OUTLINE

☞ Experimental observations (creep tests under natural climate or under controlled conditions (RH+T°))

☞ Models

- stochastic climate model -> RH (+T°)
- Moisture transport (1D)

Experimental

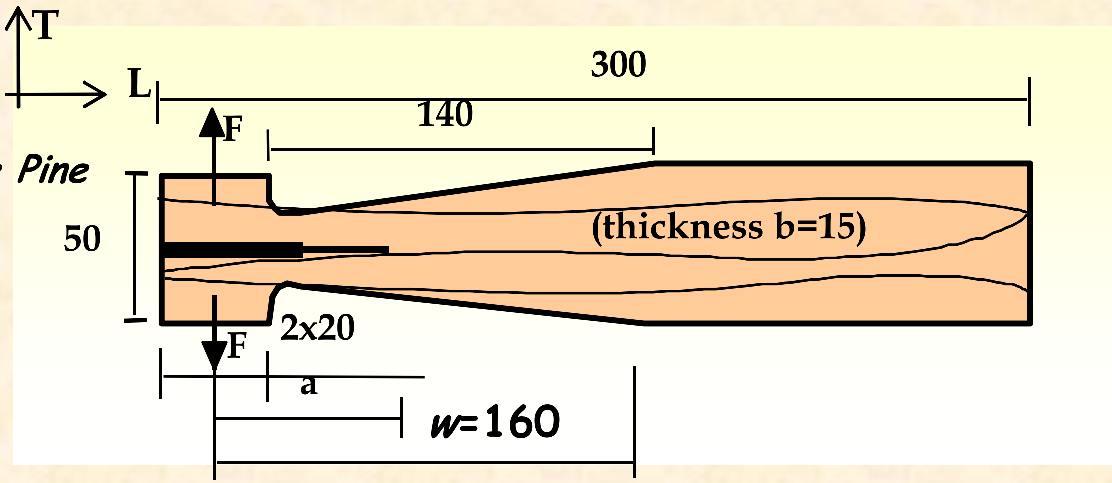
observations

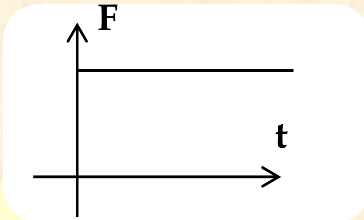
Experiments

Under several RH -T° conditions

Maritime Pine

LVL





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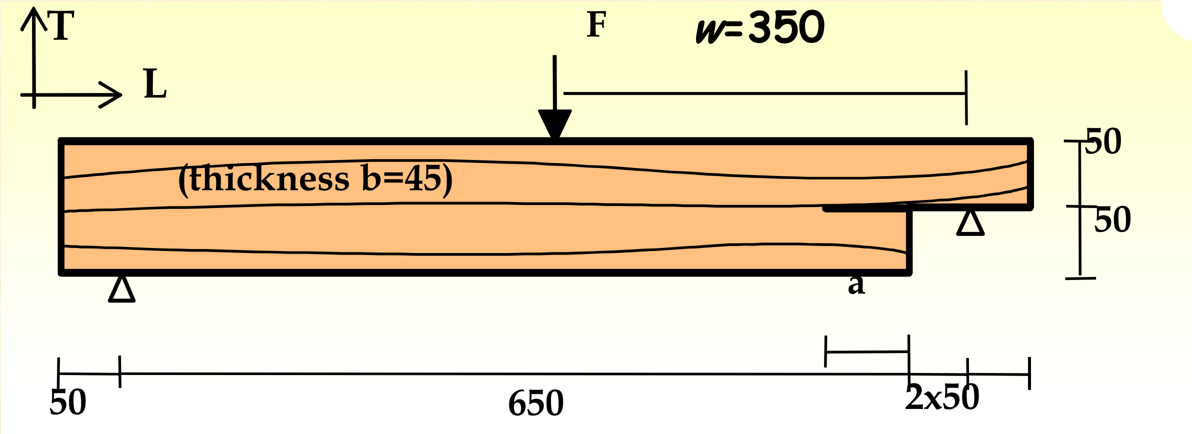
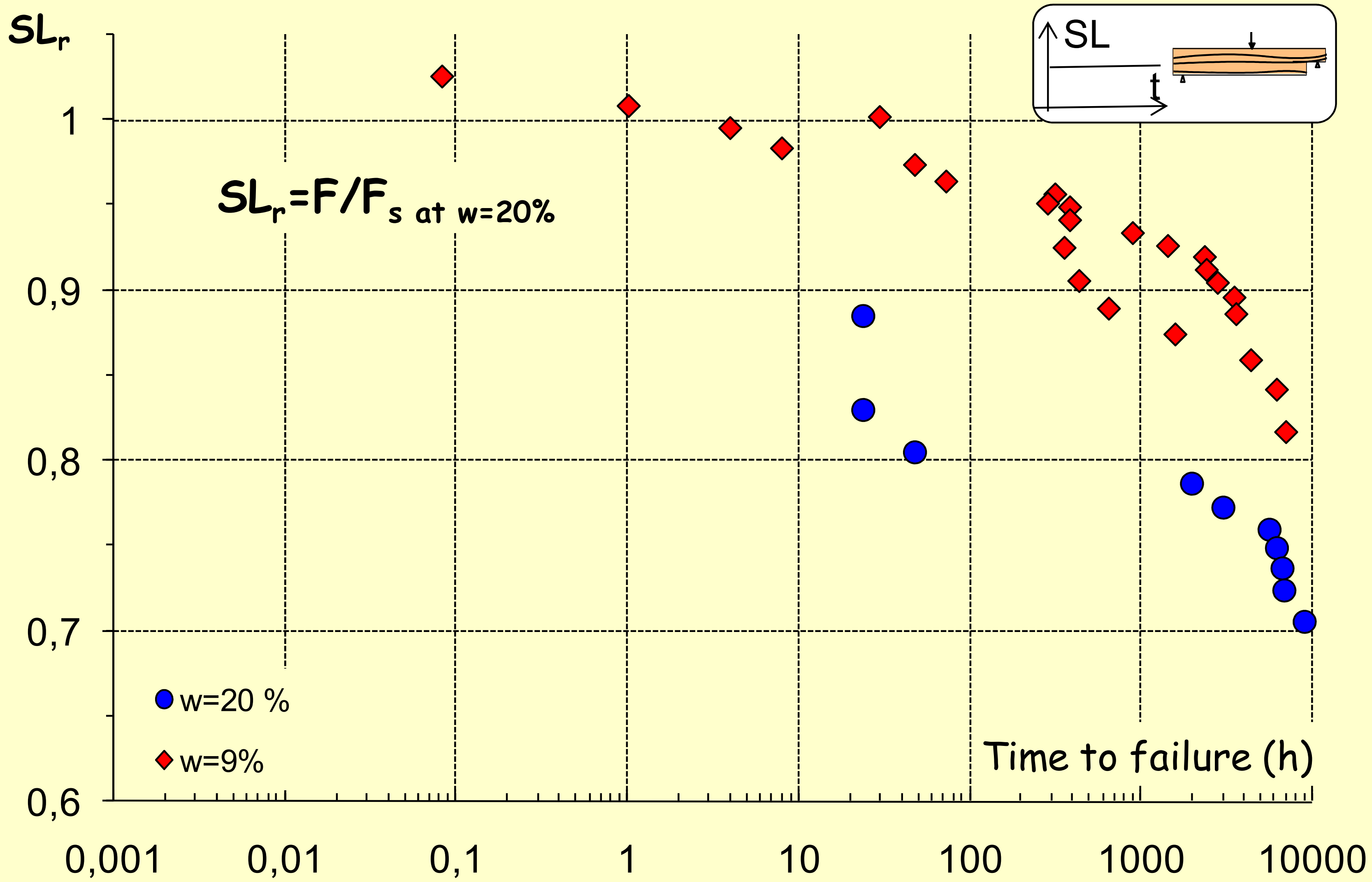
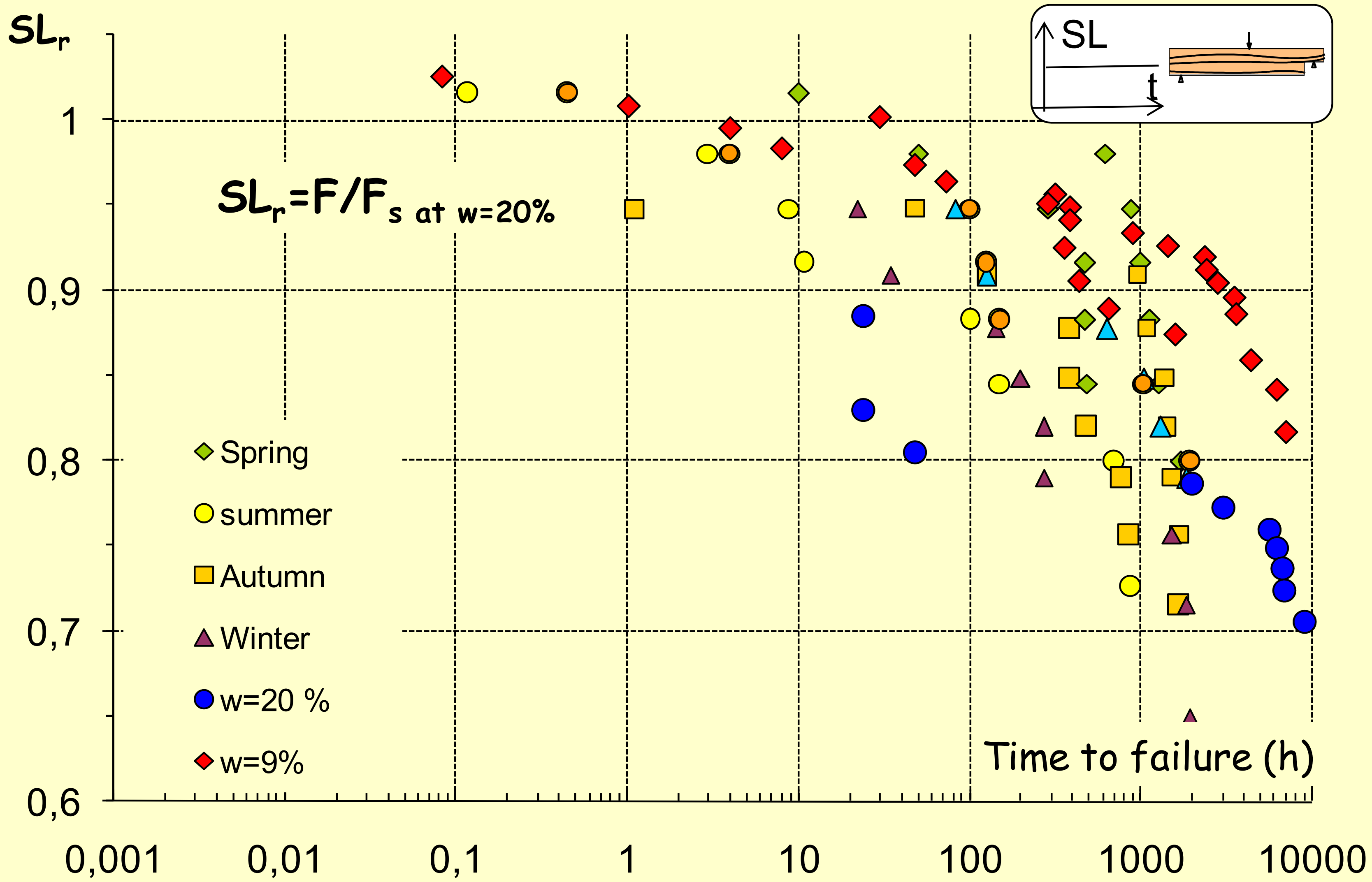


Experimental observations



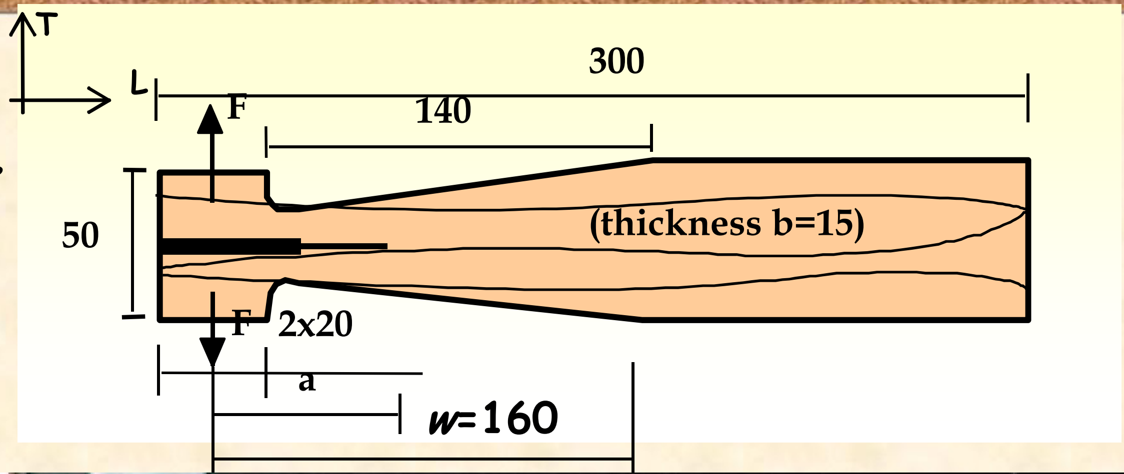
Experimental observations

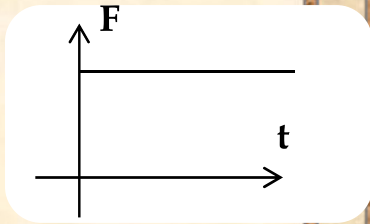


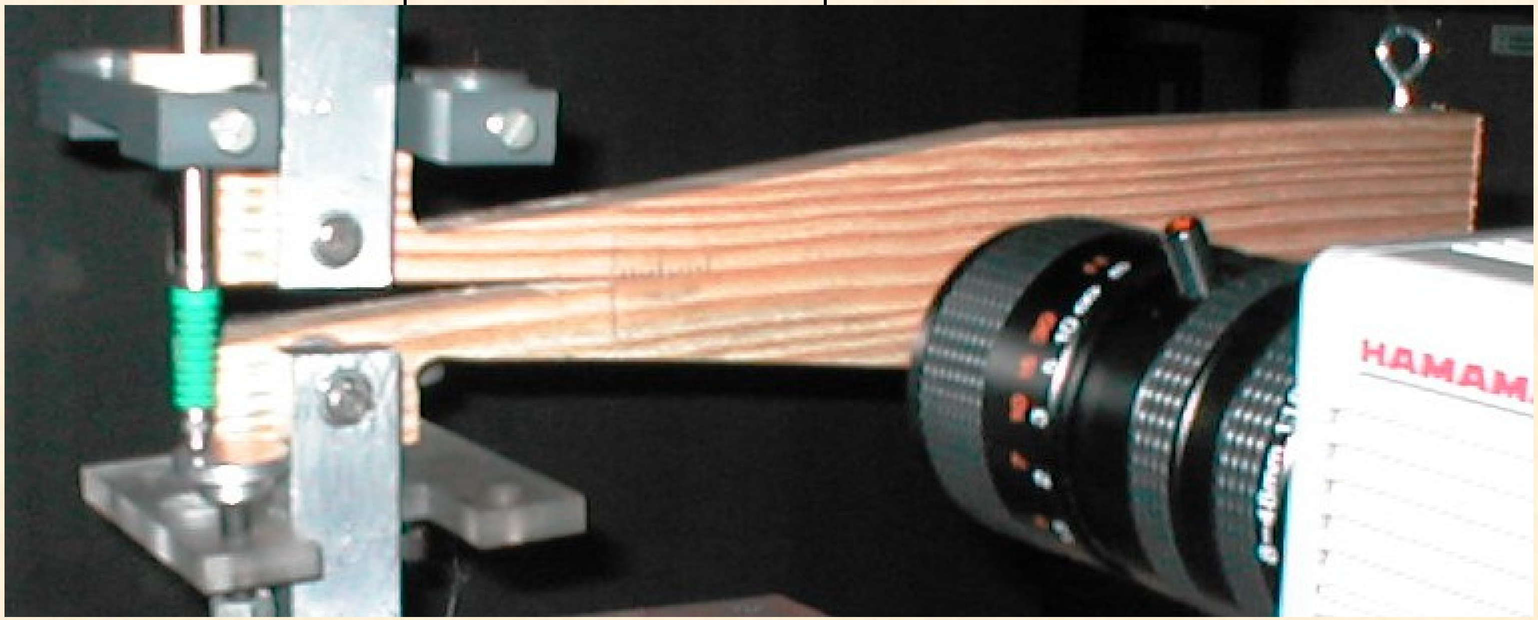
Experiments

Maritime Pine

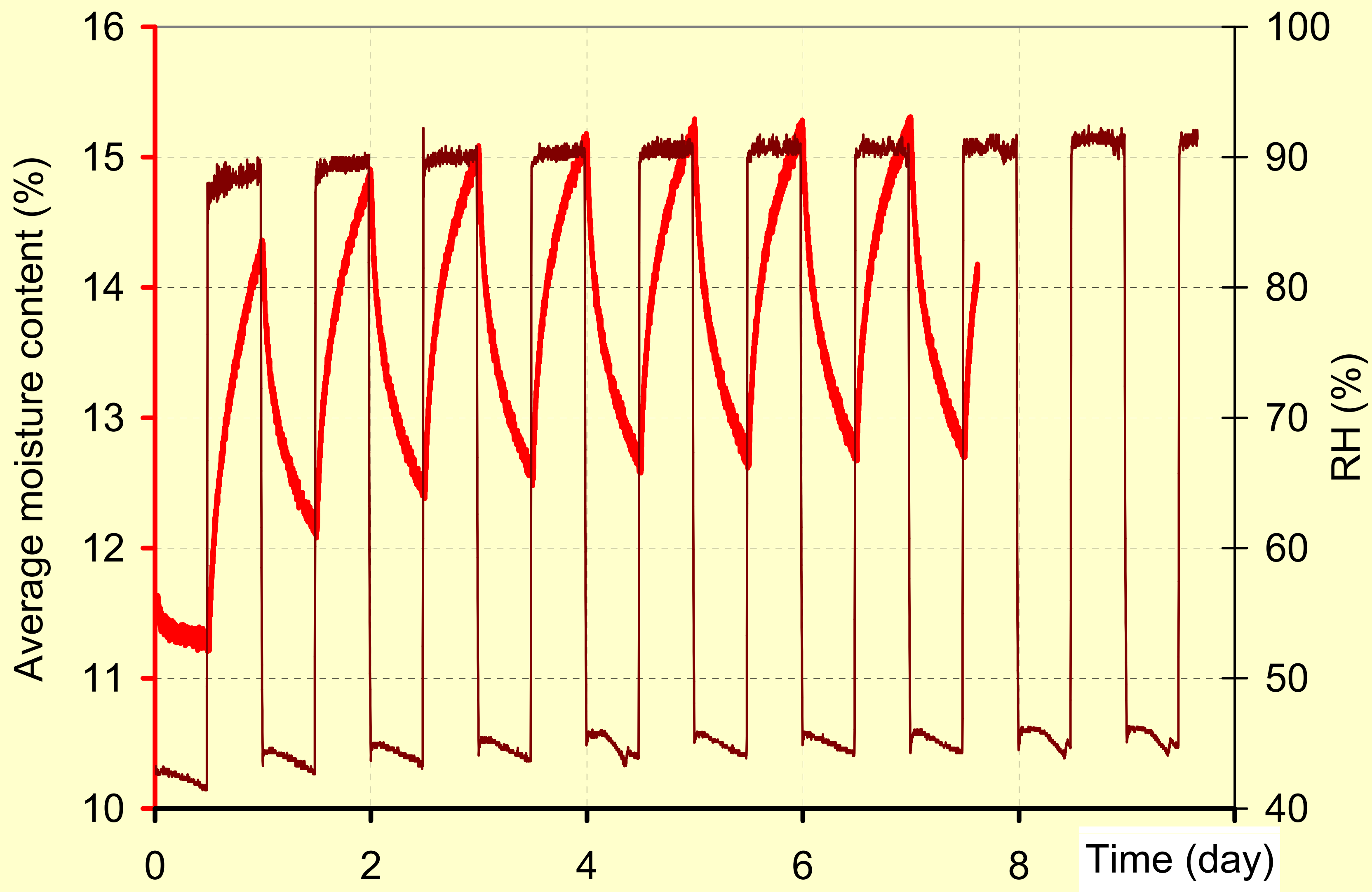
LVL







Experimental observations



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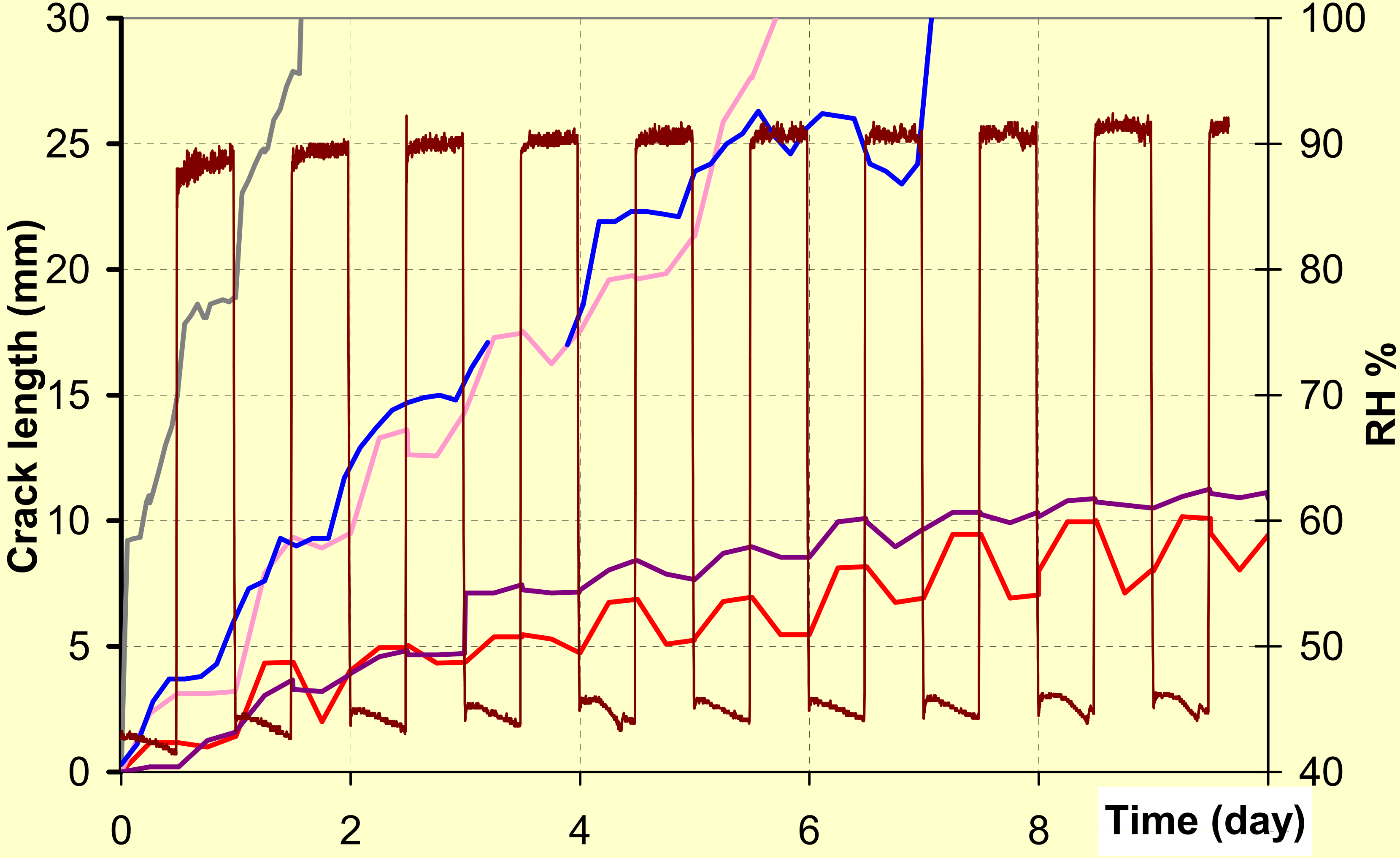
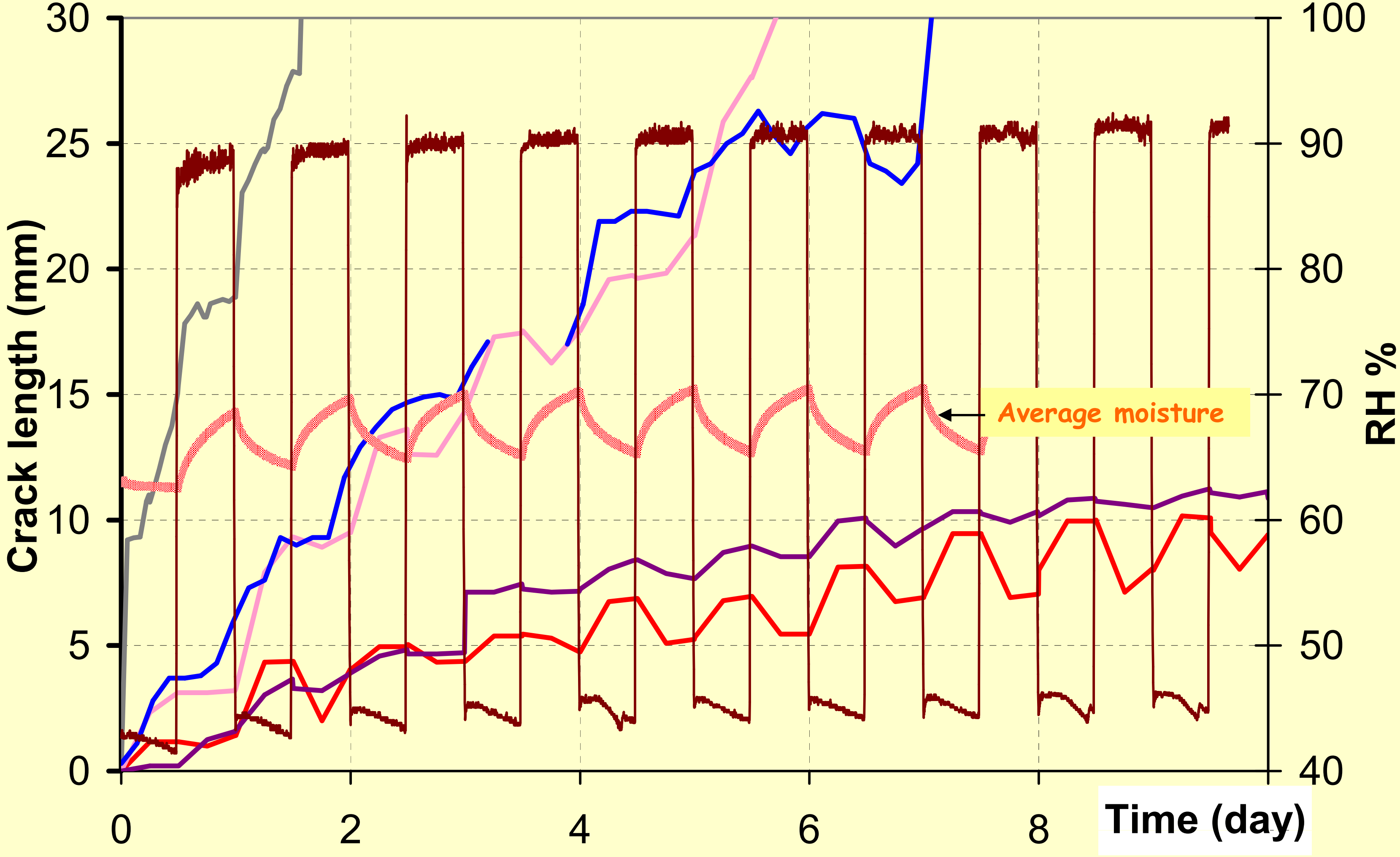


Experimental observations



Models

-Moisture transport (1D)

- Stochastic Climate

Moisture transport

$$w(z) = \overline{w_{eq1}} + \sum_{i=2}^{5} \left(\overline{w_{eq\,i}} - \overline{w_{eq\,i-1}}\right) \cdot \exp\left(-\sqrt{\frac{\pi f_i}{\Delta}} \cdot z\right)$$

$\overline{w_{eqi}}$ = Equilibrium average moisture w (on surface) for the period i

f_i= frequency associated to the period i (ex : for a year f_1 =1/365,25 j^{-1})

i=1: year, i=2: 3 months, i=3: 1 month, i=4: 1 week, i=5: 1 day

Δ= sorption coefficient = 20.10^{-11} m^2/s (Maritime Pine)

Moisture transport

$$w(z) = \overline{w_{eq1}} + \sum_{i=2}^{5} \left(\overline{w_{eq\,i}} - \overline{w_{eq\,i-1}} \right) \cdot \exp\left(-\sqrt{\frac{\pi f_i}{\Delta}} \cdot z \right)$$

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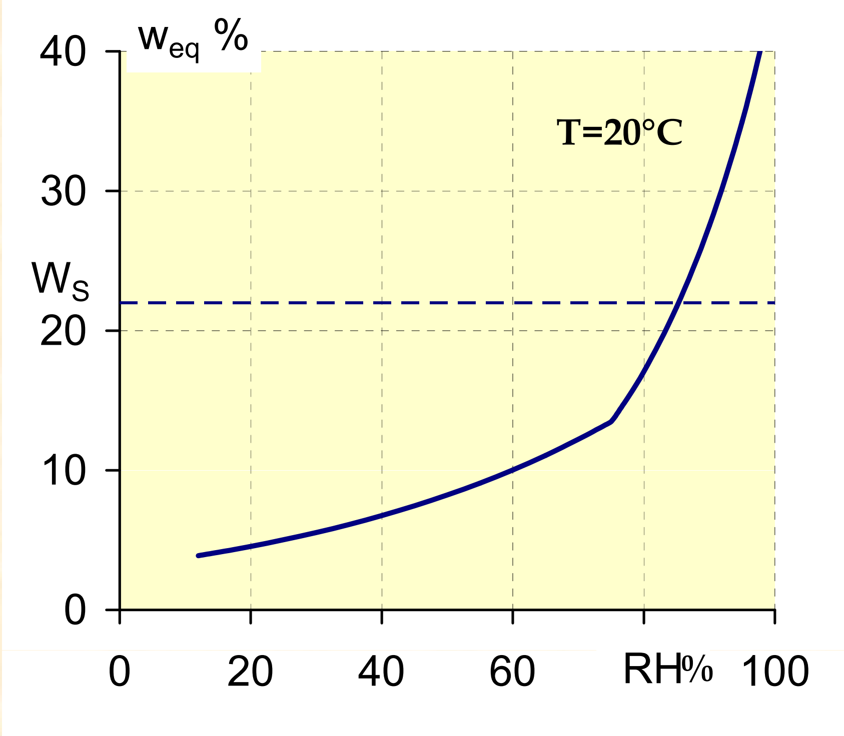
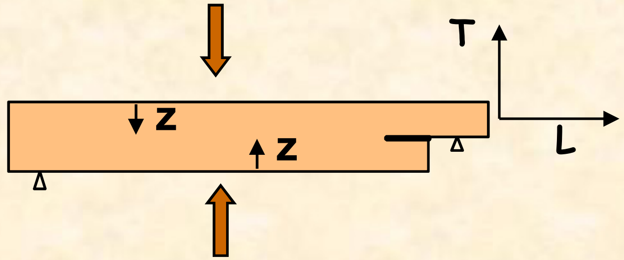
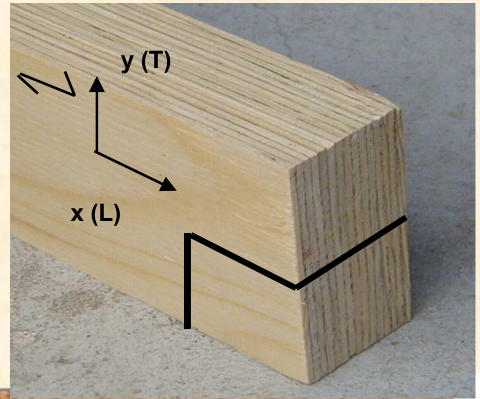






RH stochastic modeling

Stochastic process

Monte Carlo + Karhunen-Loève:

$$RH(t) = \overline{RH}(t) + \sum_{i=1}^{\infty} \sqrt{\lambda_i} \cdot \xi_i(t) \cdot f_i(t)$$

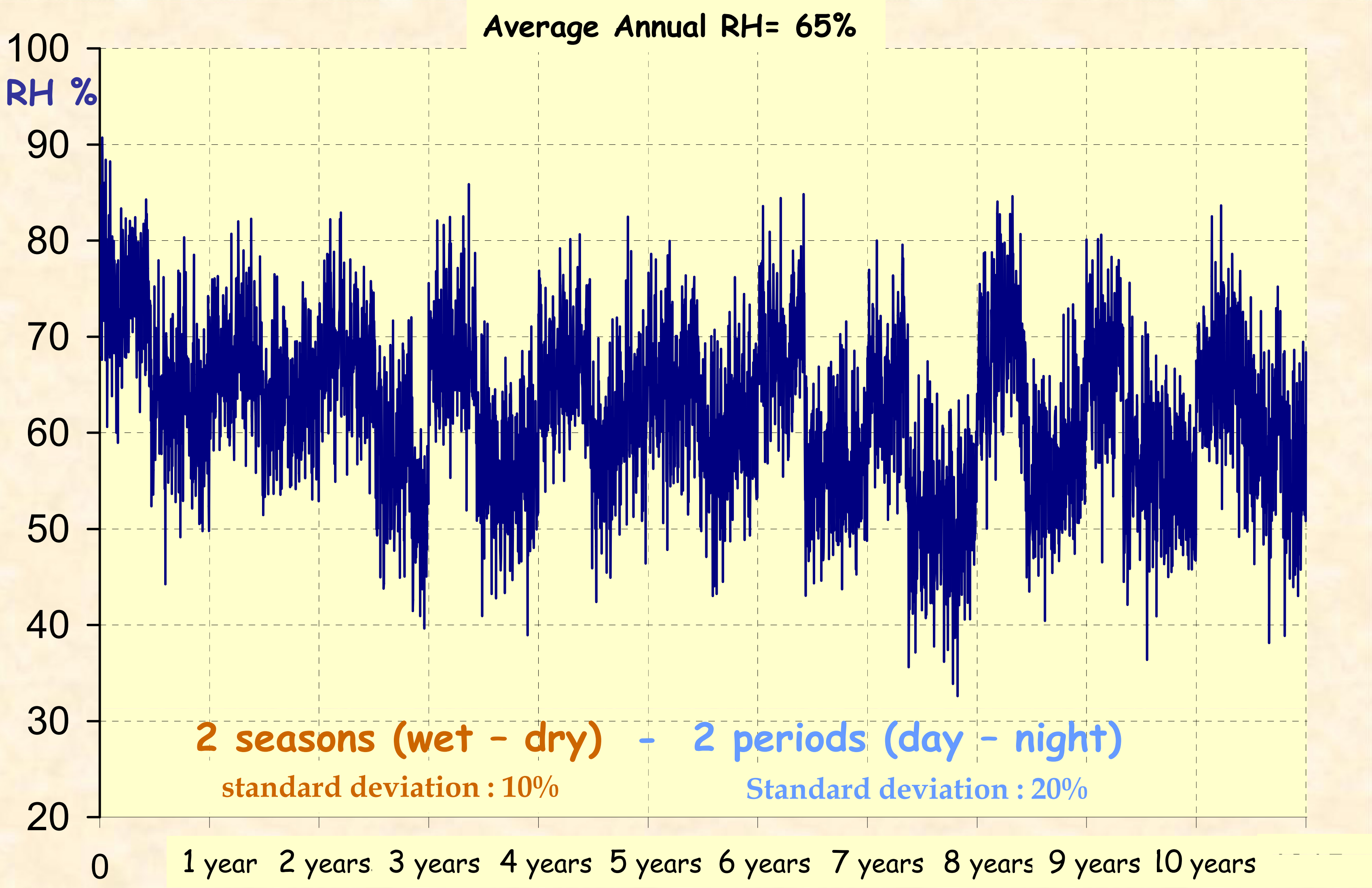
$\overline{RH}$: average process (sinusoid)

$\xi(t)$: is a vector whose components $\xi_i(t)$ are Gaussian random centered variables

λ_i : eigenvalue corresponding to the eigenvector f_i of the covariance

2 seasons (wet – dry) - 2 periods (day – night)

RH stochastic modelling



Relationship w - RH