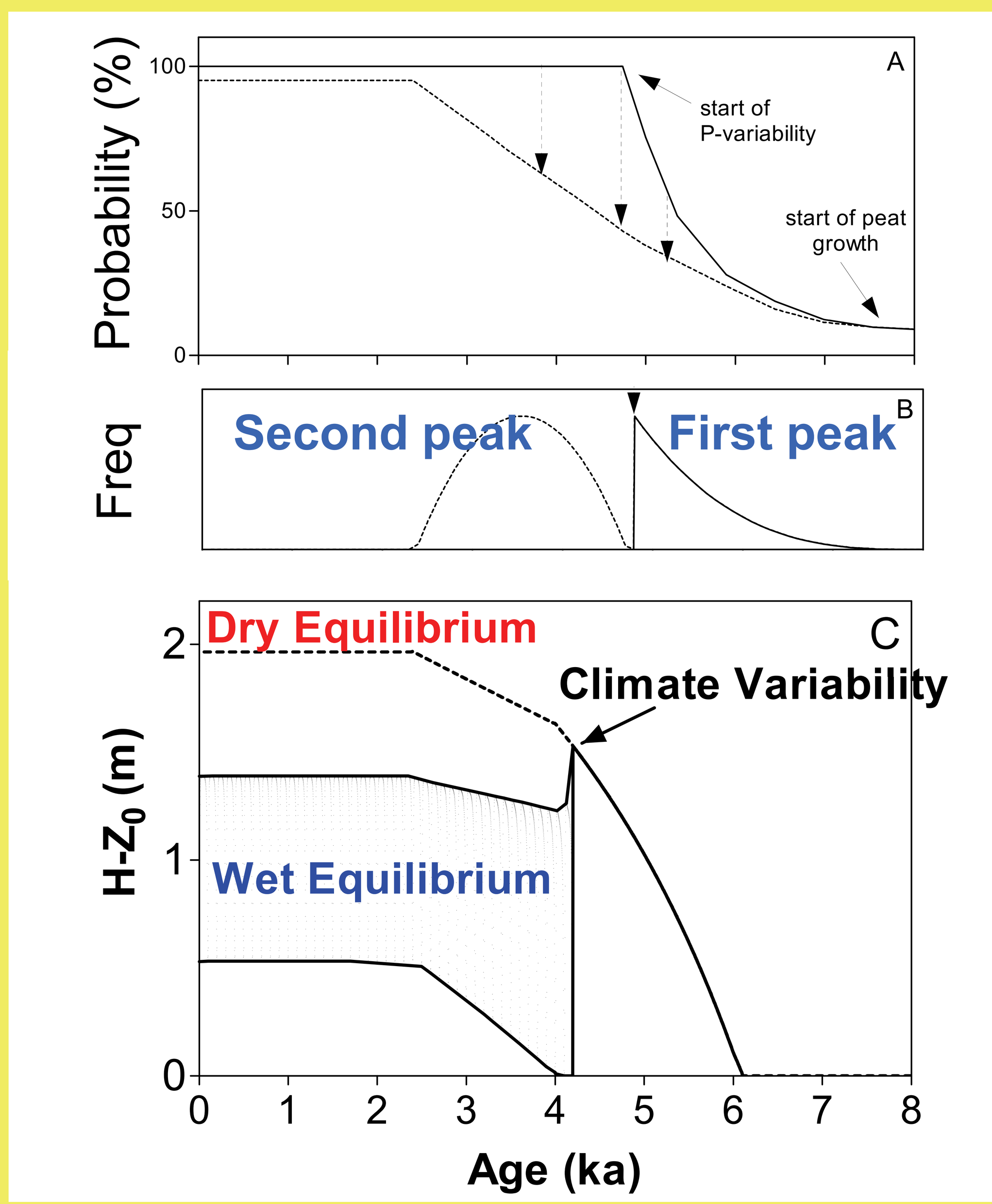
***A. Precipitation and Equilibrium states of H (height of peat) and Z_0 (water table depth below peat surface)** Dry-equilibrium give higher peat depths due to higher plant productivity. Bistable conditions are found*

B. Drainage and Equilibrium states of H and Z_0 depending (i.e. sea water level).

***C. Simulated probability of peat accumulation due to sea water level and precipitation rise.** All peats are already developed before mid-Holocene conditions (only first peak).*

Results: Climate variability

Increased climatic variability may have caused the offset between the firsst and second peak of peat initiation. When peatlands fall dry (H-Z0)=0 they become vulnerable to erosion and fire.



***A. Probability of peat accumulation** without (black line) and with (dotted line) climate variability.*
B. Two peaks of peat accumulation
***C. Shift from dry to wet-equilibrium** due to increase in climate variability*

Conclusions

Precipitation during the Holocene was high enough to initiate peatlands.

The sea level rise causes the first peak in peatland initiation during the Mid-Holocene

The second peak of peatland initiation is caused by increased climate variability.

Due to climate variability, the peatlands shifted from the dry to the wet-equilibrium, associated with low peat heights, because during wet conditions peat growth is limited.

These low peat height (wet state) are more vulnerable to spells of dry years, as buffer capacities are lower, making them highly vulnerable for erosion, fire and decomposition