



## WP5. Atmospheric forcing (air-sea interaction processes, deposition, transient runs including control and scenarios)

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#### Deliverables, UU

- D24: Improved parameterisations of the gas exchange transfer velocity, month 18. Work is ongoing.
- D25: Measurements from the first 12 month of the project from the Östergarnsholm station, month 18. Measurements running.
- D26: Acidic depositions for the Baltic Sea drainage basin, month 8. Done, will be presented by Björn.
- D27: Compiled present and future scenario, data + land use data for the Baltic Sea drainage basin, month 12.





### What controls the uptake/outgassing of CO<sub>2</sub> (gases in general)?

Major uncertainties:

Transfer velocity (k) and pCO<sub>2w</sub>

What influences k?

D24: Improved parameterisations of the gas exchange transfer velocity.





### Water-side convection





# The Baltic-Sea model

[µatm]

pCO<sub>2w</sub>

2005

2006

2007

year

2008

2009

2010

- A biogeochemical climate model
- Interaction between physical, chemical and biological processes
- 13 natural sub-basins, each with vertical resolution
- Coupling between sub-basins through strait flow models
- Forced by meteorological data every third hour (ERA-40)





Monthly mean CO<sub>2</sub> flux for the Baltic Proper with (RS10)/without (W09) water-side convection

 Including water-side convection gives increase upward/downward fluxes during winter/summer

Annual mean, 1960 to 2009







### Impact when introducing the effect for both $pCO_2$ and $O_2$ in the Baltic Sea model

Monthly mean pCO<sub>2w</sub> and O<sub>2</sub>





### Impact when introducing the effect for both $pCO_2$ and $O_2$ in the Baltic Sea model

Monthly mean flux of CO<sub>2w</sub> and O<sub>2</sub>





D25: Measurements from the first 12 month of the project from the Östergarnsholm station (Jan to Sept 2009).







D25: Measurements from the first 12 months of the project from the Östergarnsholm station (example Feb 2009).















D26: Acidic depositions for the Baltic Sea drainage basin.





Atmospheric deposition of nutrients and acidic substances 1960 to 2006 (Carlsson et al 2011)

- Deposition data 1990/1995 to 2006 from EMEP model.
- Reconstruct earlier data from:
  - Emission data EDGAR-HYDE1.3 1960 to 1990 (every 10:th year)
  - Emission data EDGAR 3 1990 to 2000 also including airplane and boat emissions (to determine emission region).
- Method
  - annual cycle from EMEP
  - long term trend from EDGAR-HYDE (1960-1990)





### SO<sub>2</sub> (Björn Carlsson)







### SO<sub>2</sub> (Björn Carlsson)







### D27: Compiled present and future scenario, data + land use data for the Baltic Sea drainage basin.

	GCM	SRES narrative	Ensemble member	Land cover	Nutrient loads	GCM bias correction	Factor addressed
1	ECHAM	A1B	#1	present-day	present-day	none	(baseline scenario)
2	ECHAM	A1B	#2	present-day	present-day	none	natural variability
3	ECHAM	A1B	#3	present-day	present-day	none	natural variability
4	HadCM	A1B		present-day	present-day	none	climate system
5	CCSM	A1B		present-day	present-day	none	climate system
6	ECHAM	A2		present-day	present-day	none	emissions (higher)
7	ECHAM	B1		present-day	present-day	none	emissions (lower)
8	ECHAM	A1B	#1	GRAS	present-day	none	land cover change
9	ECHAM	A1B	#1	present-day	"medium"	none	nutrient loads change
10	ECHAM	A2		BAMBU	"business as usual"	none	multi-factor, "business as usual"
11	ECHAM	A1B	#1	GRAS	"medium"	none	multi-factor, "balanced policy"
12	ECHAM	B1		SEDG	Baltic Sea action plan	none	multi-factor, "environmental"
13	ECHAM	A2		BAMBU	"business as usual"	yes	bias-corrected version of Scenario 10
14	ECHAM	A1B	#1	GRAS	"medium"	yes	bias-corrected version of Scenario 11
15	ECHAM	B1		SEDG	Baltic Sea action plan	yes	bias-corrected version of Scenario 12





D27: Compiled present and future scenario, data + land use data for the Baltic Sea drainage basin.

	Land	Sea	
Temperature	E-obs	ERA-40/RCA	
Precipitation	E-obs	Raw ERA-40	
Cloudiness/radiation	CRU	ERA-40/RCA	
Everything else	-	ERA-40/RCA	

#### Björn will show more tomorrow

