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A New Baltic Sea Environmental Index

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Background

- The Baltic Sea (BS) is a dilution basin characterized by strong salinity gradient and closed circulation.
- Correlation between North Atlantic Oscillation (NAO) and biological variables fails since 2000/2001
- Large scale sea level pressure fields underwent substantial change on the northern hemisphere indicating a global climate regime shift (Swanson & Tsonis, 2009)
- Large scale climate indices perfom insufficiently as predictors for most zooplankton species

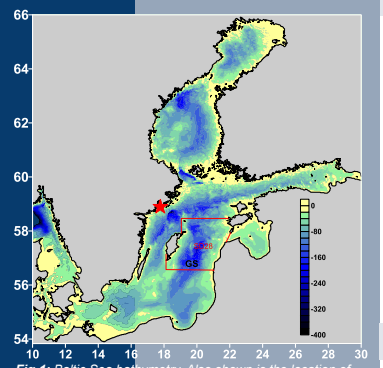


Fig.1: Baltic Sea bathymetry. Also shown is the location of the Landsort gauge (red asterix), Gotland Sea (GS) and the ICES sub-division 28 (SD28)

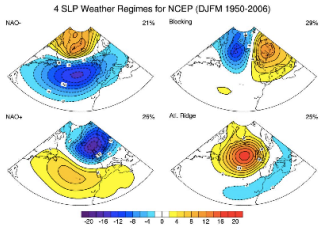


Fig.2: Climate regimes in SLP (hPa) over the North Atlantic. (Hurrell & Deser,2010)

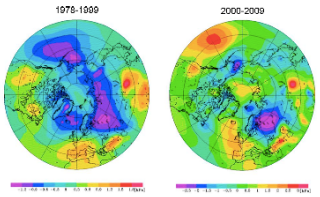


Fig.3: SLP Composite (Dec-Mar) (Dippner et al.,2010)

Baltic Sea Environmental (BSE) Index

consists of 4 time series:

- Arctic Oscillation (AO)
- Salinity between 120-200 m in the Gotland Sea
- integrated runoff of all rivers draining into the BS
- relative vorticity of geostrophic wind over the BS area (Chen, 2000)

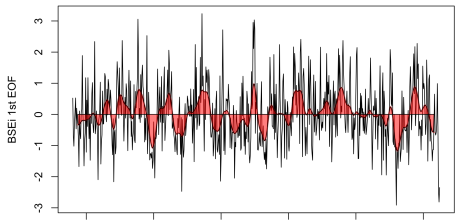


Fig.5: BSE index. The red line is the time series filtered with a cut off of 25 months

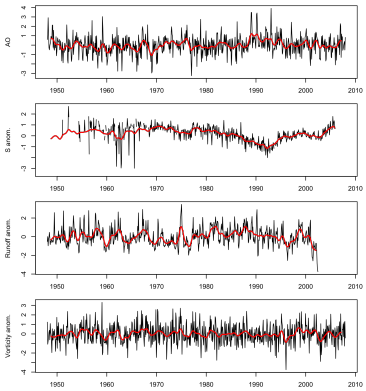


Fig.4:Components of the BSE index. The red line is the time series filtered with a cut off of 25 months

Statistical Downscaling Experiment

Predictors:

AMO, AO, NAO, BSI, Chen, BSE, COADS-SST

Predictands:

SST of the Gotland Sea (GS), Landsort gauge (LG), ice extent (IE) and abundance and biomass for the period 1969-2002 of *Acartia* spp, *Pseudocalanus* sp. and *T. longicornis, and total biomass for 1960-1997 of B. longispina*, *E. nordmanni*,, *Syncheata* spp. and *measured in ICES sub-division 28 by the Latvian Inst. of Food Safety, Animal Health and Environment*

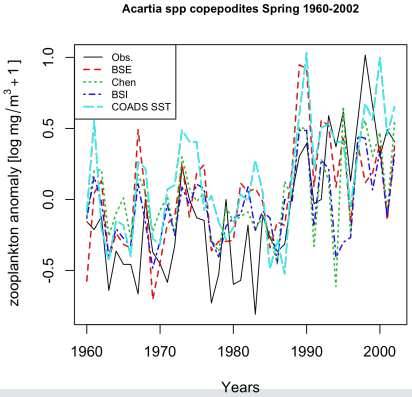
Conclusions

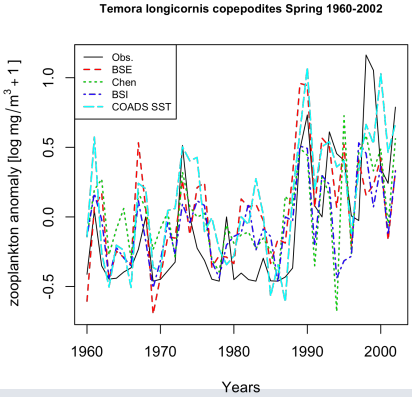
- combination of large scale and regional scale indices in a multivariate index has better performance than single large scale indices
- BSE index is versatile for studying ecosystem response to climate signal

	SST-GS (2/-1)	LG (1/0)	IE (1/0)
AMO	ns	ns	ns
AO	**0.64** (0.39)	**0.62** (0.37)	**0.61** (0.34)
NAO	**0.62** (0.35)	**0.65** **(0.41)**	0.54 (ns)
BSI	**0.71** **(0.49)**	**0.66** **(0.42)**	**0.67** **(0.43)**
Chen	**0.75** (0.45)	**0.84** (0.64)	**0.72** (0.42)
BSE	**0.73** (0.48)	**0.87** (0.68)	**0.70** (0.45)

Tab.1:Correlation coefficients and Brier based score in parentheses between climate predictors and SST in the GS (1950-2005) and Landsort gauge (LG) (1950-2002) and ice extent (IE) (1950-2006)

Downscaling Results





References

Chen, D., 2000: A monthly circulation climatology for Sweden and its application to a winter temperature case study. *International Journal of Climatology,* 20, 1067-1076.

Dippner, J.W., K. Junker, and I. Kröncke (2010). *Geophysical Research Letter*s 37, L24701, doi:10.1029/2010GL045696.

Hurrell, J. W. and C. Deser (2010). Journal of Marine Systems, 79, 231-244, doi:10.1016/j.jmarsys.2009.11.002.

Swanson, K. and A. Tsonis (2009). Geophysical Research Letters, 36, L06711, doi:10.1029/2008GL037022.

Acknowledgements

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