Freshwater outflow of the Baltic Sea and transport in the Norwegian Current: A statistical correlation analysis based on a numerical experiment

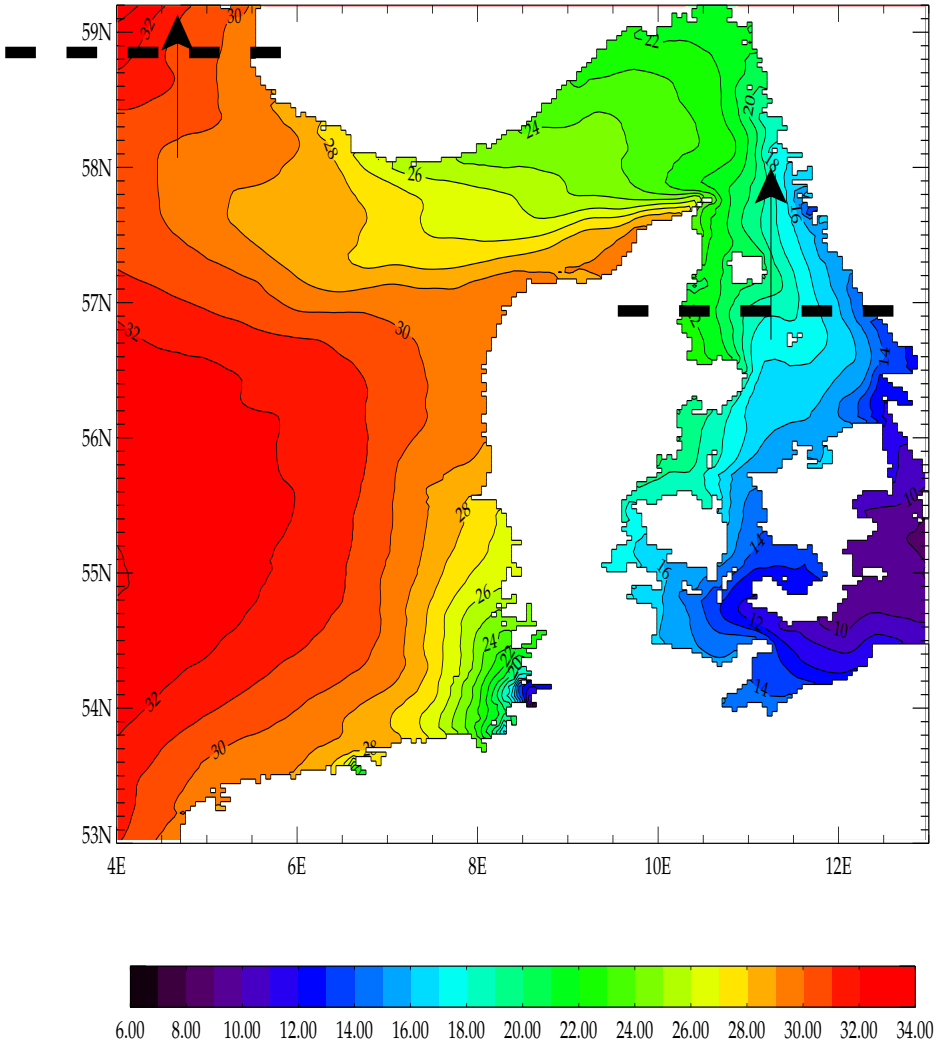
R. Hordoir, C. Dieterich, C. Basu, H. Dietze & M. Meier

Baltex Conference, Öland, June 10th 2013

Outline

Outline

Purpose



- The BS freshwater outflow is poorly described in many climate & operational models for which the BS is considered as a river

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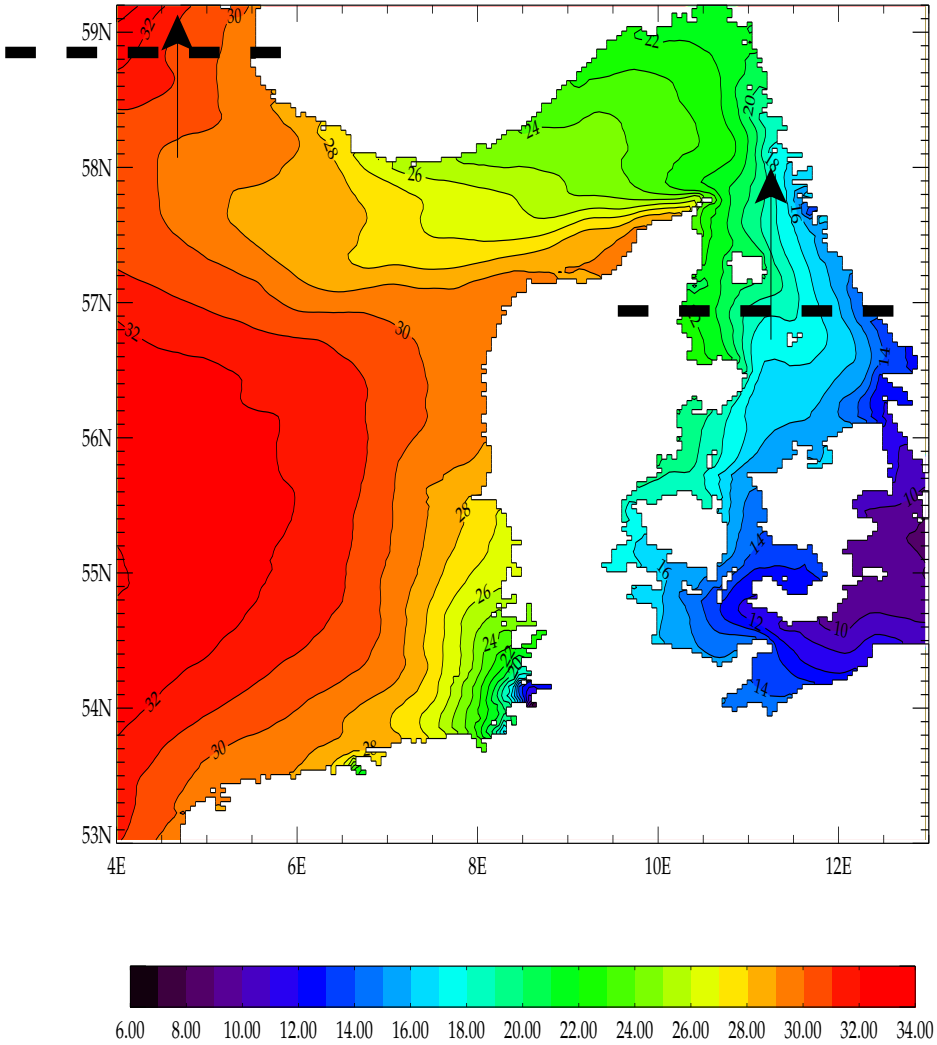

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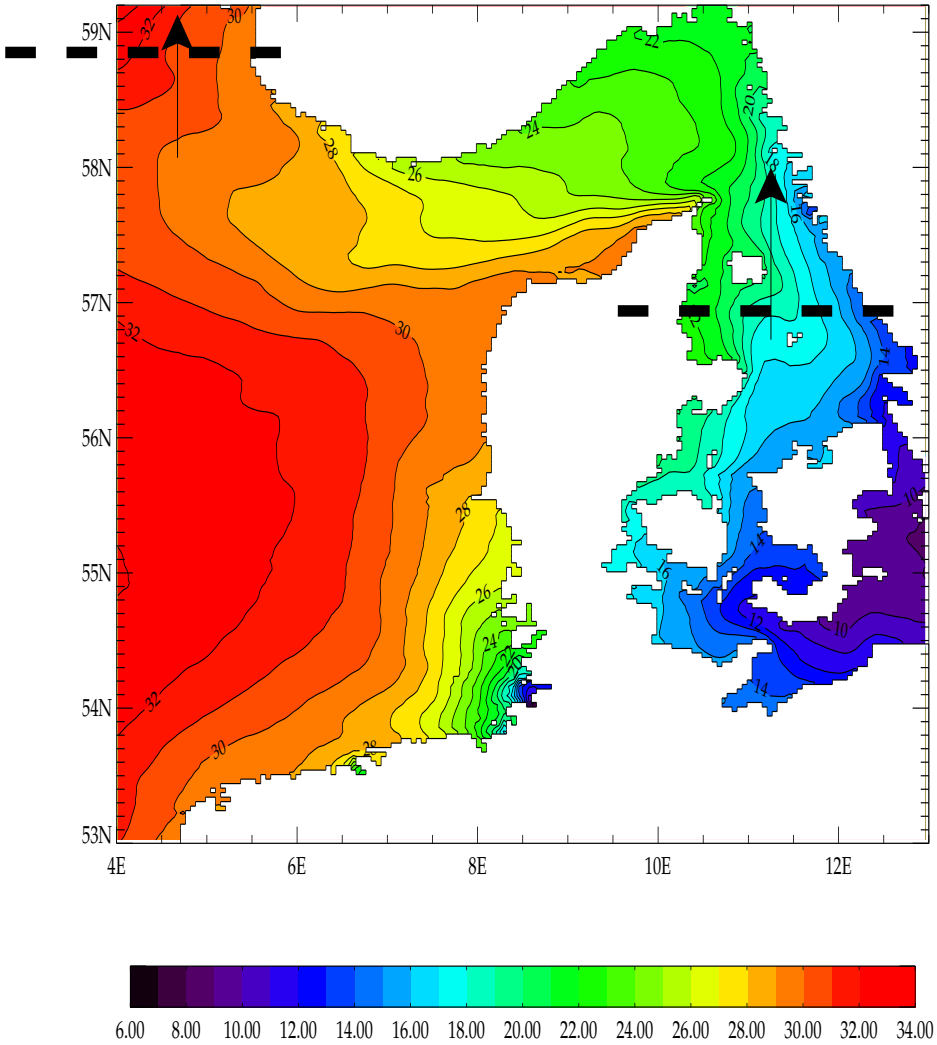
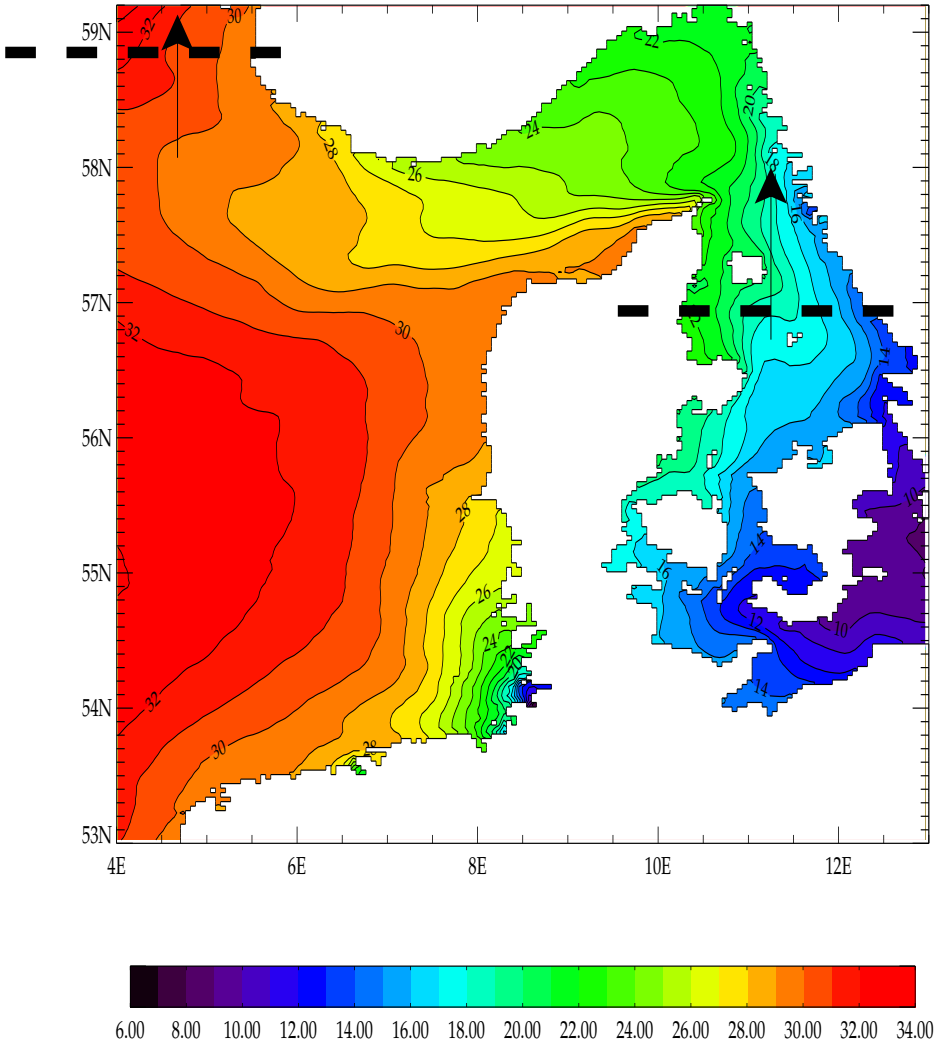


- The BS freshwater outflow is poorly described in many climate & operational models for which the BS is considered as a river
- The NCC freshwater transport is also important for Arctic freshwater content
- Is there an easy way to estimate their variability ?

Framework



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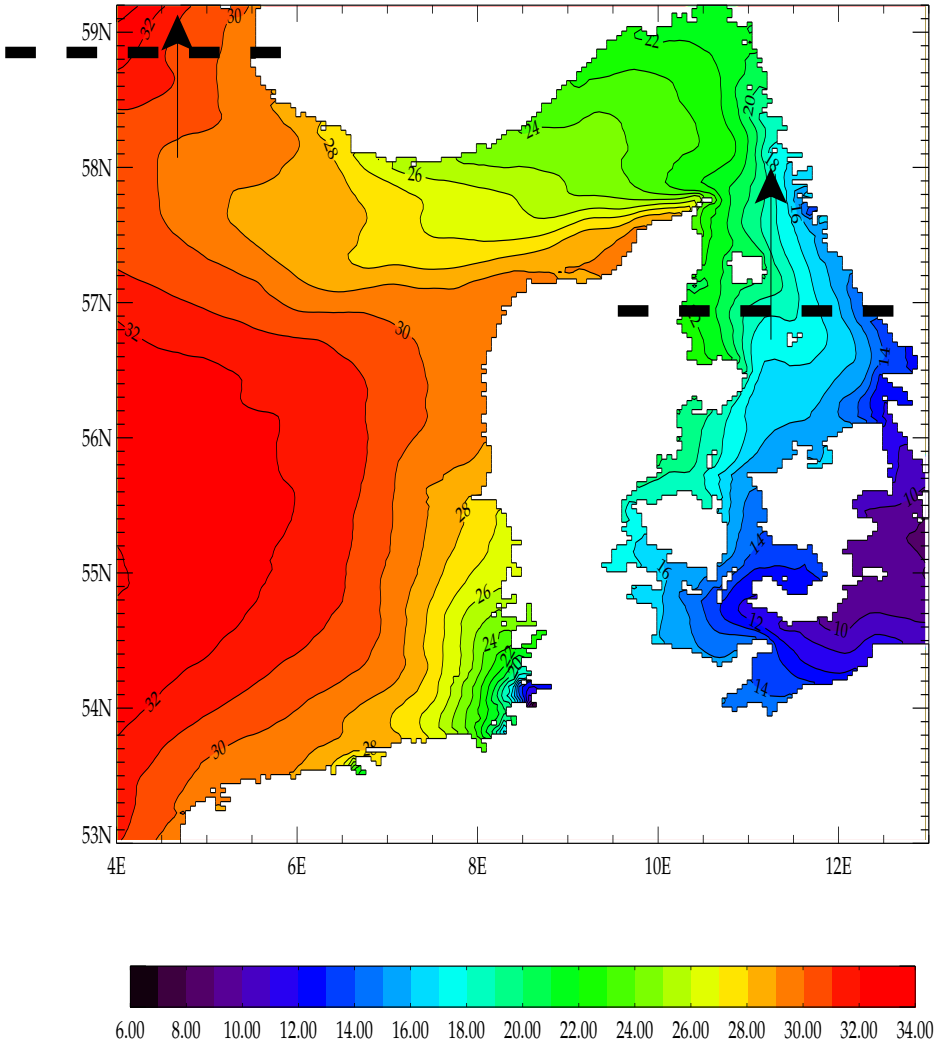

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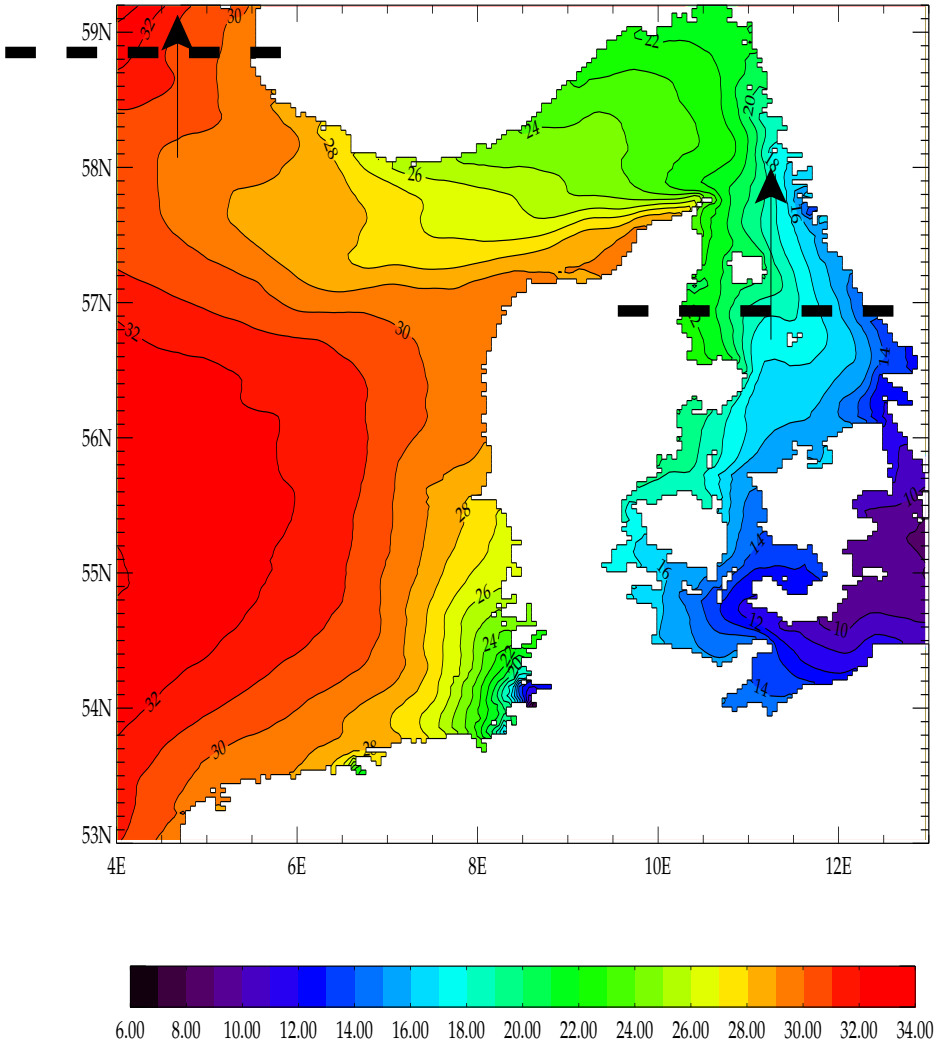
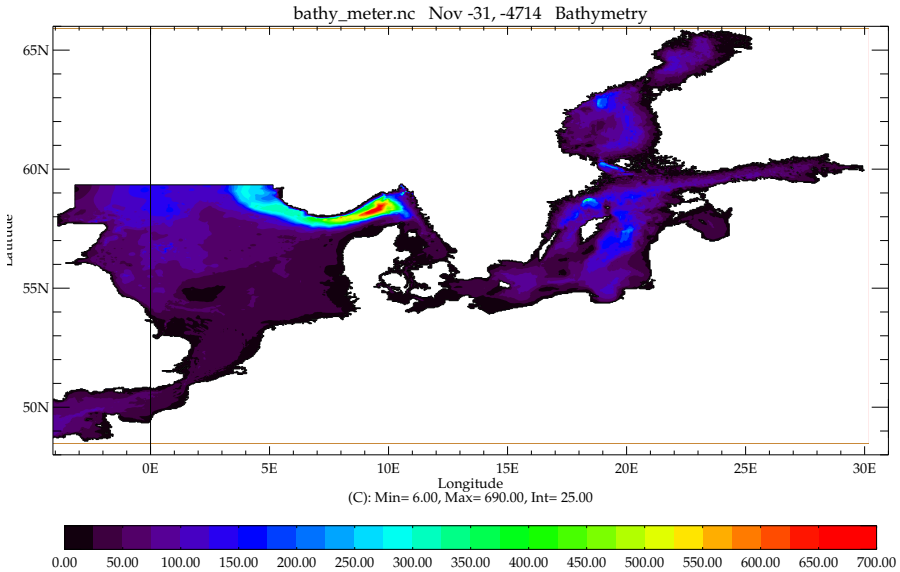


- The BS freshwater outflow has little correlation with runoff in the BS
- The BS freshwater outflow is mostly correlated with mean zonal wind variability *Hordoir & Meier, JGR, 2009*
- So there must be a way to estimate this flow based only on wind data, and perhaps even estimate that of the NCC

Outline

BaltiX - Domain & Forcing



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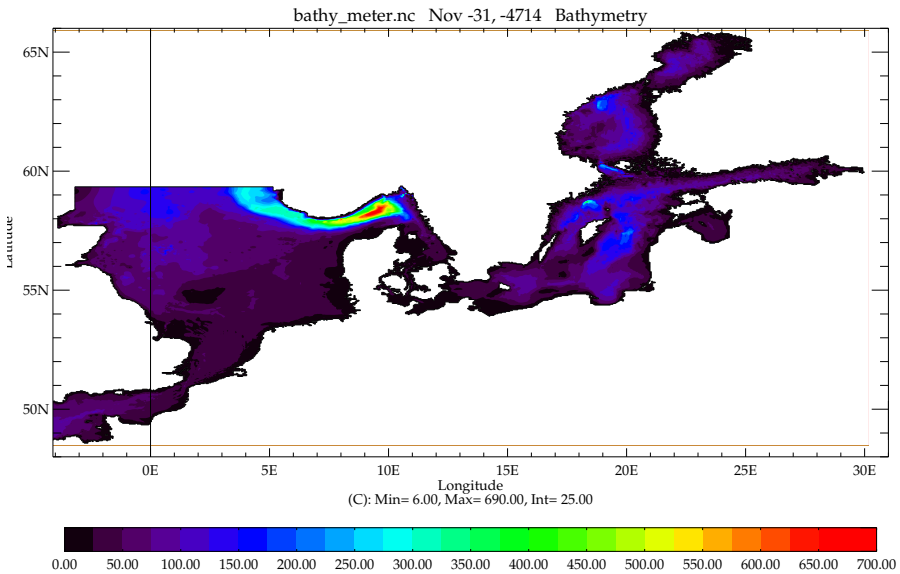

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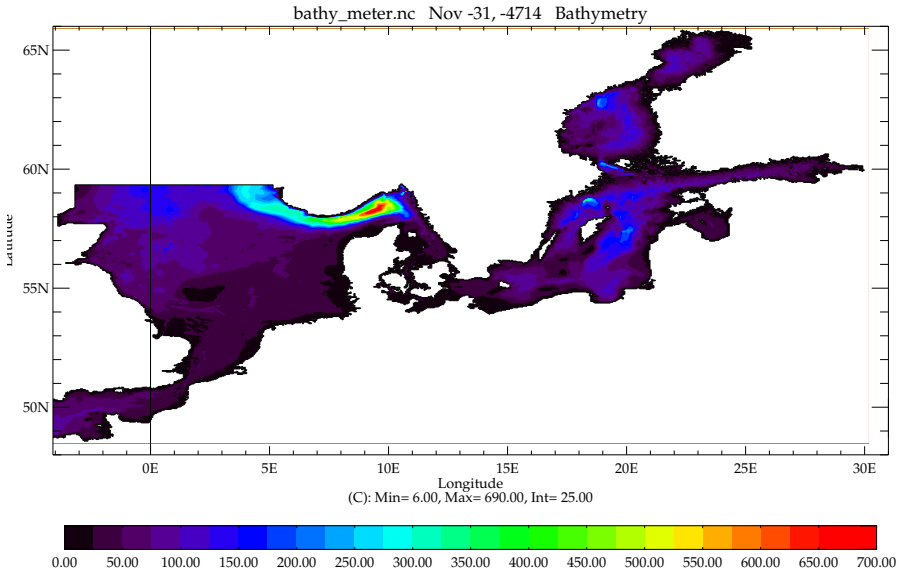

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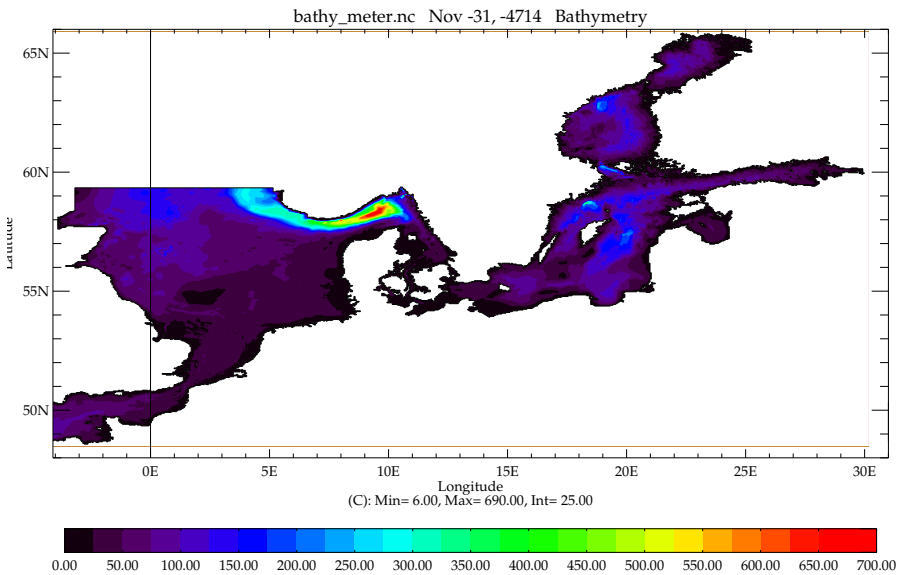

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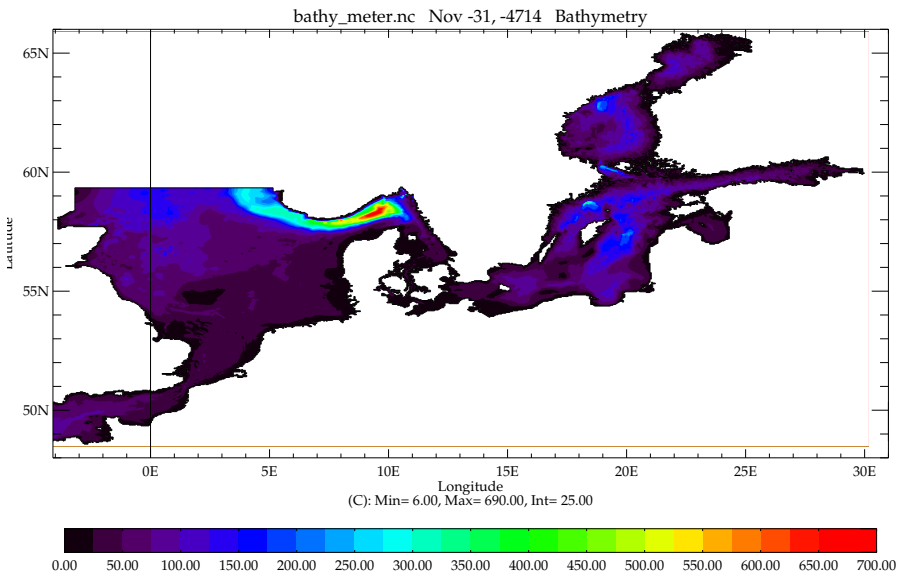

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- 31 rivers with inter-annual variability in the Baltic Sea, climatology in the North Sea with salinity of 10^{-3} PSU

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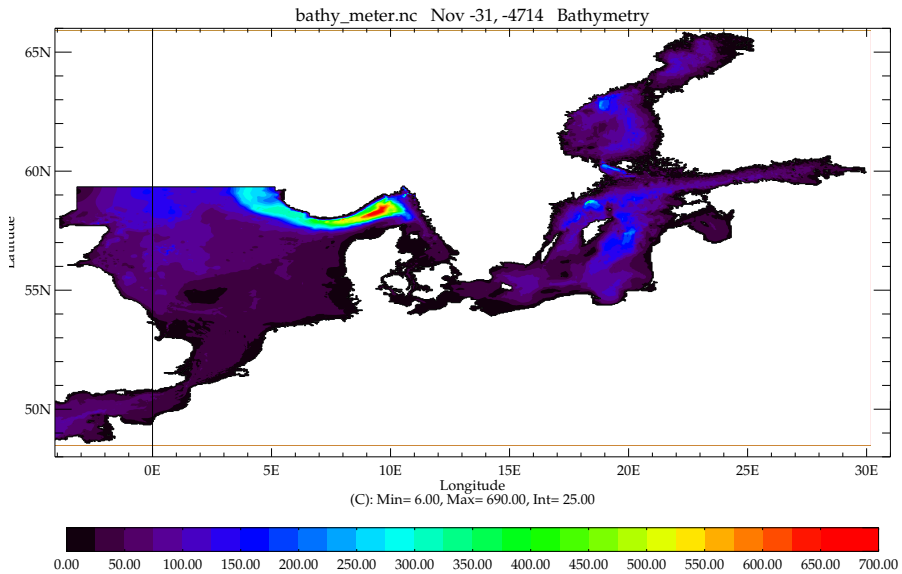

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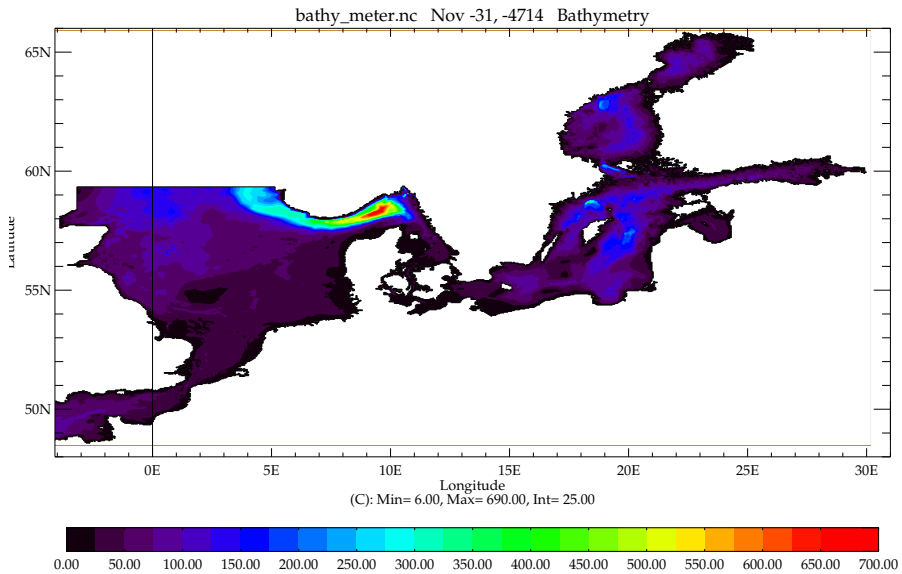

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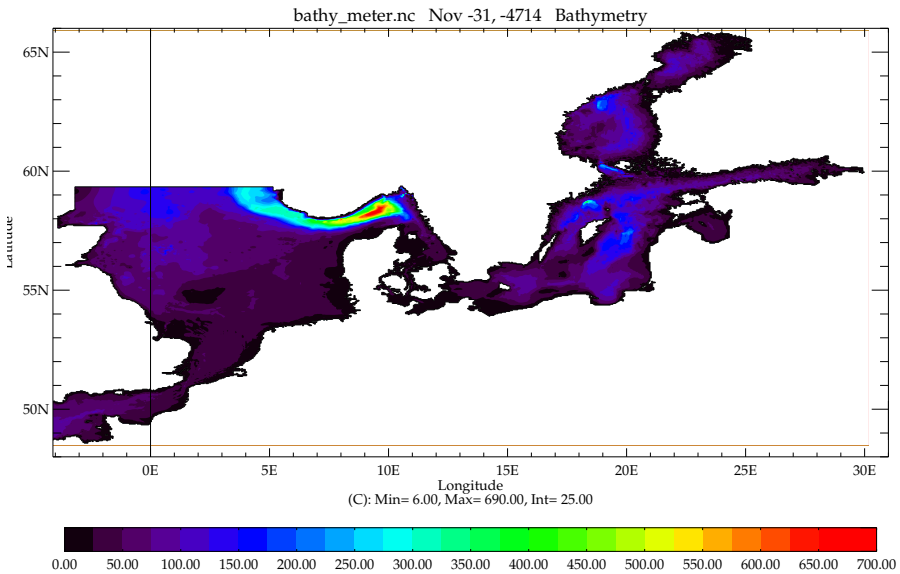

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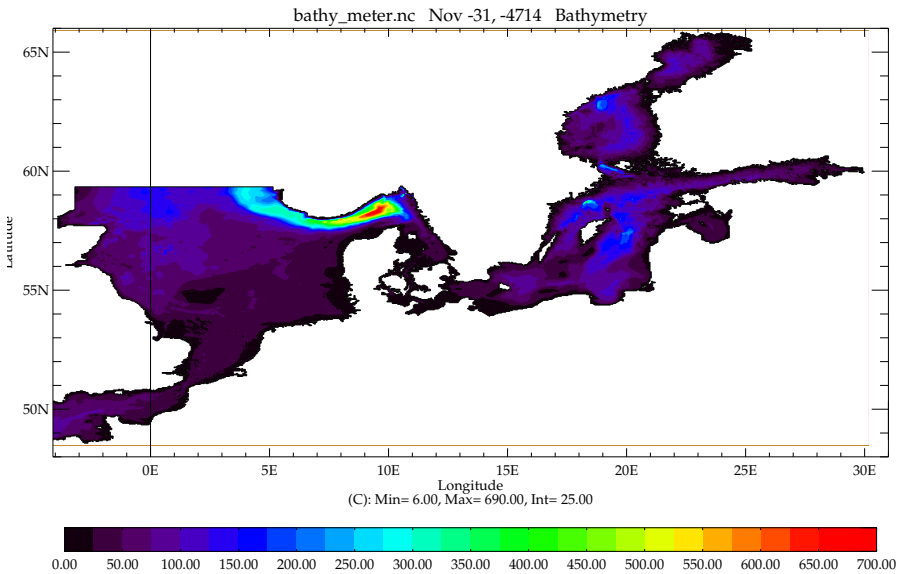

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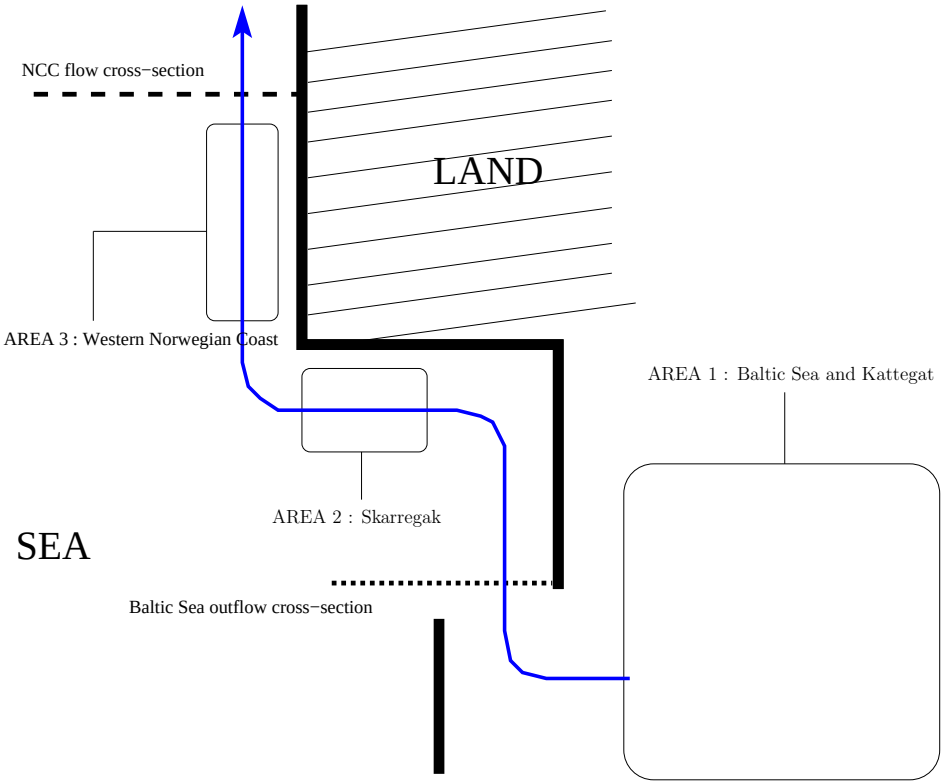
- TVD scheme, time step of 360s, time splitting
- Validation done on SSH, thermo-haline structure

BaltiX - Diagnostics



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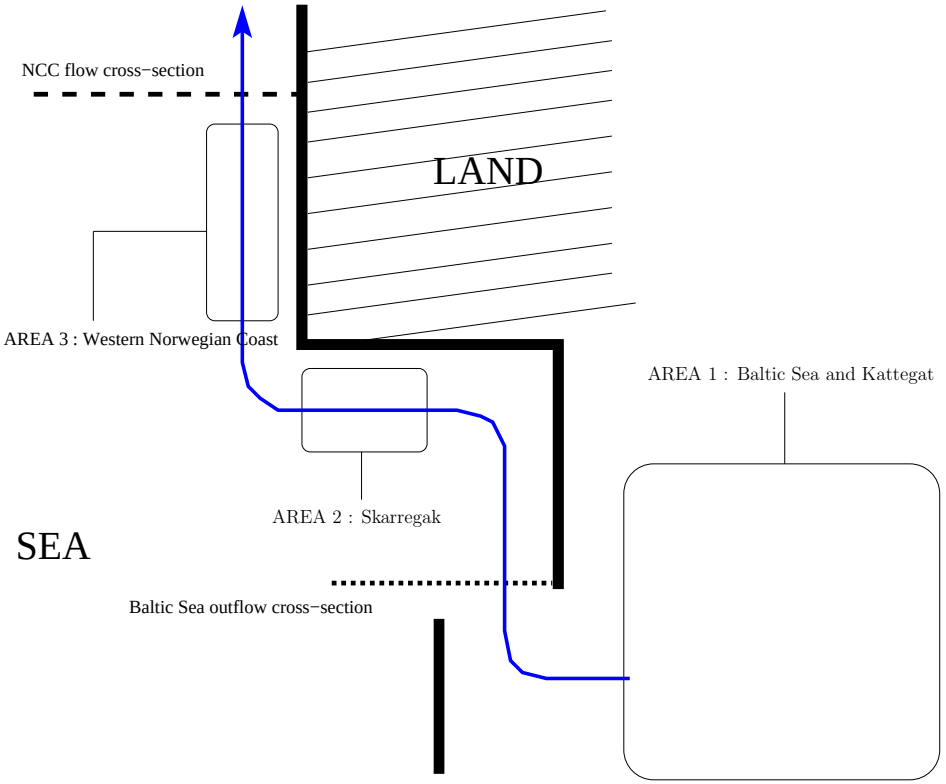

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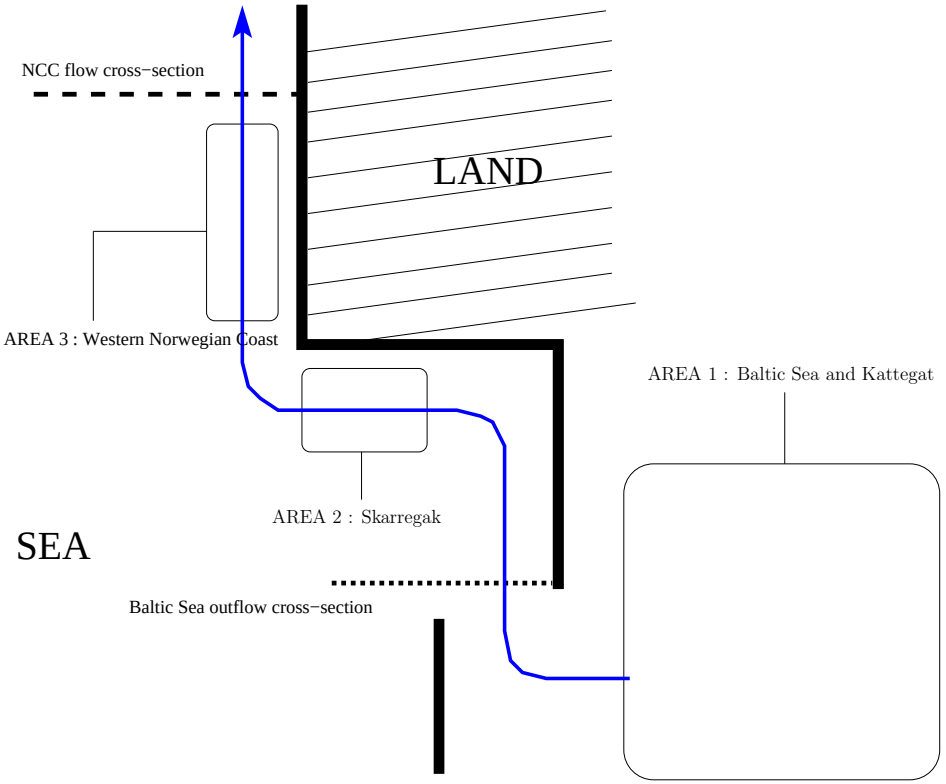

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- Monitoring of SSS along the Norwegian coast

Outline

BS outflow reconstruction

$$
\begin{aligned}
Fr_{Baltic}(t) &= \alpha_0 \\
&+\alpha_{Baltic_1} U_{Baltic}(t-\tau_{Baltic_1}) + \alpha_{Baltic_2} U_{Baltic}(t-\tau_{Baltic_2}) \\
&+\alpha_{Kattgt_1} U_{Kattgt}(t-\tau_{Kattgt_1}) + \alpha_{Kattgt_2} U_{Kattgt}(t-\tau_{Kattgt_2}) \quad (1)
\end{aligned}
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- Using monthly mean data provides a correlation of 80% and similar variability

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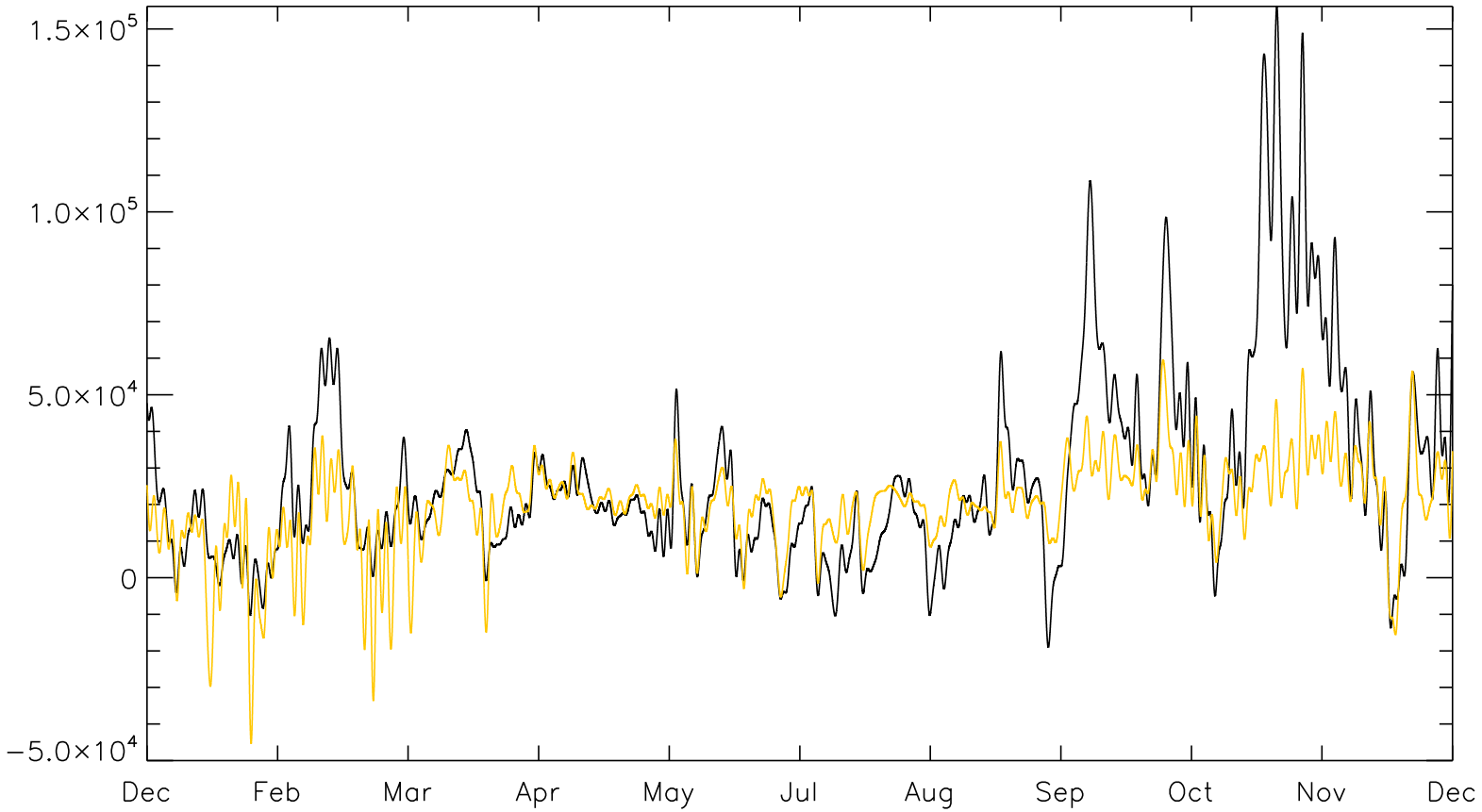
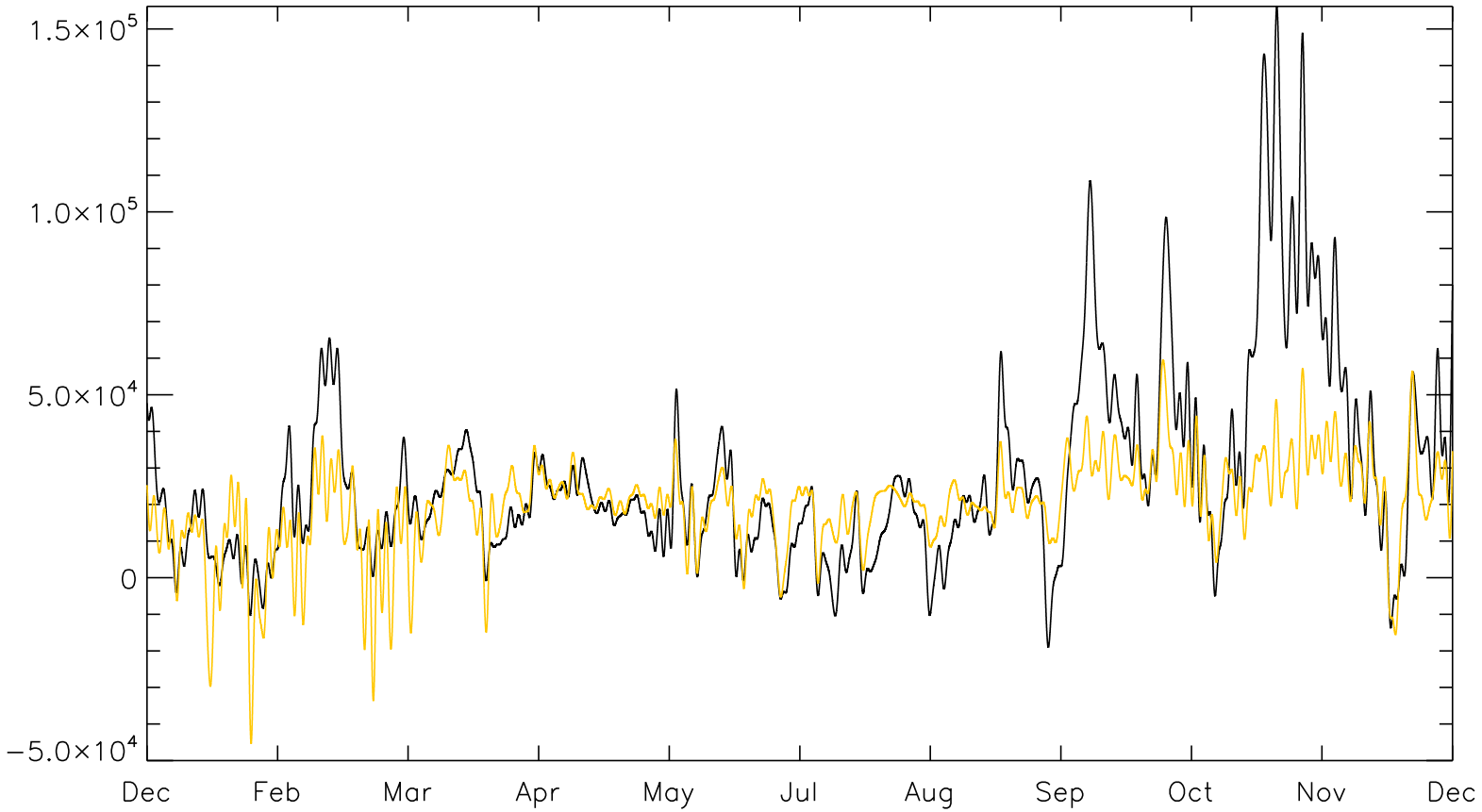


- Reconstruction for year 2000



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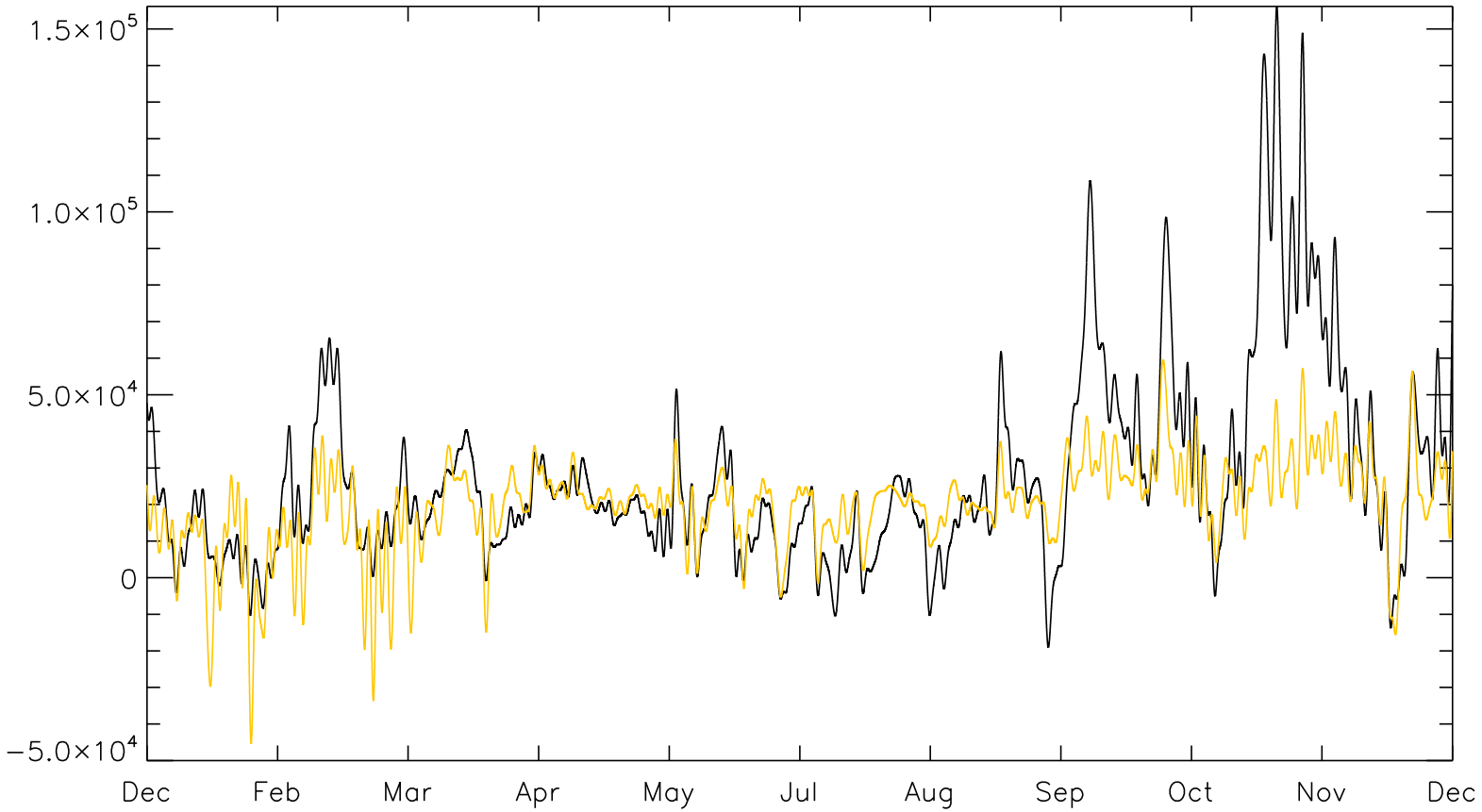

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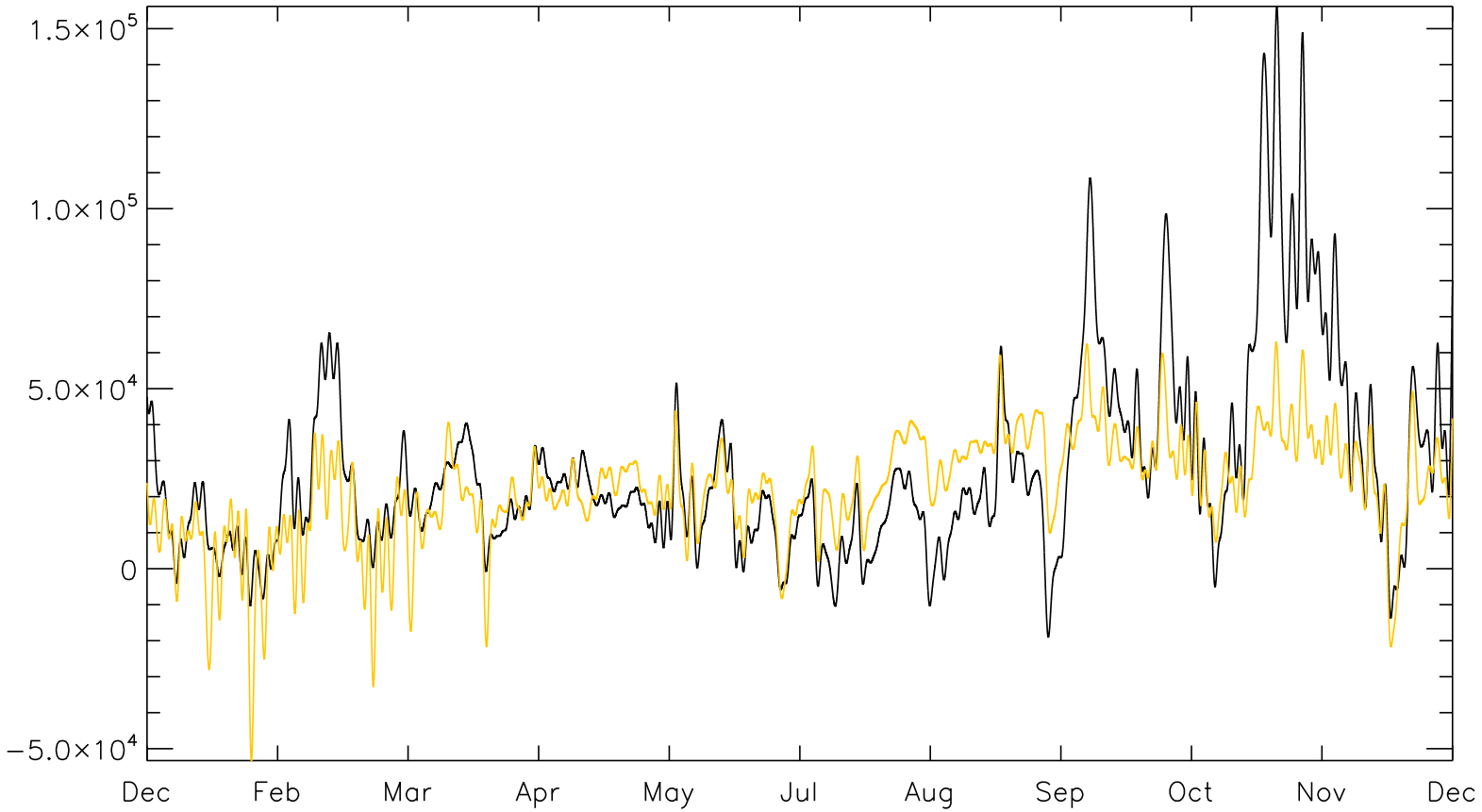
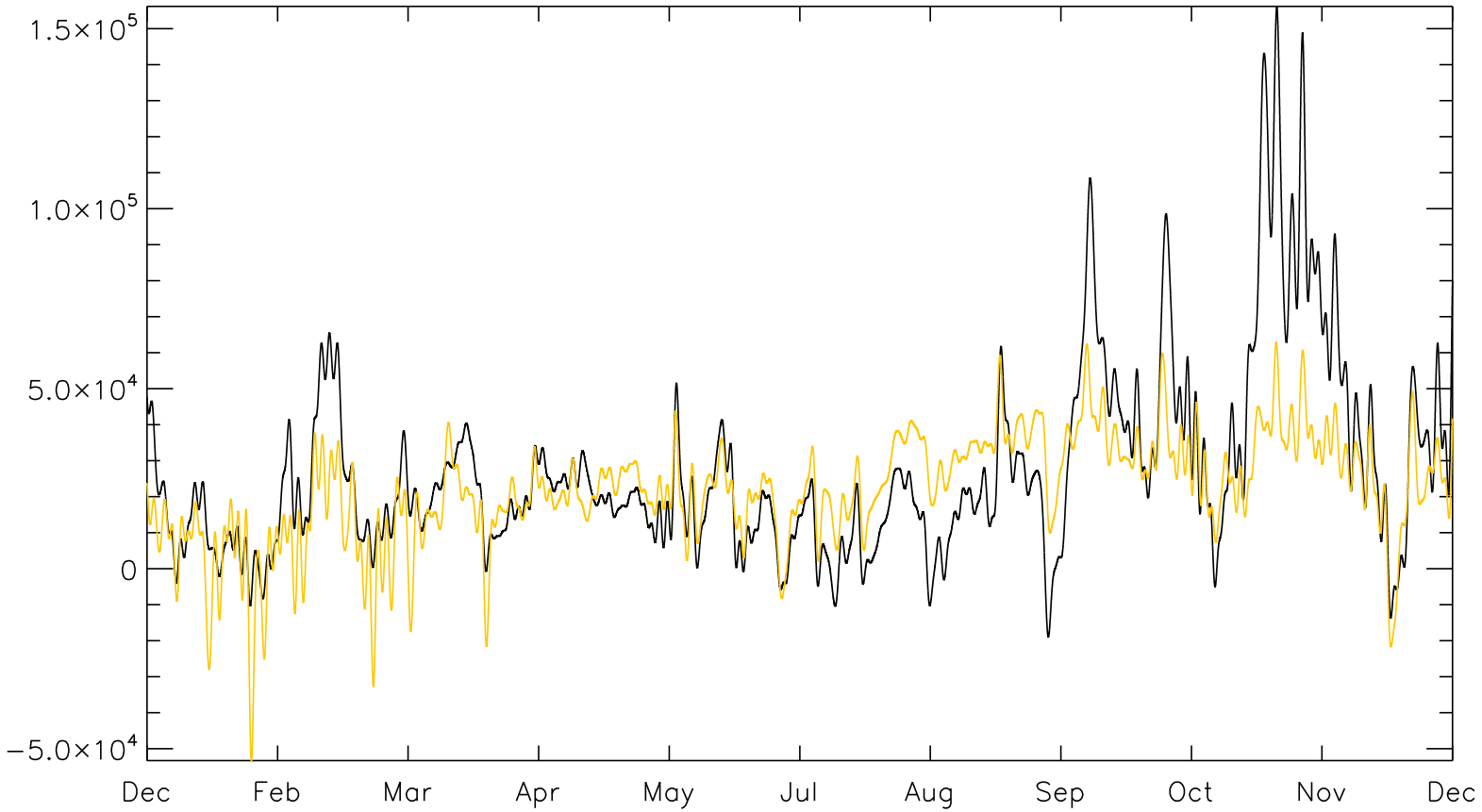
- Higher extremes correspond to baroclinic transport ?



- We add a baroclinic term $\alpha_{Norweg_3} Sa_{Norweg}(t - \tau_{Norweg_3})$



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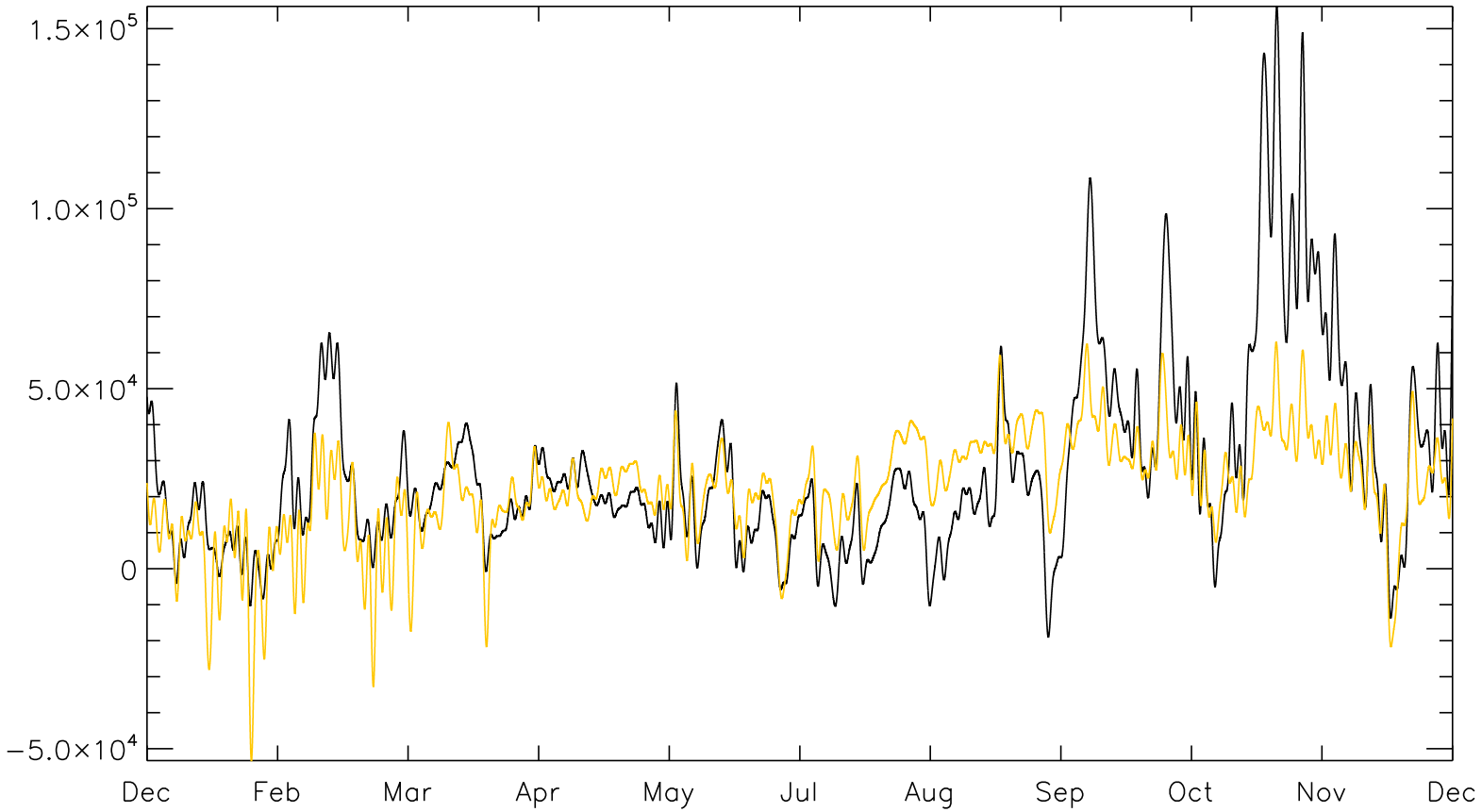

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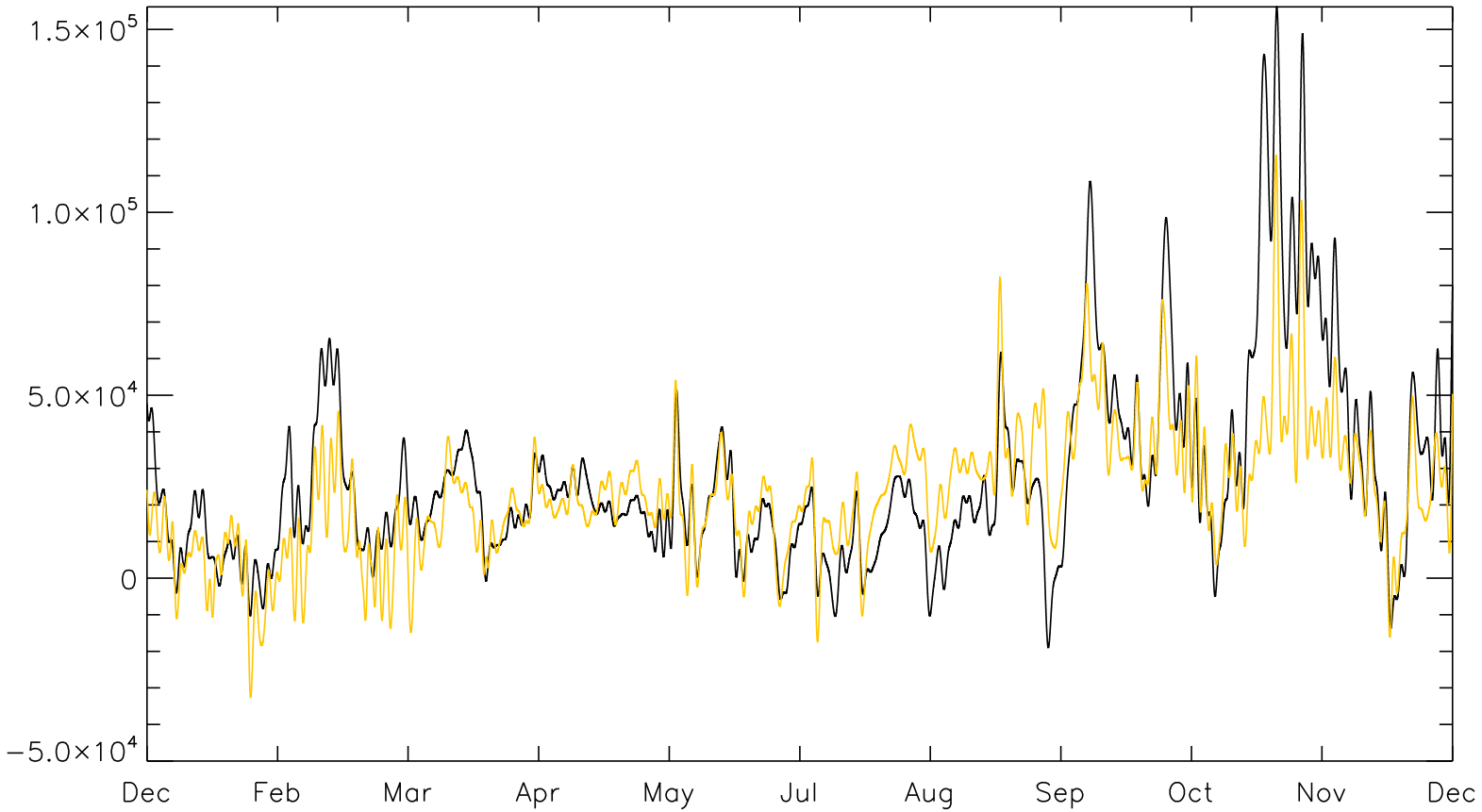
- Higher extremes are better, but still misses variability



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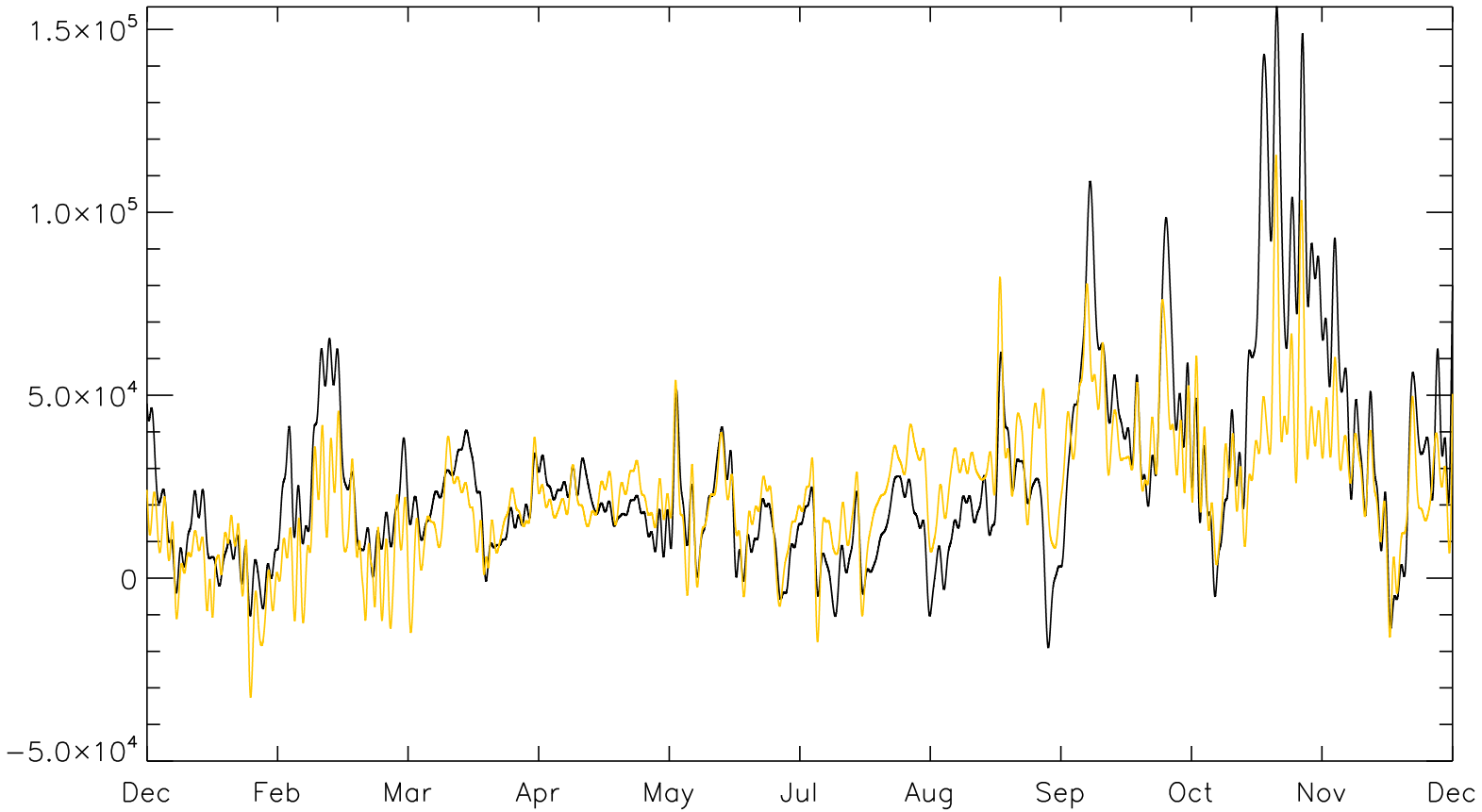

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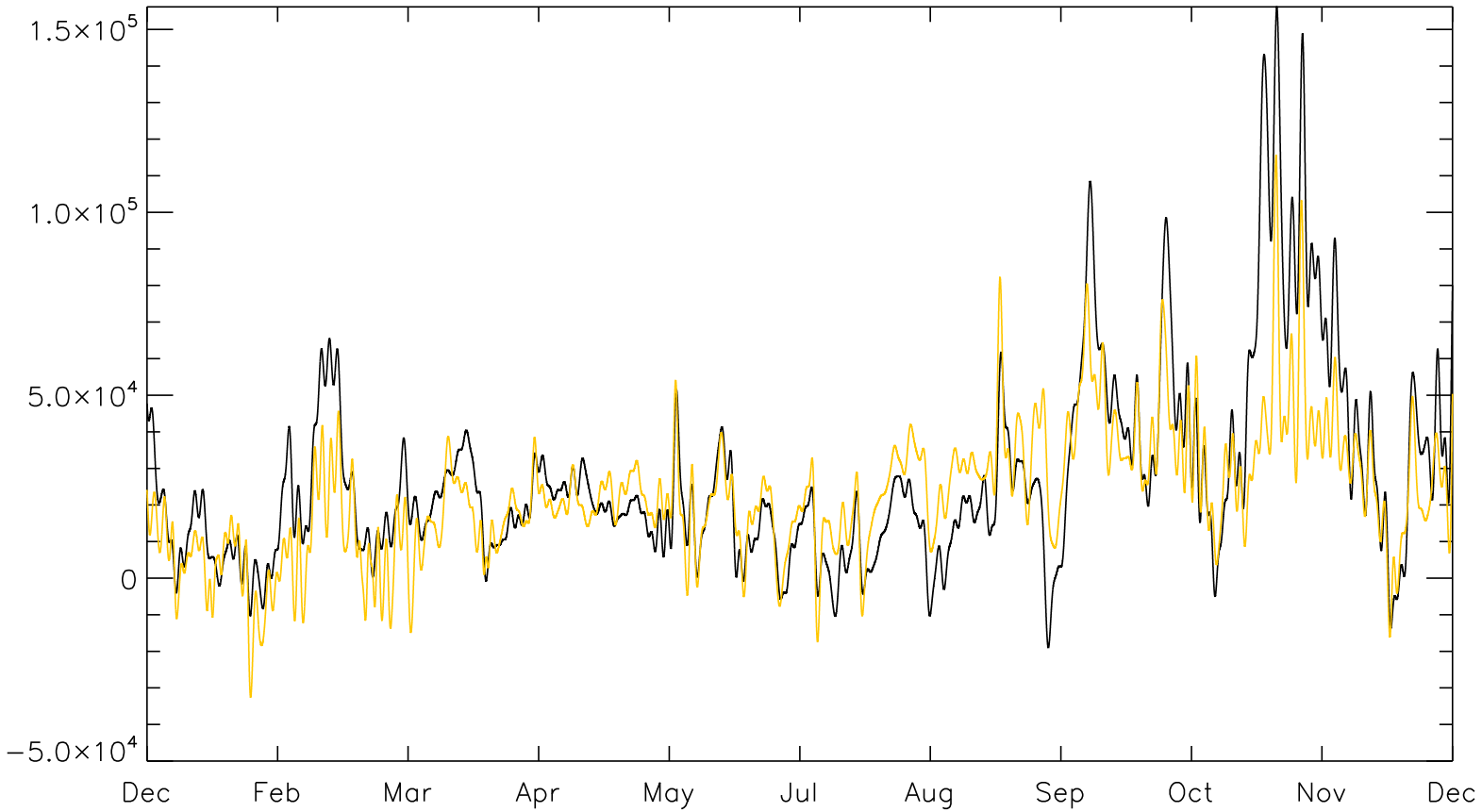

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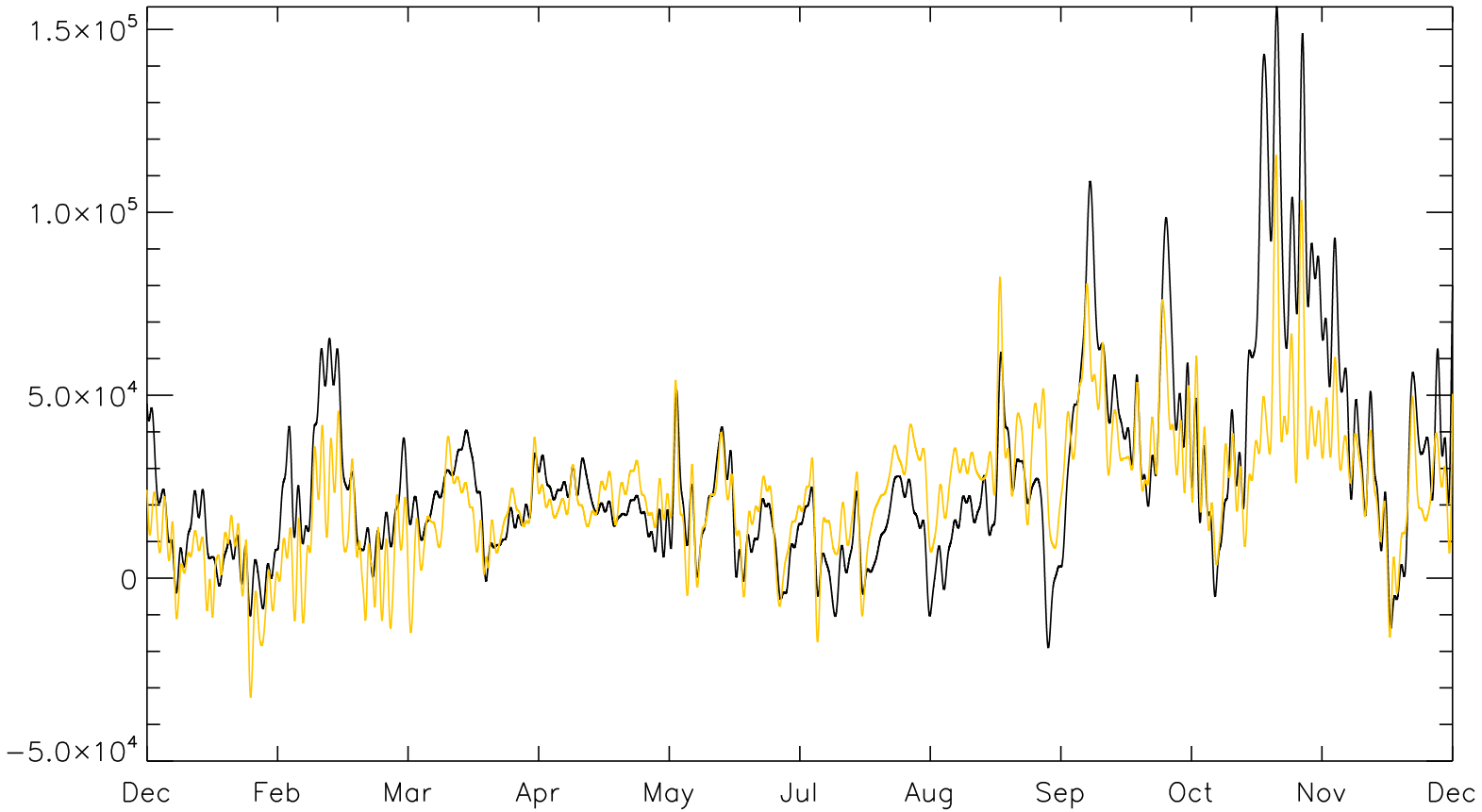

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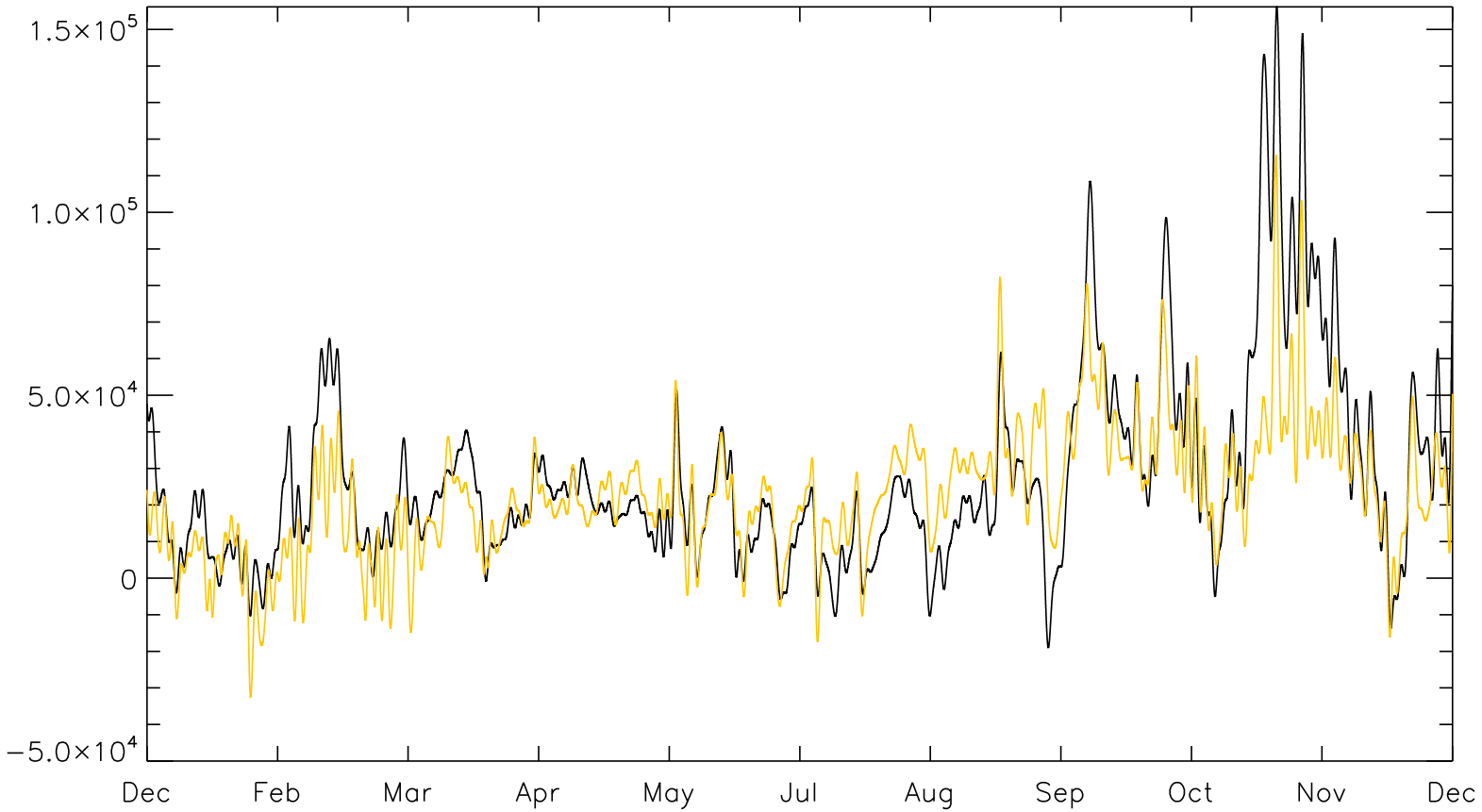

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- Higher correlation (80%), better reproduction of extremes

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- All details in *Hordoir et al., Cont. Shelf Res., May 2013, DOI : 10.1016/j.csr.2013.05.2006*