PALM Ocean-Atmosphere Coupling

PALM group

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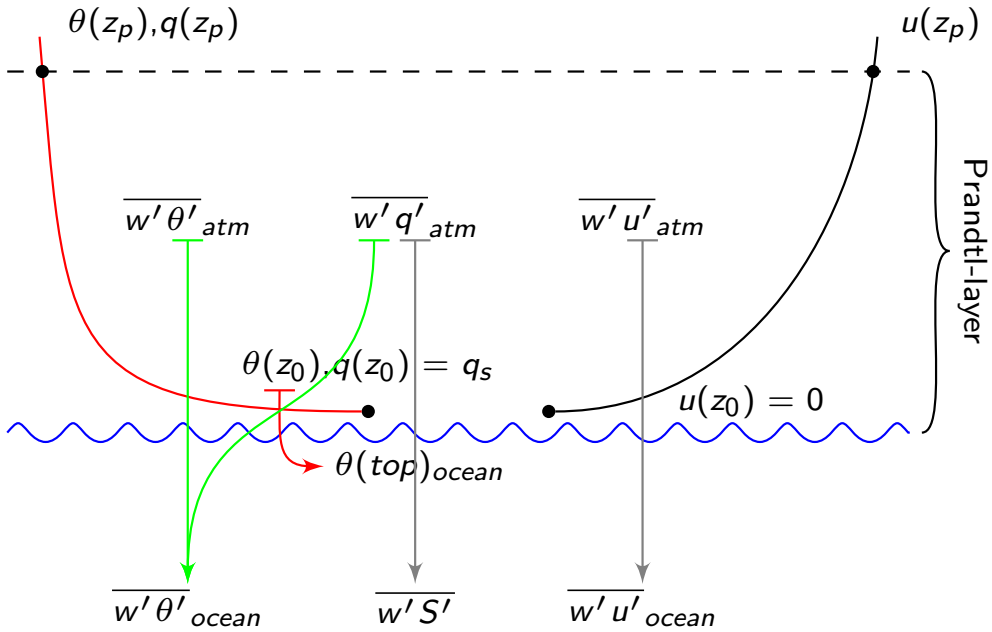
PALM - Ocean-Atmosphere Coupling - General Method

- atmosphere to ocean
  coupling through Prandtl-Monin-Obukhov sublayer (constant flux layer)
- ocean to atmosphere
  coupling through flux conservation
- variables implemented: momentum, heat, humidity/salinity
- no precipitation effects
- wave effects at the interface are not regarded
  ($z_0 \sim u_*^2$ easy to implement)



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PALM - Ocean-Atmosphere Coupling - Flux Equations

- ocean heat flux depends on atmospheric sensible AND latent heat flux (evaporation)

$$\overline{w'\theta'}_{ocean} = \frac{\rho_a}{\rho_w}\frac{c_p}{c_{p_w}}\left(\overline{w'\theta'}_{atm} + \frac{l_v}{c_p}\overline{w'q'}_{atm}\right)$$

- increase of salinity due to evaporation by salinity flux (after Steinhorn, 1991: JPO)

$$\overline{w'S'}_{ocean} = -\frac{\rho_a}{\rho_w}\frac{S}{1-S}\overline{w'q'}_{atm}$$

- momentum

$$\overline{w'u'}_{ocean} = -\frac{\rho_a}{\rho_w}\overline{w'u'}_{atm}$$

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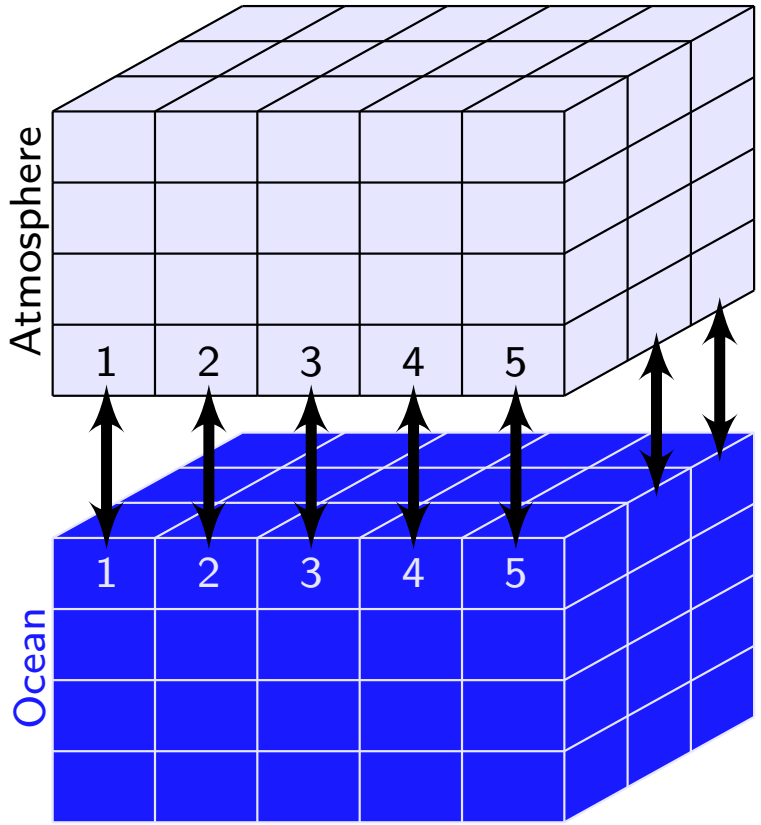
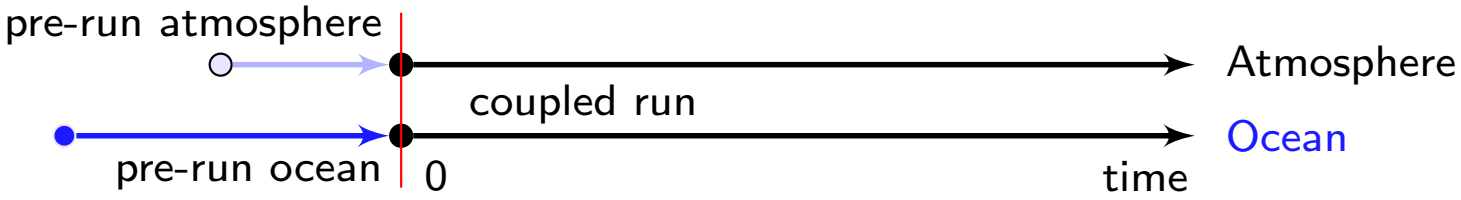
PALM - Ocean-Atmosphere Coupling Technical Realization (I)

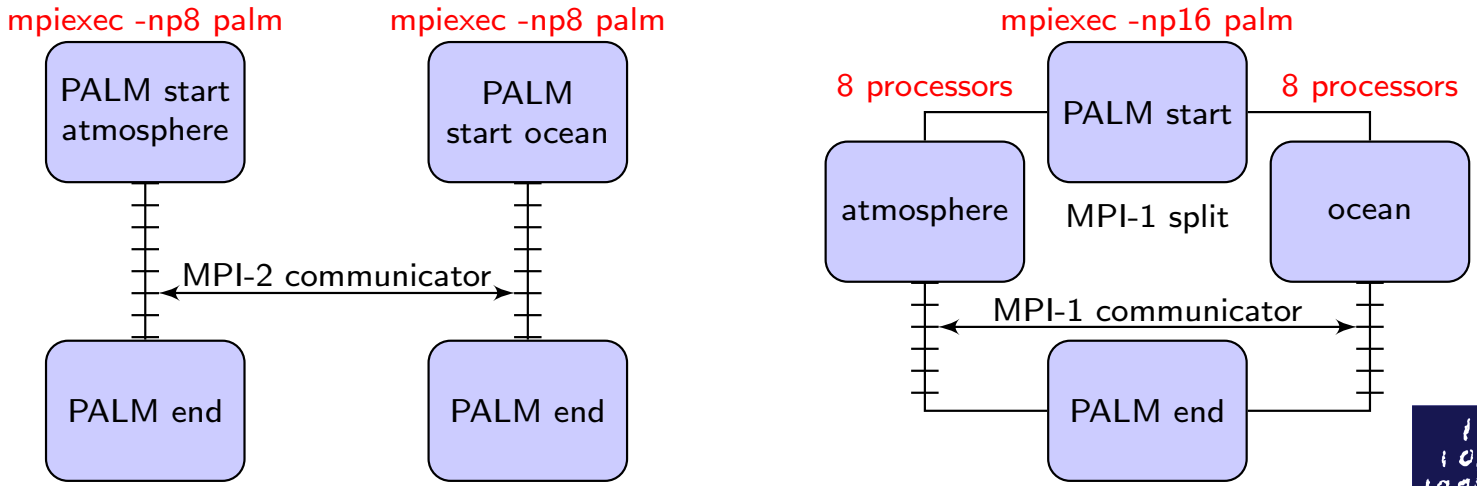
- so far, a 1-1 coupling is used
- boundary information is exchanged after given time intervals (120 s)
- before the coupling, each model can run seperately in order to allow for development of quasi- steady turbulence (different spin-up times in atmosphere and ocean)





PALM - Ocean-Atmosphere Coupling
Technical Realization (II)

- communication between the two models is realized with MPI.
- MPI-2 intercommunicators allow to couple two different executables,
- however the full MPI-2 standard is hardly available.
- MPI-1 starts only one executable, splits the total number of processors and calls the different models as subroutines.



PALM - Ocean Version - Final Remarks

- The atmosphere ocean coupling of PALM has not been tested sufficiently so far! Only some plausibility checks have been done.
- Please carefully check the results and please also check the code.