NOOS working group on transports

On the computation of volume fluxes: some results and comments

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NOOS meeting, Hamburg, 7 March 2013

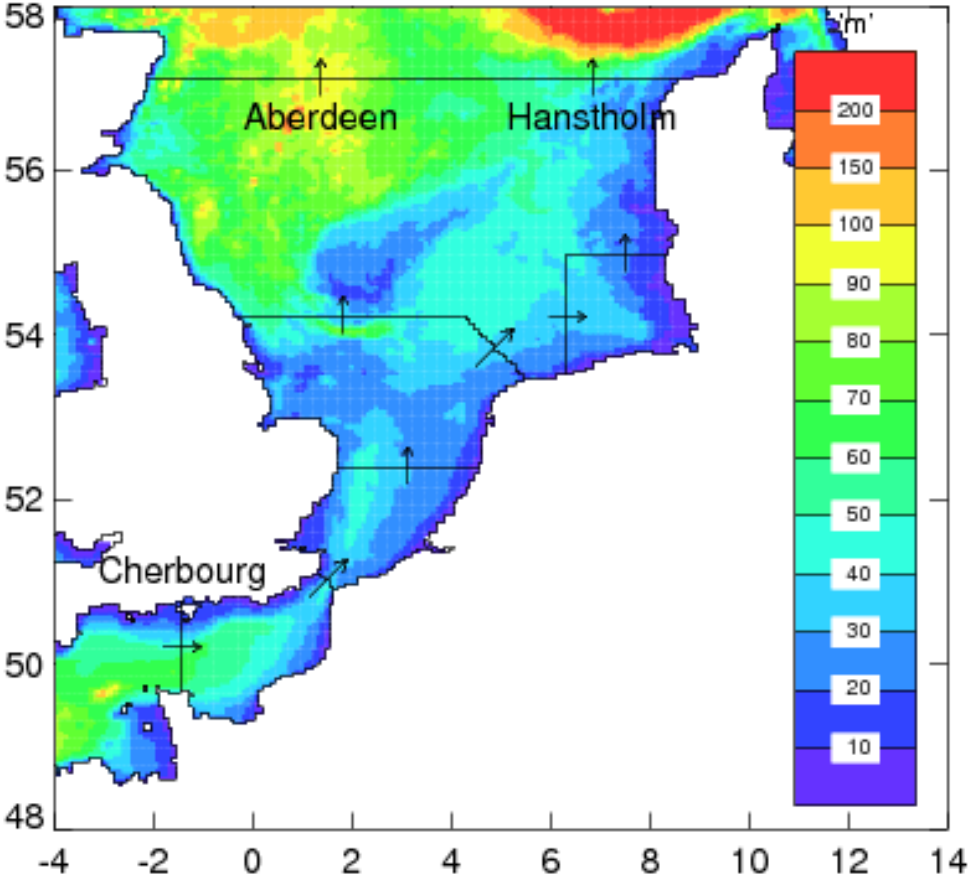
Structure

- Background
- Description of the numerical experiments
- Analysis of the results
- Proposal for forecast exchanges in the future

Background

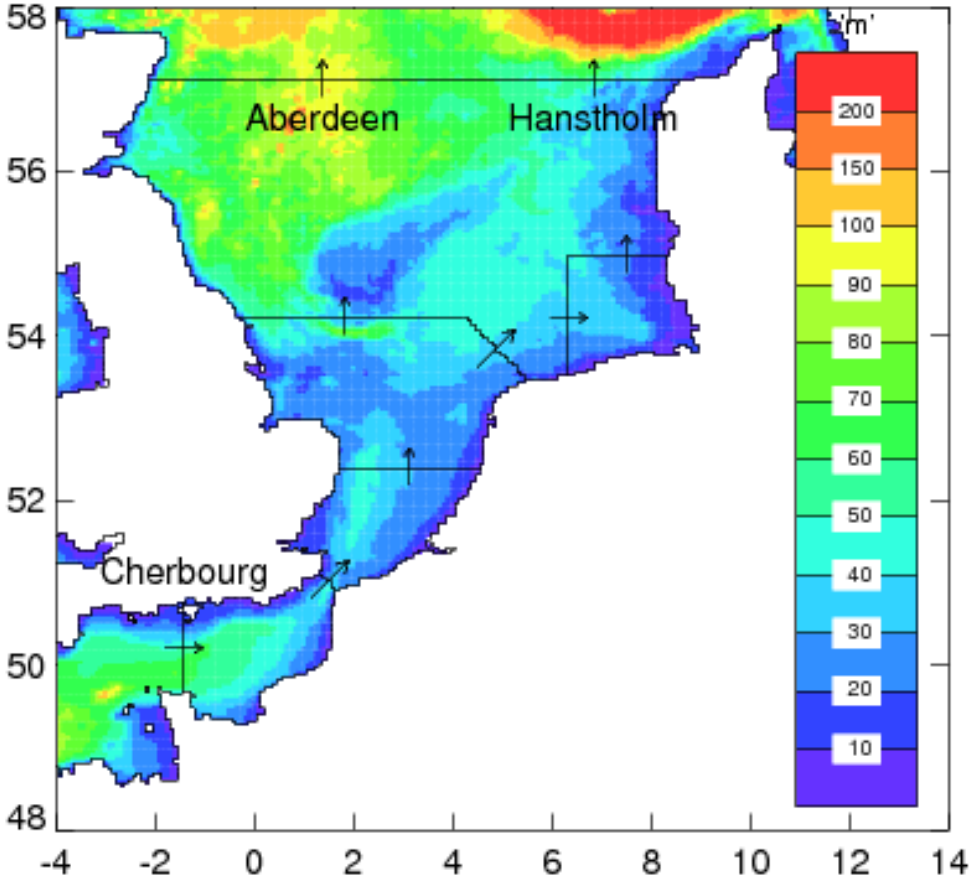
- Ozer, J., 2011. Model to model comparison of transports through North Sea transects. NOOS report.
- 3 models: Met.Office, BSH, MUMM.
- Year 2008, North Sea.
- Summary and conclusions:
  - "The use of 2 tidal averaged values and the presence of some gaps … do not really allow checking long term balances between inflows and outflows in the area."
- ( ) fter one year.
- Later: contribution of is constant over time and different for each section.

Numerical experiments: tool



- 2D Storm Surge Model.
- CSM area: -12.W 12E; 48N 62.5N.
- ADI scheme.
- Tides and surges (inverse barometric effect) along OB's.

Description of the numerical experiments



No atmospheric Forcing.

Exp#1: OBC: Only M2.

Exp#2: OBC: Only M2+S2.

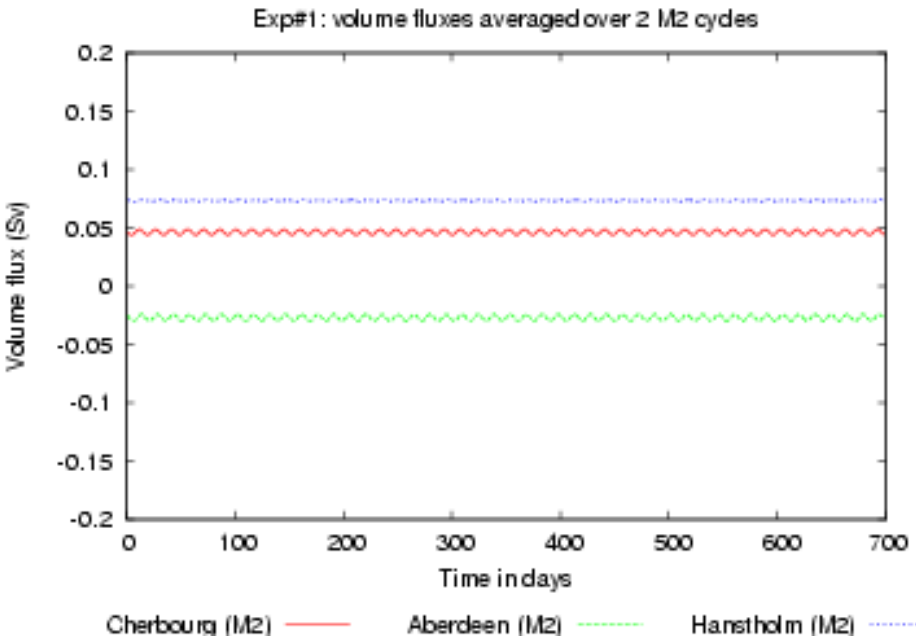
Exp#3: OBC: 8 Tidal constituents (4 diurnal, 4 semi-diurnal).

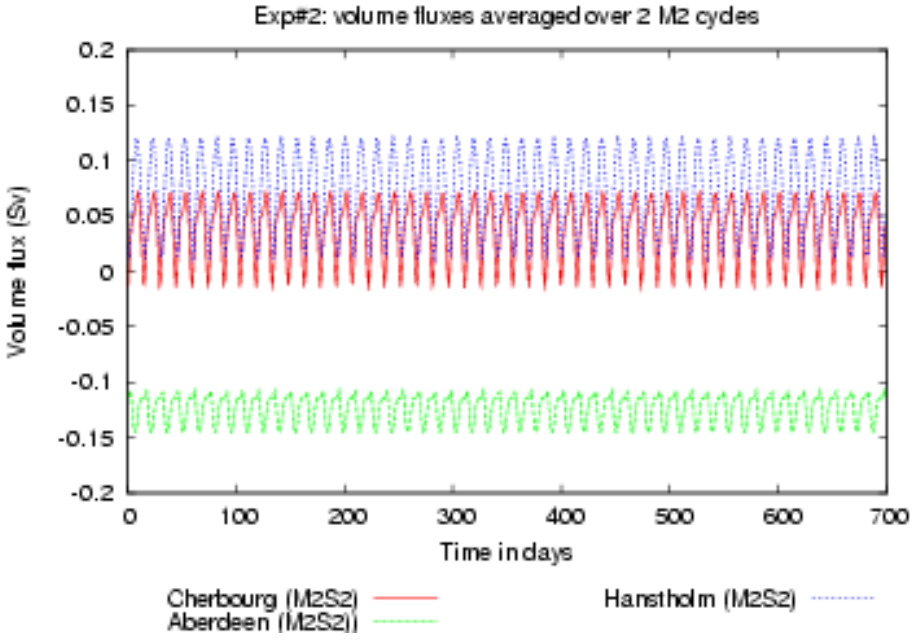
2 years from sea at rest.

Time start: 1/1/1997.

Computation of mean volume fluxes starts on the 1st of February

Volume fluxes averaged over 2M2 TC: M2(left), M2+S2(right)





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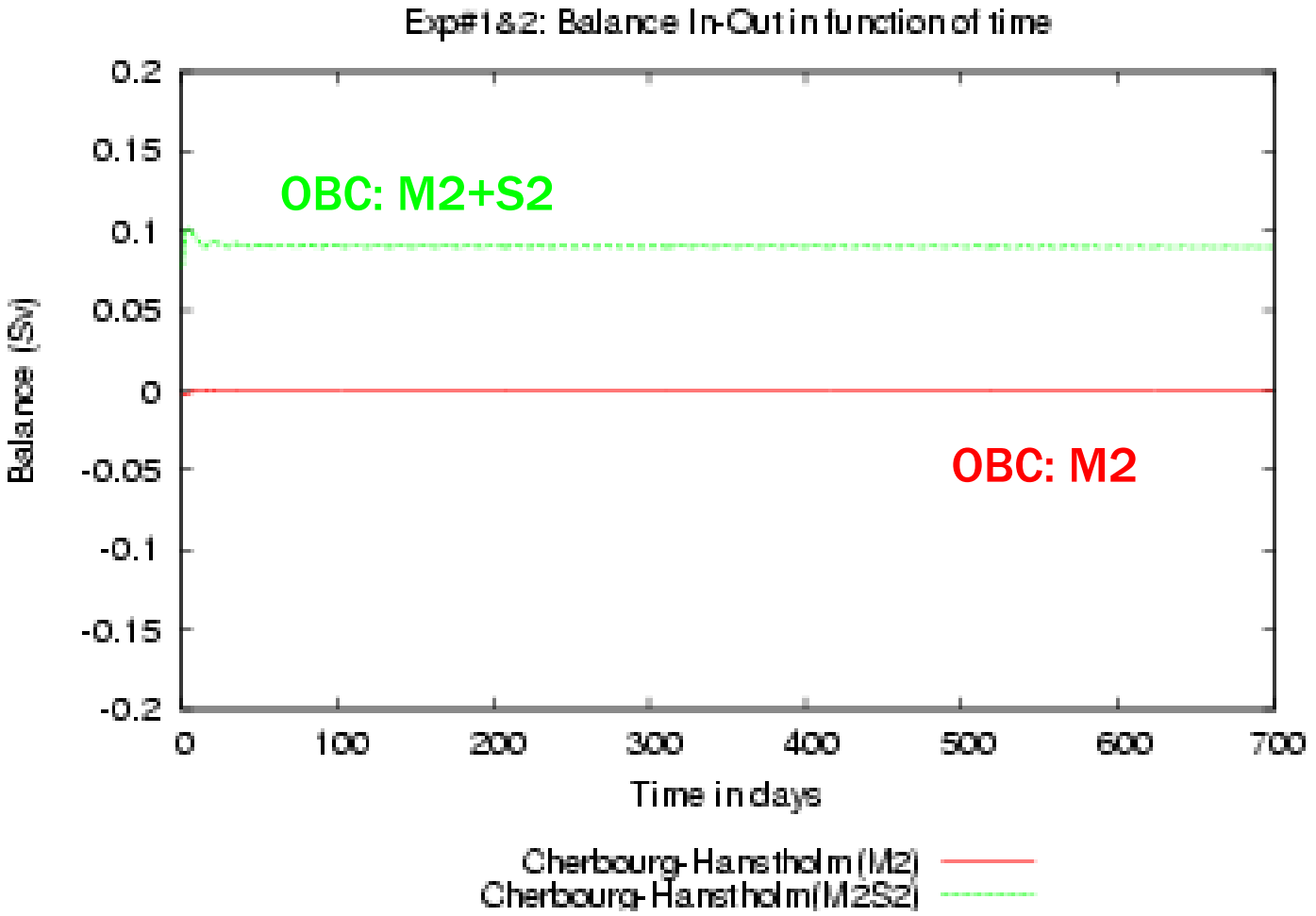
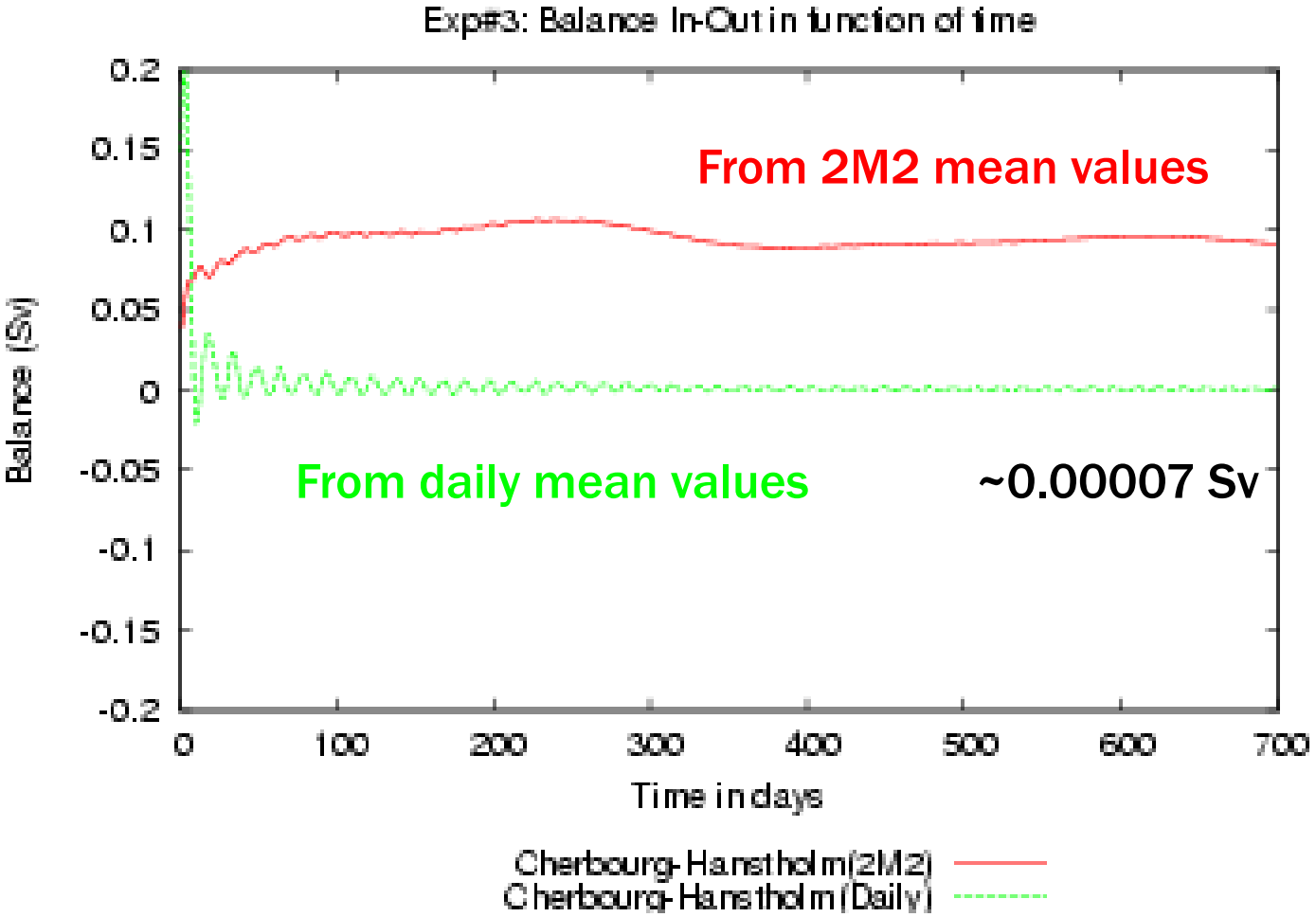
Balance In/Out based on 2M2 averaged volume fluxes



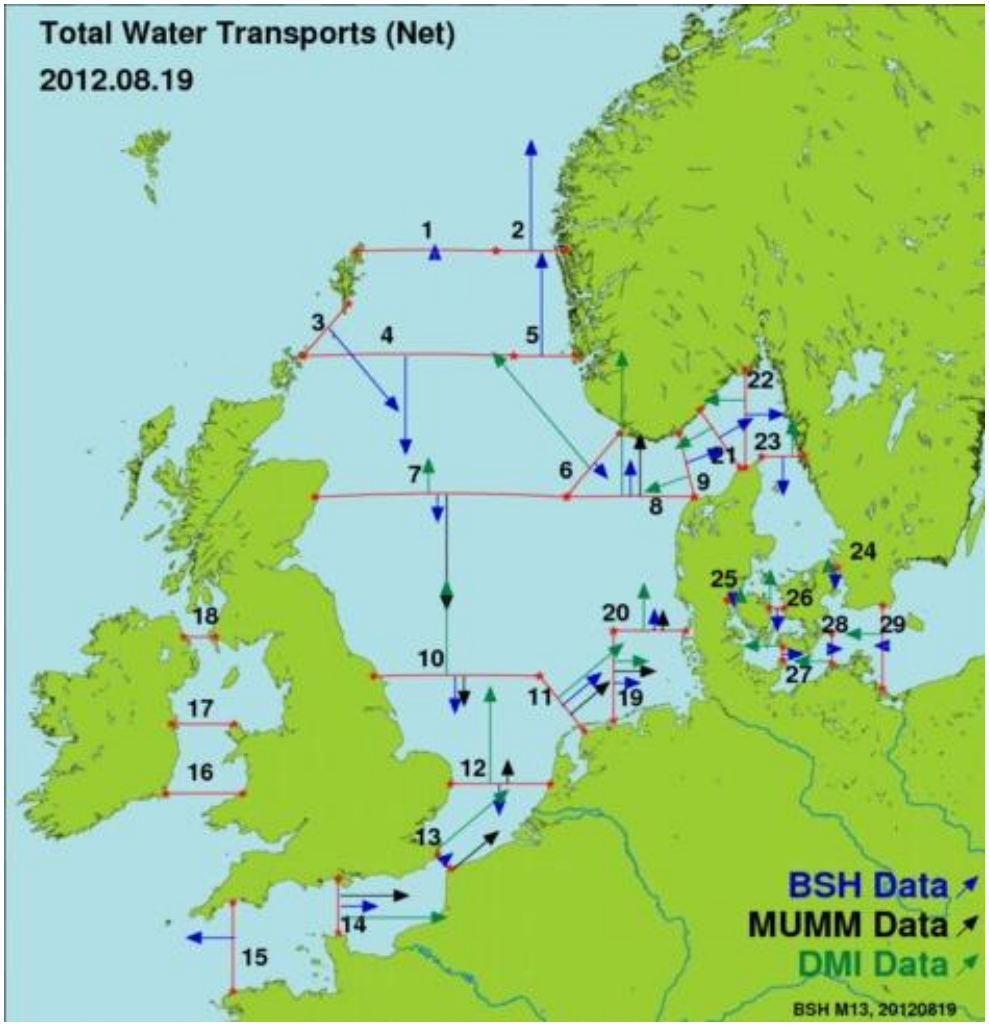
Balance In/Out from Exp. with 8 TC



Recommendations (1)

- For volume balance verifications, either hourly or daily mean values should be preferred. I'm in favor of hourly mean.
- How many files should be provided?
  - One with hourly mean values;
  - two: hourly(daily) mean + 2M2 mean (Web site). Both could be necessary.
- What about the # of digits:
  - Maximum hourly value observed in Exp.#3 (TO) is of the order of 15 Sv (will be greater during strong wind periods).
  - To get a balance of the order of 10^{-5} Sv, mean hourly values should be given in Sv with at least a format like E15.8

Recommendations (2): closing the North Sea



On the computation of **mean** values

- Mean values must be computed during the model run at every (2D) time step.
- Mean values must be computed in accordance with the time stepping procedure used to solve the vertically integrated continuity equation.

Examples of appropriate computation of mean values

- **Explicit scheme**
  - ( ) ( ) ( ) ( ))
  - =)
- **“Implicit” scheme**
  - ( ) ( ) ( ) ( ))
  - =)
- **ADI scheme**
  - ( ) ( ) ( ) ( ))
  - ( )=) = ( ) ( )

Conclusions

- For proper balance computation:
  - Hourly mean values would be better than mean values over 2 M2 tidal cycles. They will allow separating the tidal part from the wind driven part.
  - Mean hourly values must be at every (2D) time step.
  - Mean hourly values must be computed according to the time-stepping procedure used to solve the vertically integrated continuity equation.
  - Mean hourly values should be given in Sv with a sufficient # of digits (E15.8 or even E17.10).
  - If the horizontal resolution of the model grid is sufficiently high, a new transect should be added to close the North Sea.
- For the Web site: today files remains necessary. (Doodson filter?)