

# Low complexity model provides new insights into mechanisms and timing of sapropel formation



## Transient box model analysis of sapropel formation in the Mediterranean Sea

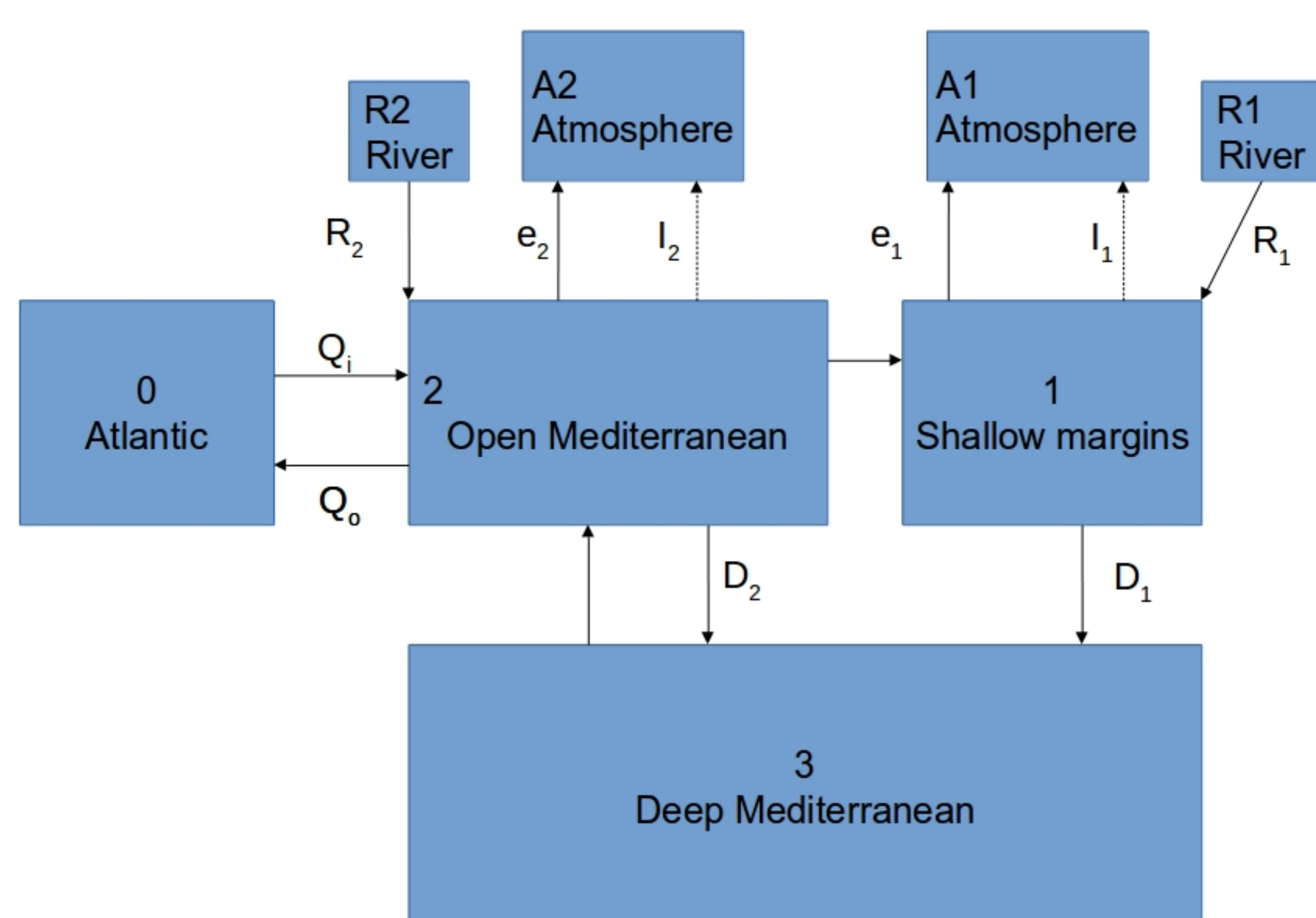
• Pieter Dirksen, Paul Meijer

### Introduction

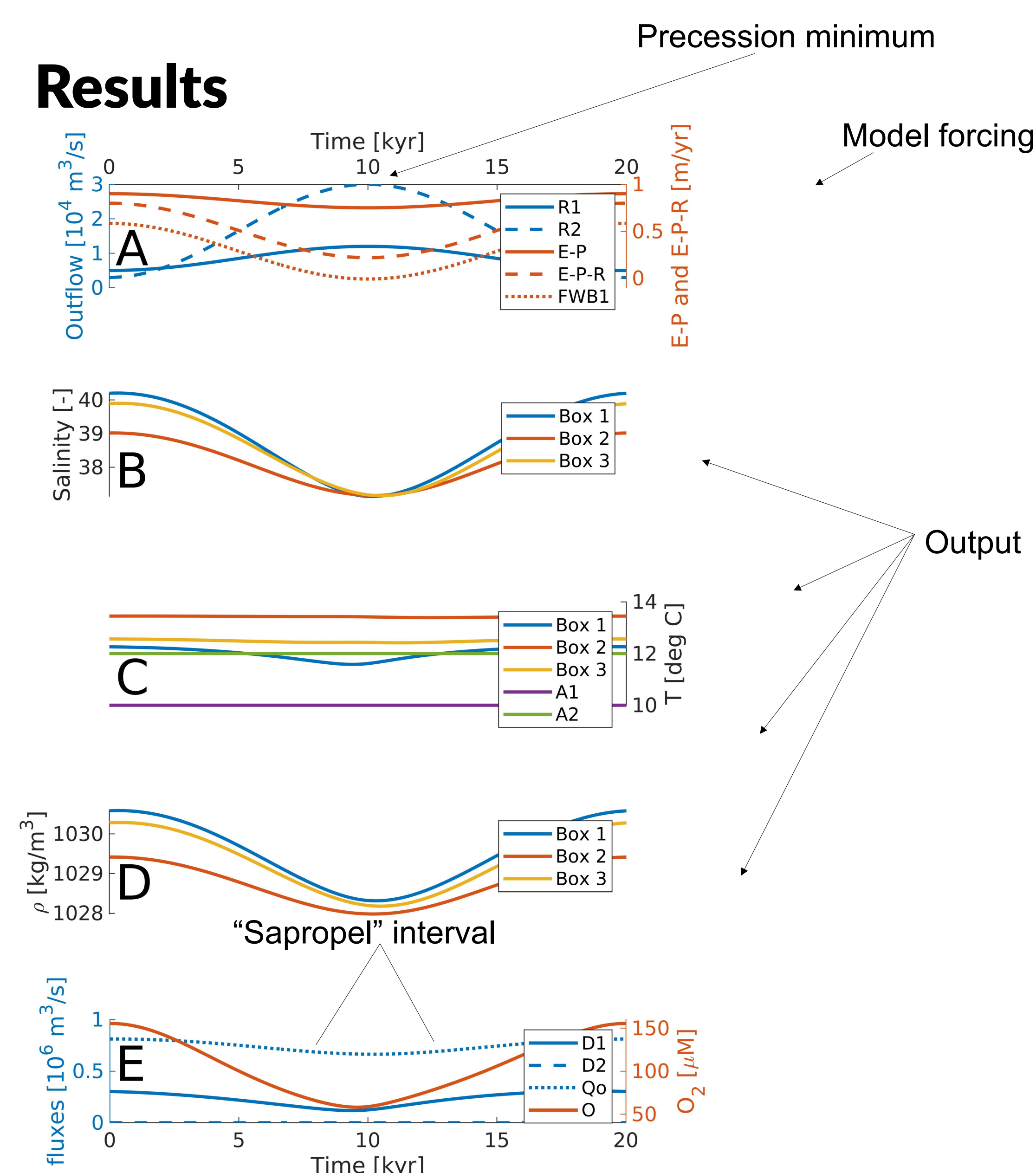
Sapropel formation in the Mediterranean Sea has been studied extensively in the geological record and with snapshot and short time-slice experiments with comprehensive ocean models. In contrast, we present a low complexity box model to investigate the physical processes causing sapropel formation. The model allows us to focus on the transient, nonlinear response of the system over an entire precession cycle.

### Methods

- We divide the Mediterranean Sea into three dynamic boxes. (1, 2, and 3 in the diagram below).
- Each box has its own temperature and salinity.
- River outflow and evaporation (E-P) are predefined, all other fluxes are calculated from density gradients, temperature gradients, and conservation of salt and volume.
- Each run: full precession cycle.
- R1=Rivers from Europe.
- R2=Nile.



### Results

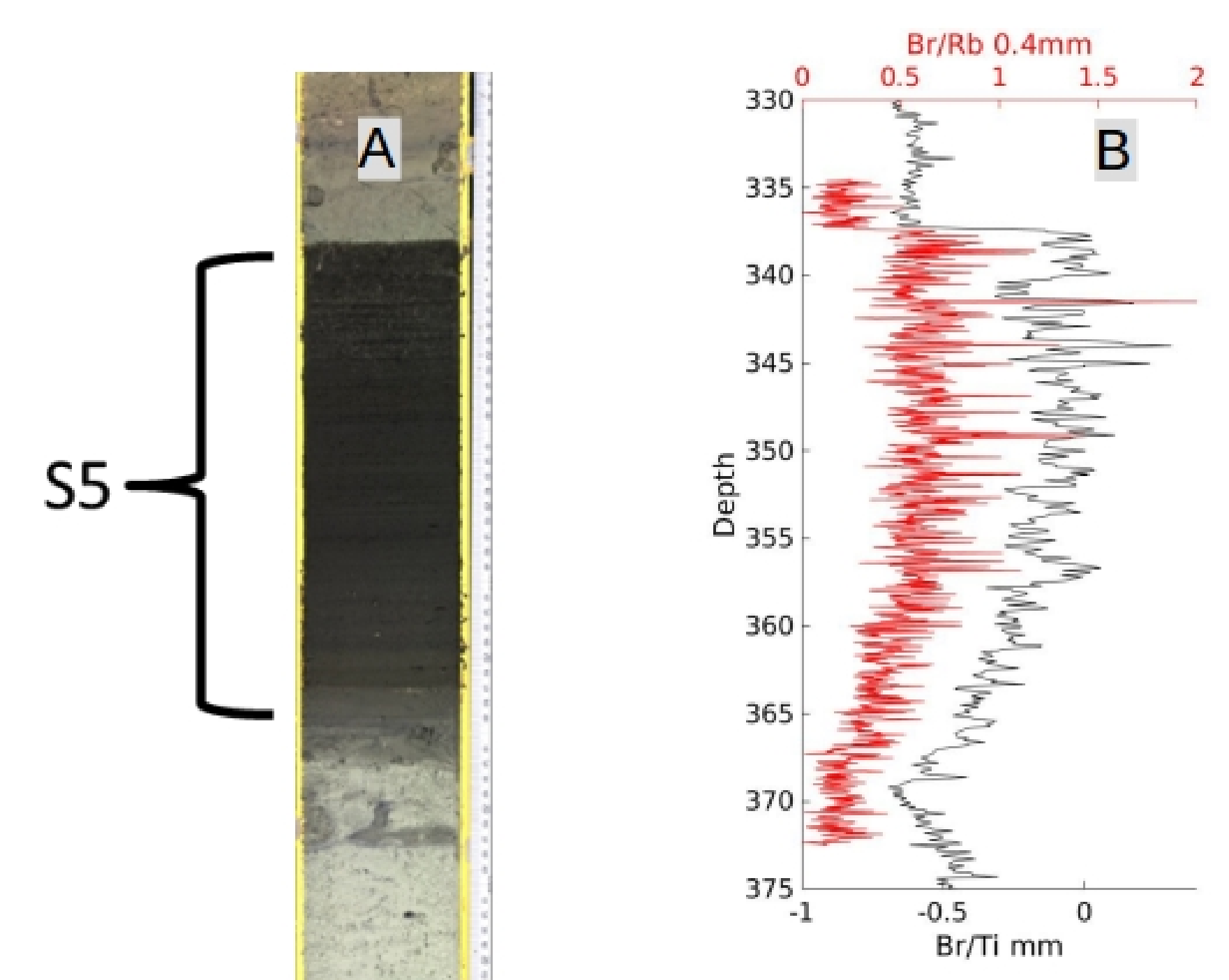


### Conclusions

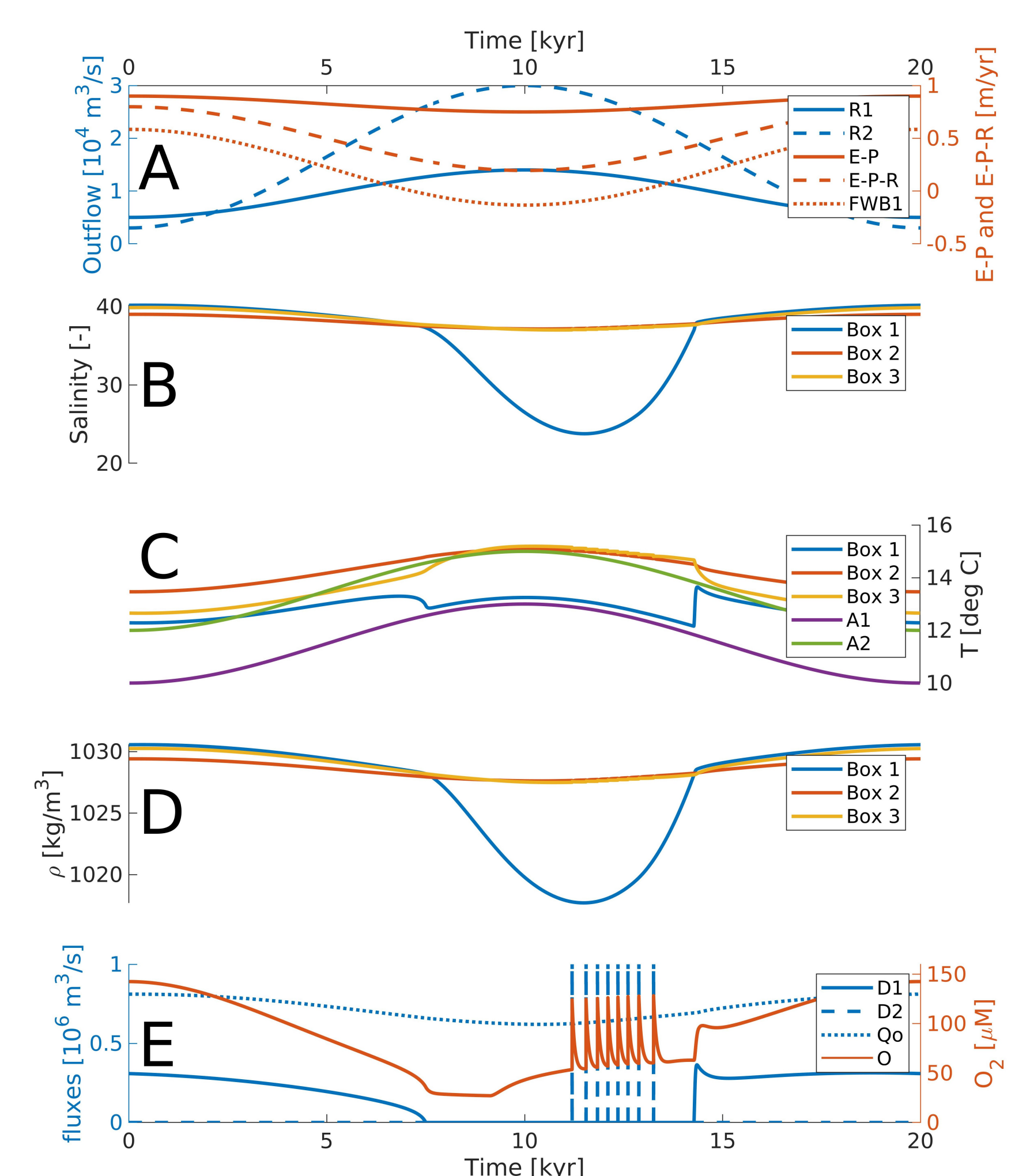
- Small change in DWF → large impact in bottom water oxygenation.
- Each sapropel is different.
- Sapropels are the result of nonlinear behavior.
- No linear relation with insolation → phase undefined.
- Sudden terminations and resonances occur in the model when the freshwater budget of (part of) the basin reverses.

### Extra figures

Picture and XRF measurement of sapropel S5.



FWB of margins reverses: resonance!



Utrecht University

Link to preprint:

