

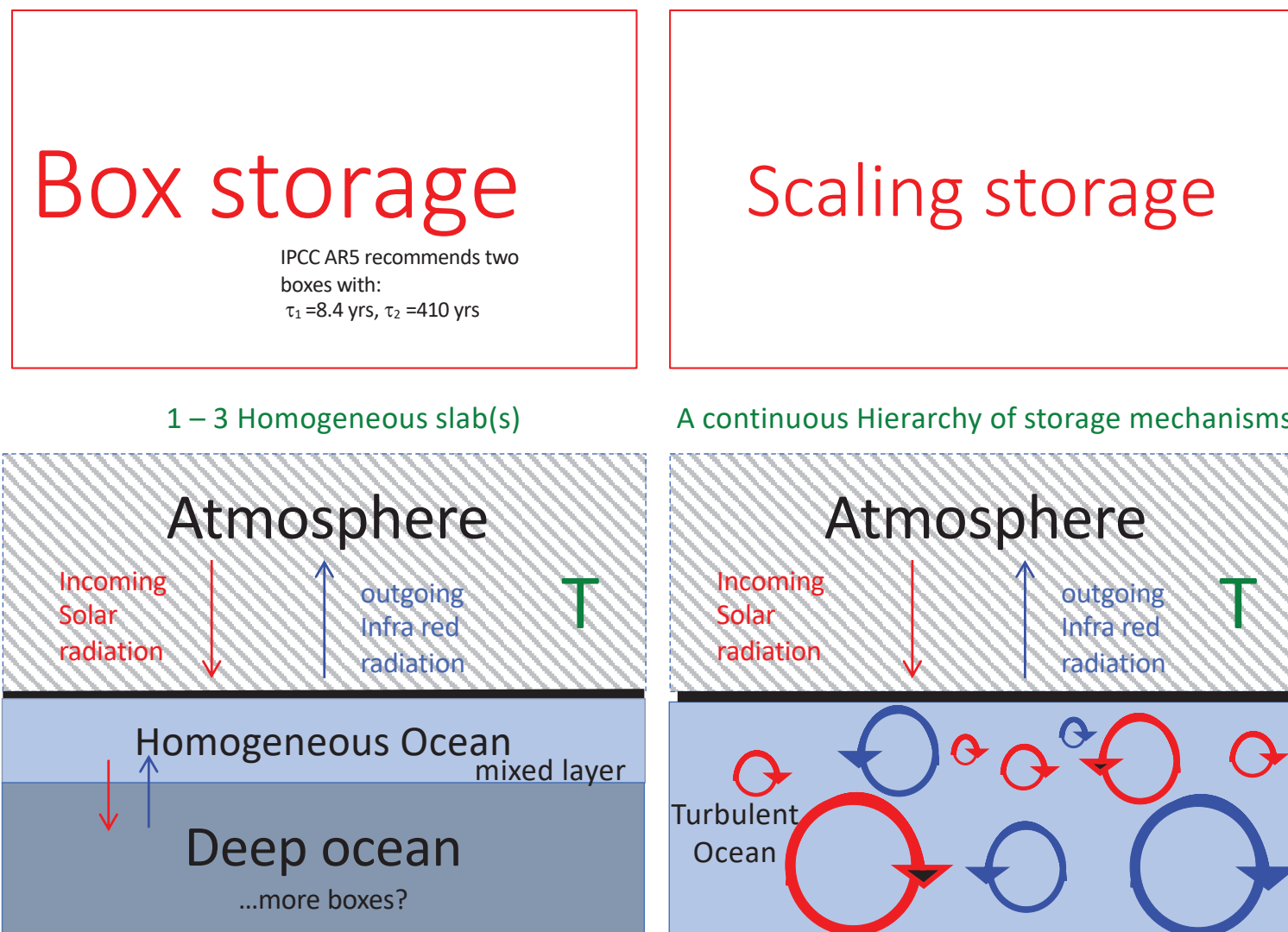
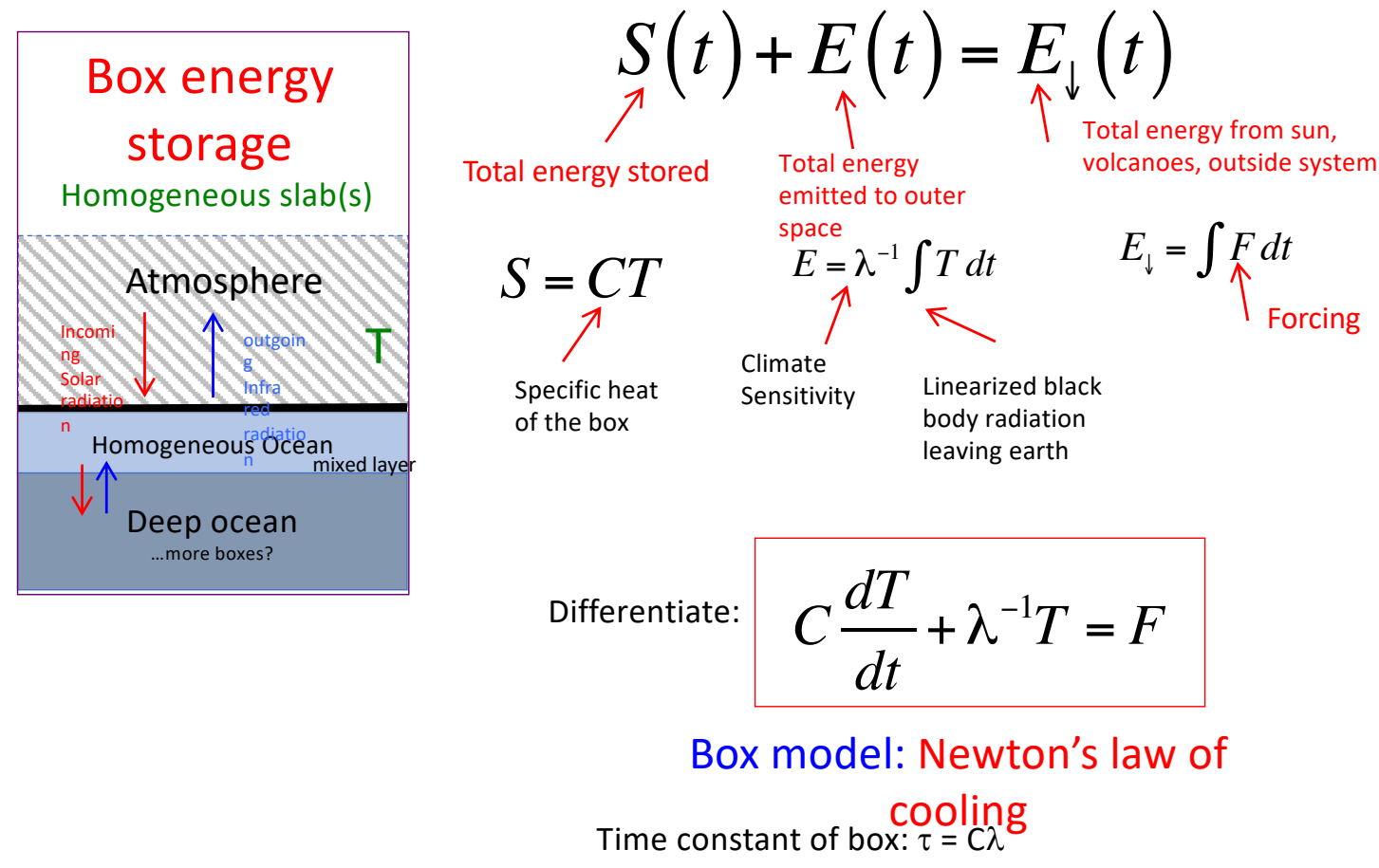
The Fractional and Half-Order Energy Balance Equations

Fractional relaxation noises, motions

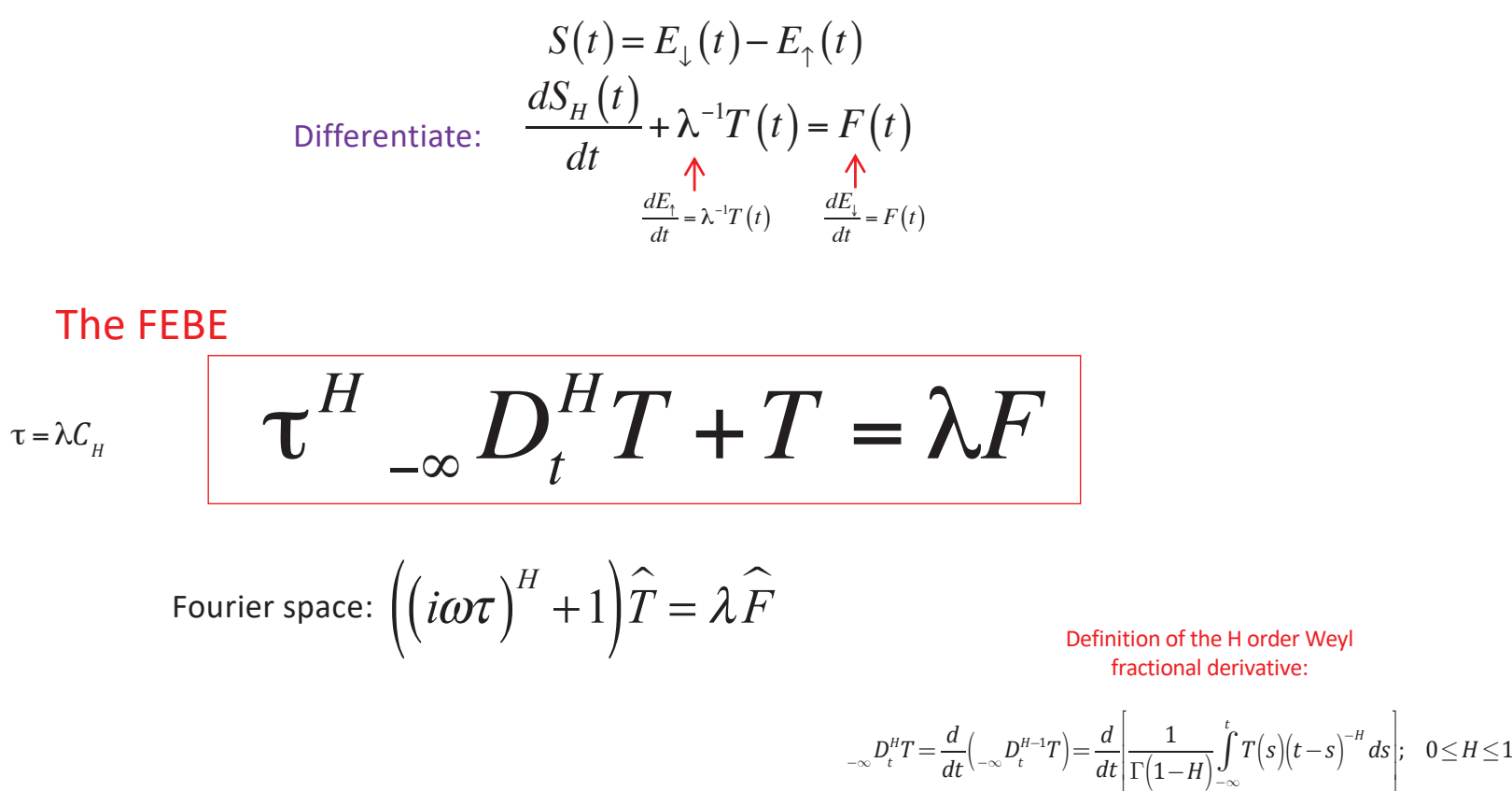
The Fractional order Energy Balance Equation (FEBE)

The Half-order Energy Balance Equation (HEBE)

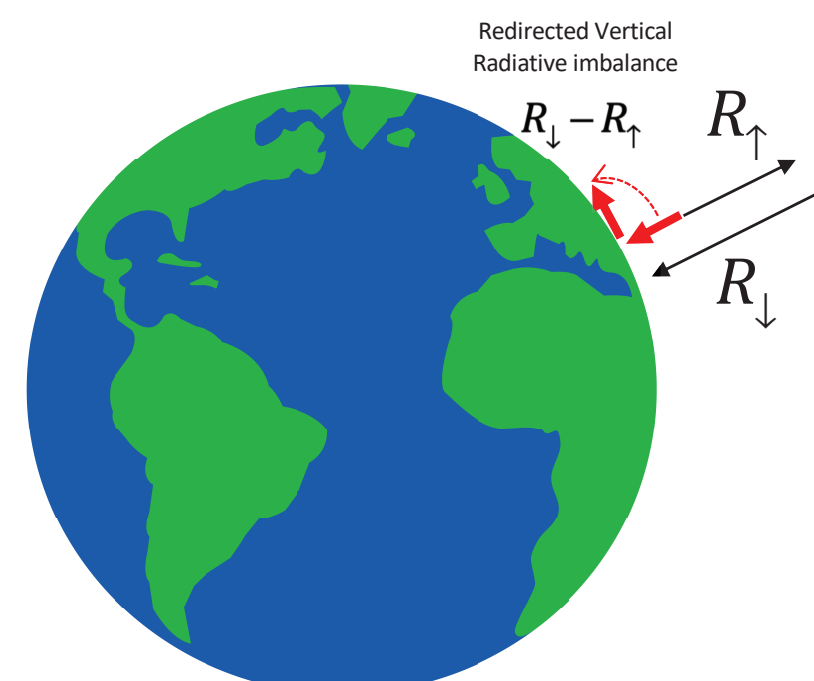
Fractional relaxation noises, motions and the FEBE



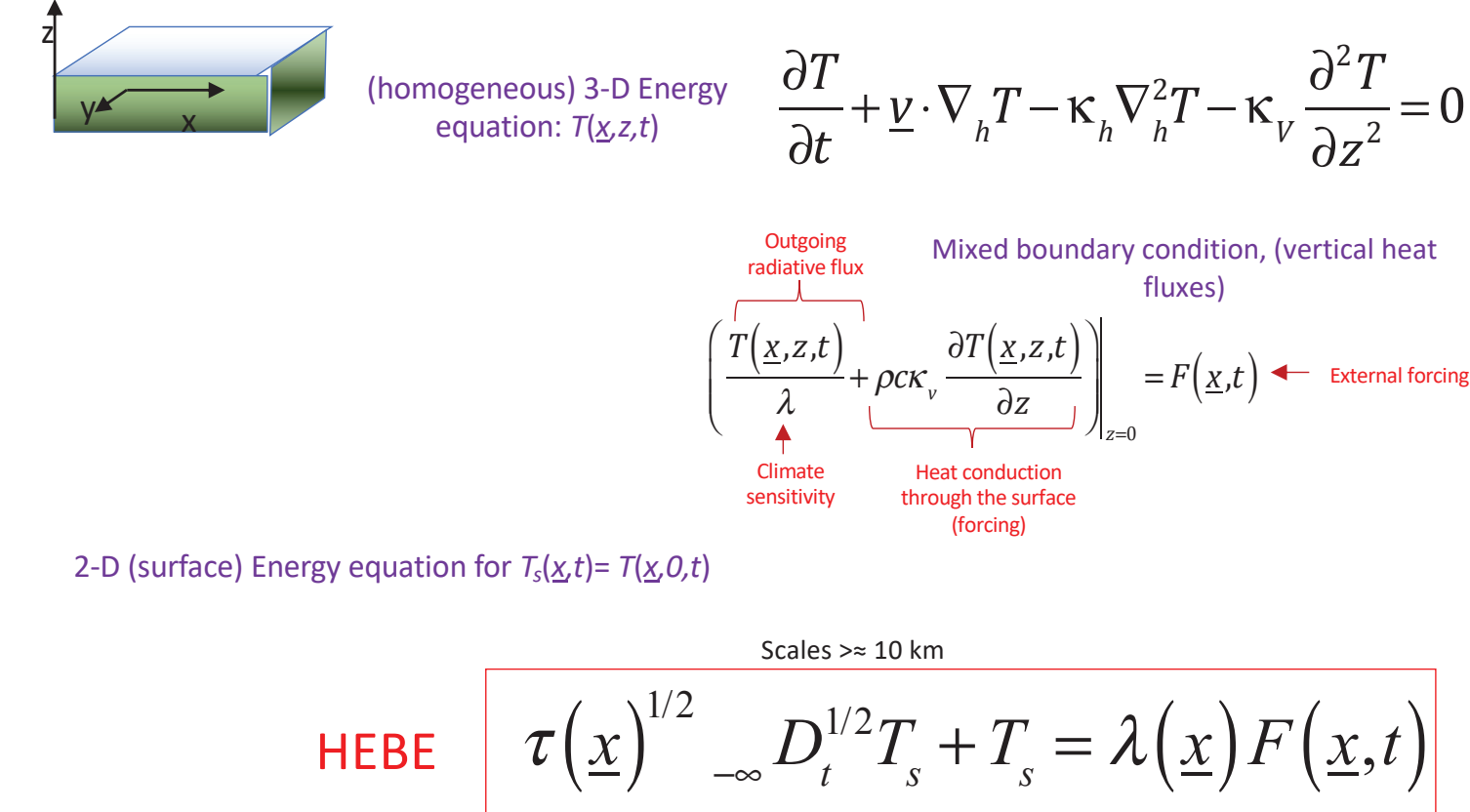
Energy rate equation



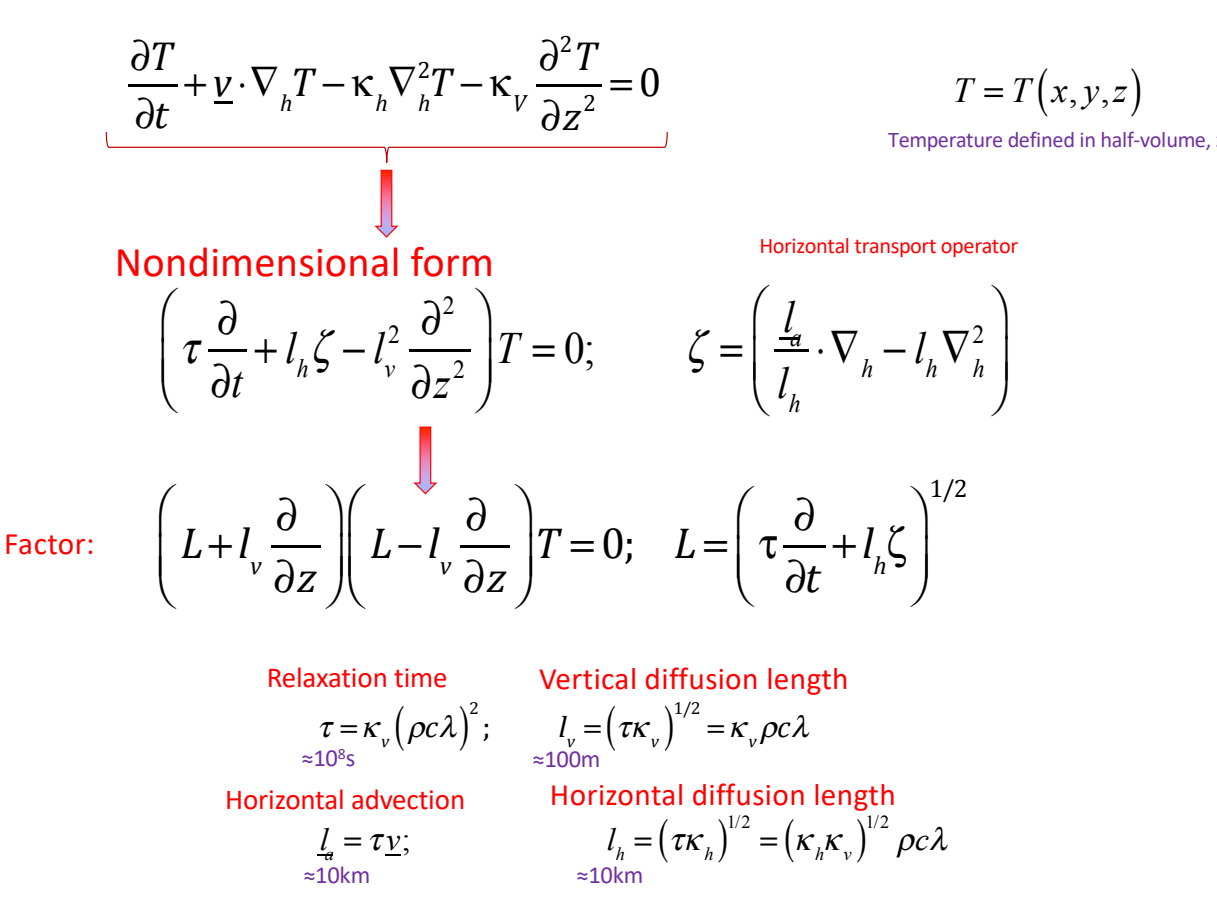
Regional energy balance



Correcting Budyko-Seller's boundary conditions:
 $H=1/2$ - the Half-Order Energy Balance Equation (HEBE)



Babenko's method



Conclusions

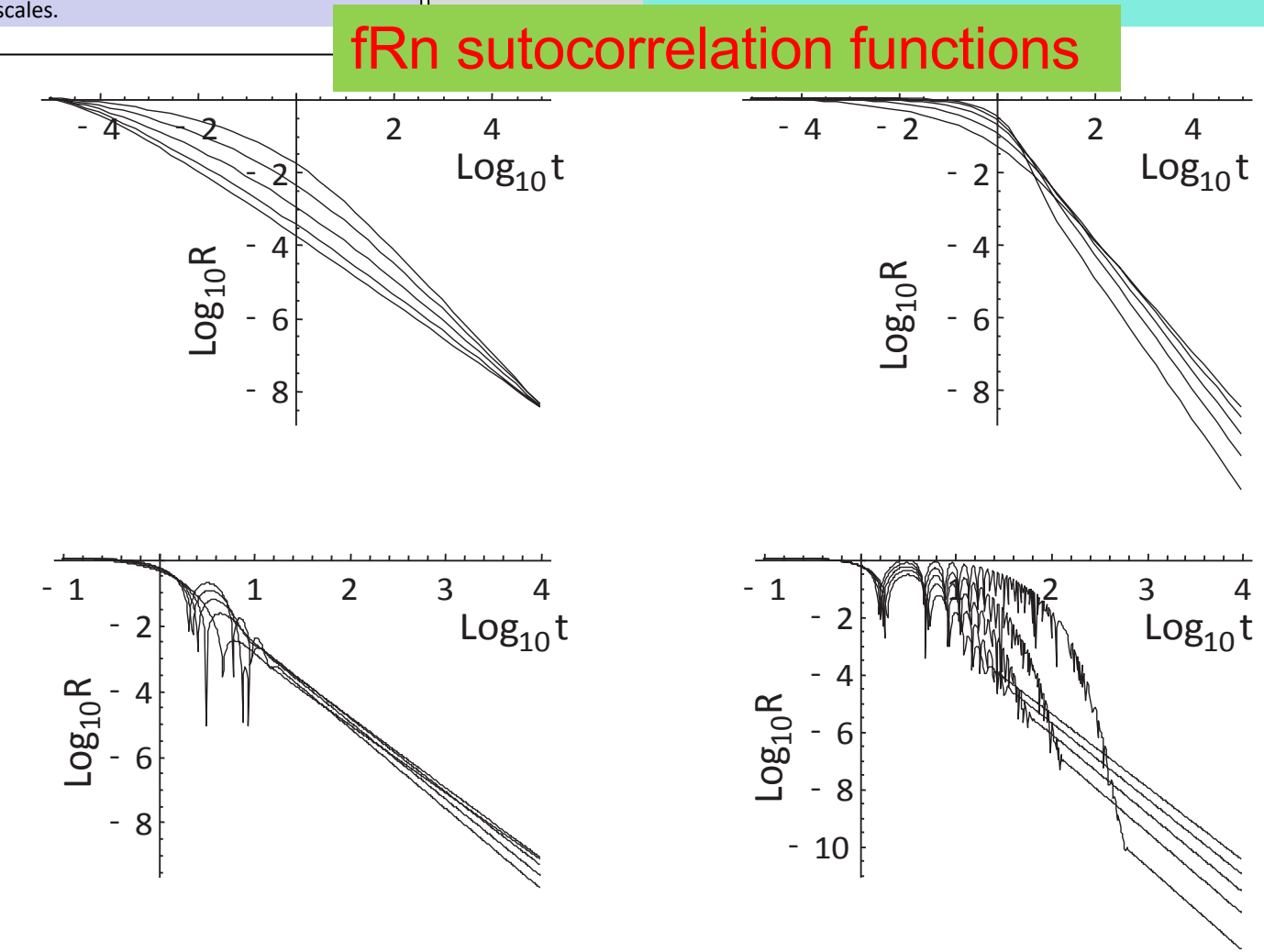
We have proposed a 2D energy balance equation for macroalgal systems: *lms* and *lms*_{2D}. By introducing a vertical coordinate, we were able to rigorously treat the forcing of the entire water body and not just the surface. The *lms*_{2D} model is more general than *lms* because it includes the possibility that the (apparently diffuse) “mixed” surface boundary conditions are needed and the (apparent) temperature gradient is not negligible. The *lms*_{2D} model is also more general than *lms* because it allows us to obtain an equation for the time varying aloneness. In comparison, the use of (e.g., Bullock-Sellers) type energy balance models is limited to steady state conditions and the *lms* model is limited to steady state conditions from the equation, *meridionally*.

Since the forcing is via the vertical boundary condition, the equation remains homogeneous and bidirectional. This is a significant improvement over the *lms* model, which is unidirectional and requires a boundary condition at the surface. The *lms*_{2D} model is also more general than *lms* because it includes the possibility that the (apparent) temperature gradient is not negligible. The *lms*_{2D} model is also more general than *lms* because it allows us to obtain an equation for the time varying aloneness. In comparison, the use of (e.g., Bullock-Sellers) type energy balance models is limited to steady state conditions and the *lms* model is limited to steady state conditions from the equation, *meridionally*.

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References



fRn predictability skill

