

Environmental impact on crack propagation of biobased building materials: application to Abies Alba Mil and Douglas

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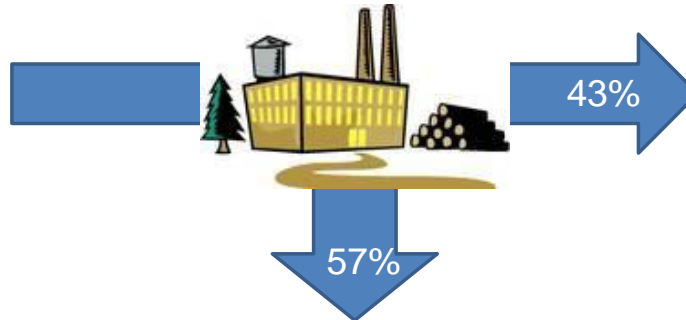
This work is sponsored by French National Research Council through the ANR JCJC Project CLIMBOIS N° ANR-13-JS09-0003-01 and Labelled by ViaMeca

□ Context

Forest



First industry of wood's transformation



Wood sawed



Related Products

□ Problems

- **Various species** : *Abies Alba Mil (AAM)*, *Pseudotsuga Menziesii* (Douglas)
- **Importance of AAM in private forest** : 30%
- **Mechanical behavior**: drying process, nodes, creep, fracture processes...
- **Difficult to use in building** (Thermo-hydro-visco-mechanical)

➤ **Main goal**

- Know the impact of the climatic variations and the defaults of wood on the mechanic behavior of the structure.

➤ **specifics goal**

- Creep tests to propose experimental models and to characterize the spatial variability of wood properties and defects
- To take into account the mechanisms of wood degradation, under the combined action of the environmental changes and the physical parameters of the wood.
- Taking into account the randomness and spatial variability of wood properties
- To propose new experimental methodology coupled with numerical incremental viscoelastic formulations under climate changes

1. Context & goals

2. Materials & Methods

3. Results

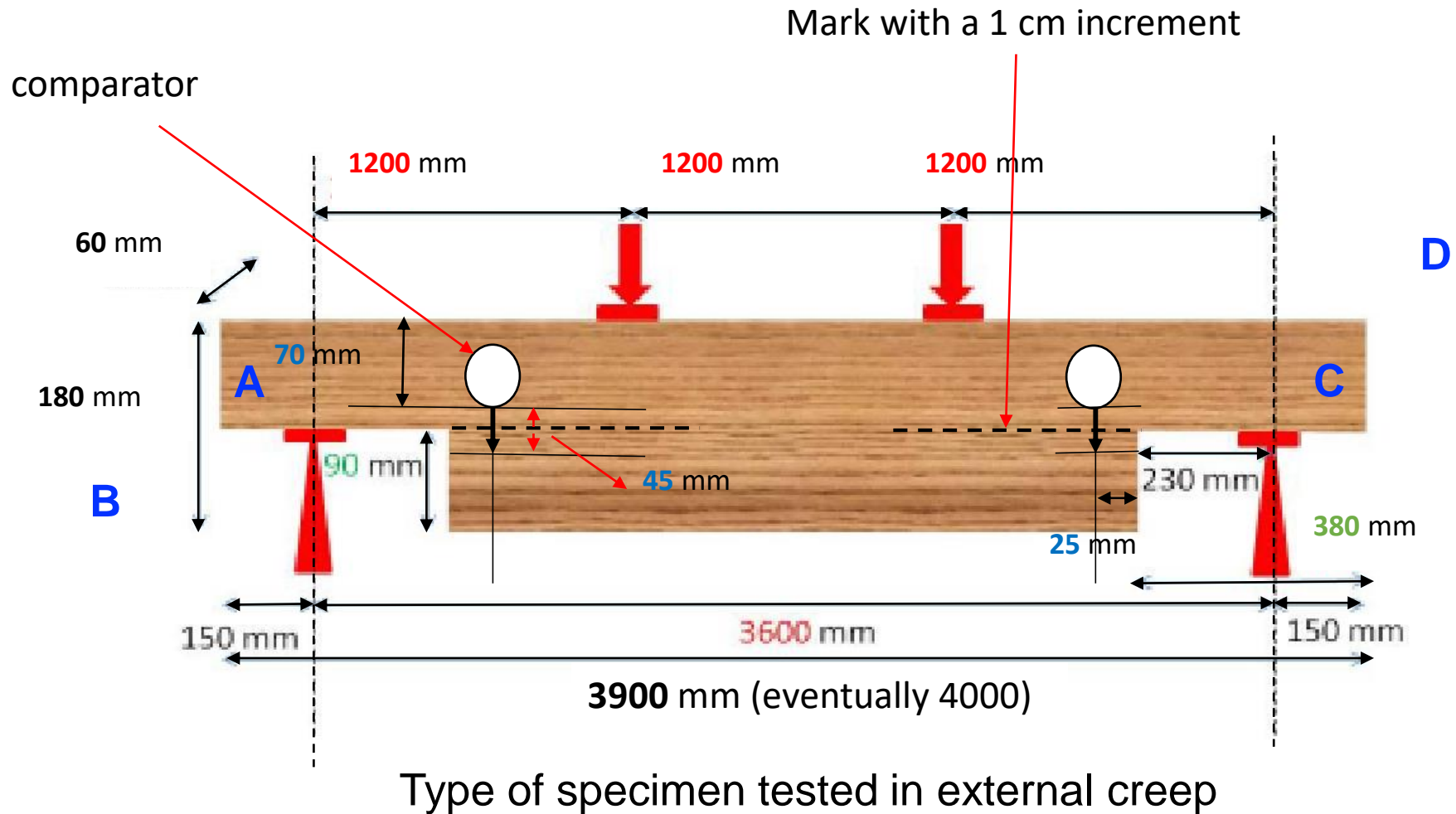
Conclusion & Outlook

➤ **Materials:**

- 12 beams of white fir and 13 beams of Douglas Fir



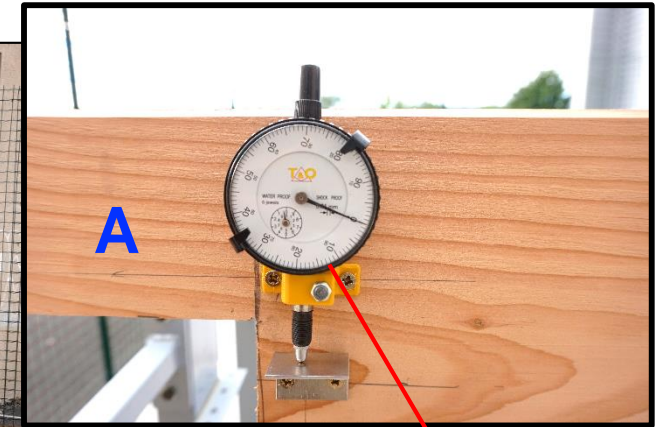
➤ Configuring test specimens for creep tests:



A & C: faces with comparators

B & D: faces without comparators

➤ Experimental devices



Comparator
To measure the
crack opening

Notched Beams in external creep loading



Concrete beam used as a load for the creep test
(413 kg)

Stacker for stacking loads

➤ Experimental devices

A



B



D



C



Faces to measure crack length and crack opening on beam S5 (S5A, S5B, S5C, S5D)

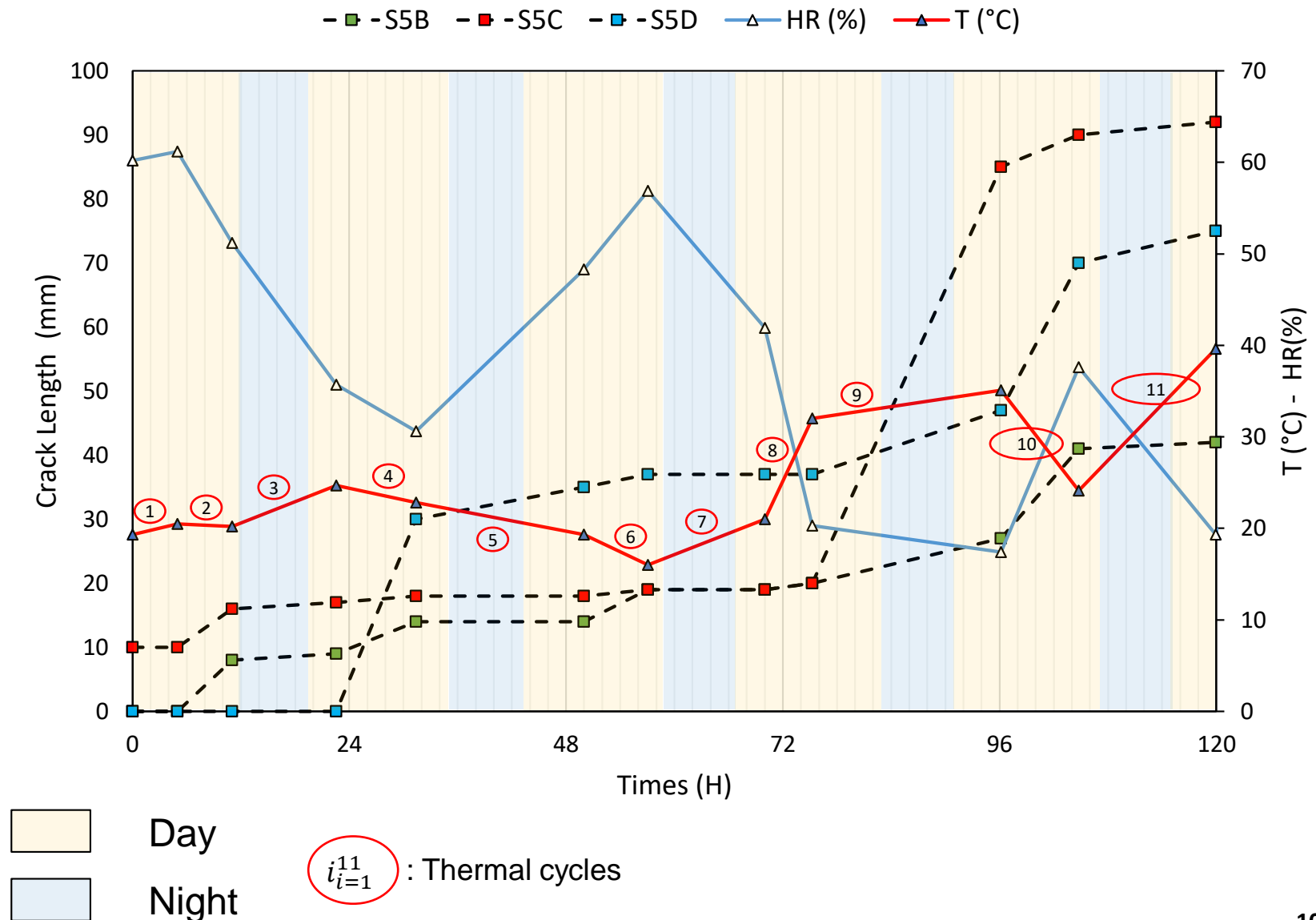
1. Context & goals

2. Materials & Methods

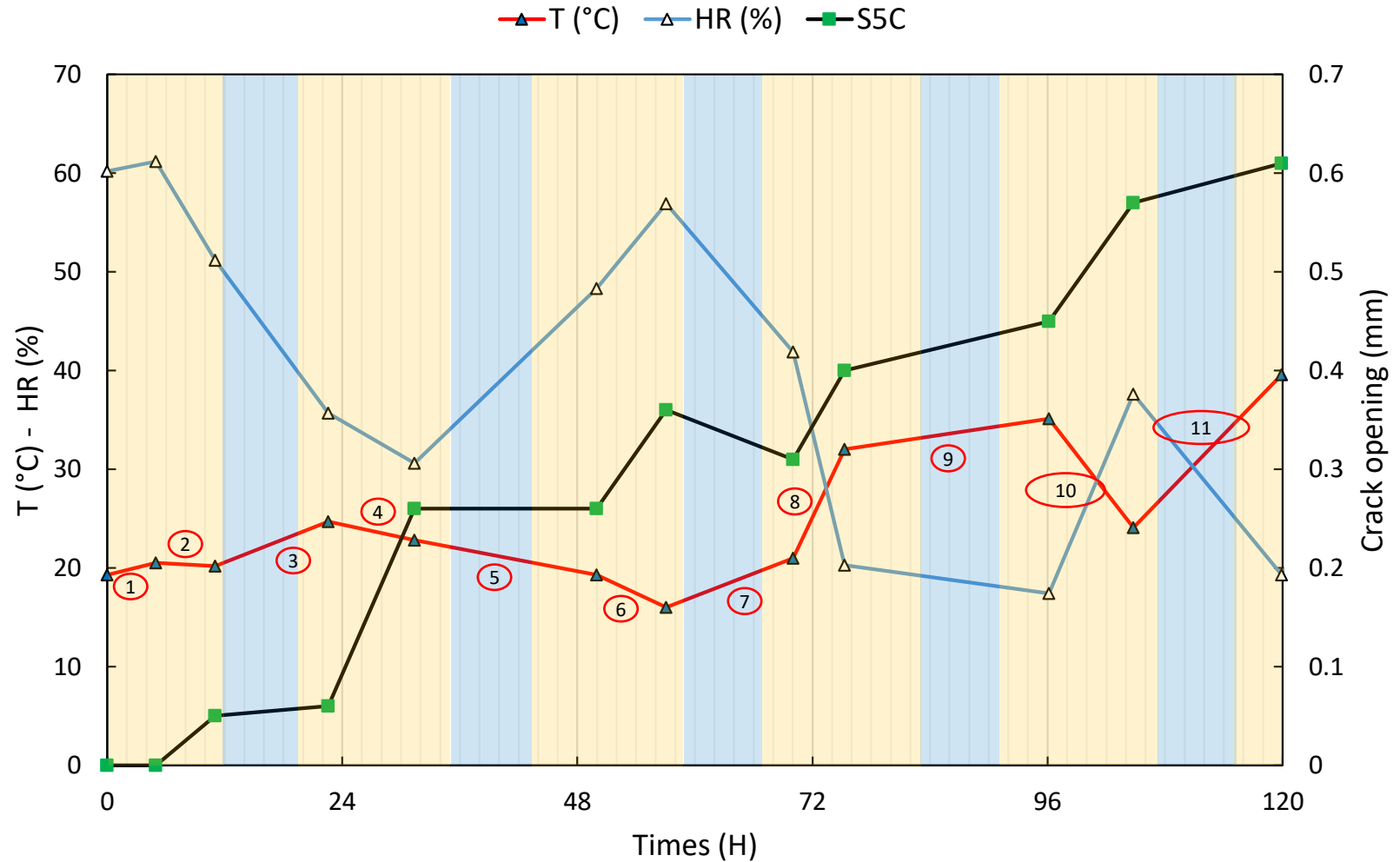
3. Results

Conclusion & Outlook

➤ Crack length evolution of AAM Vs T and HR



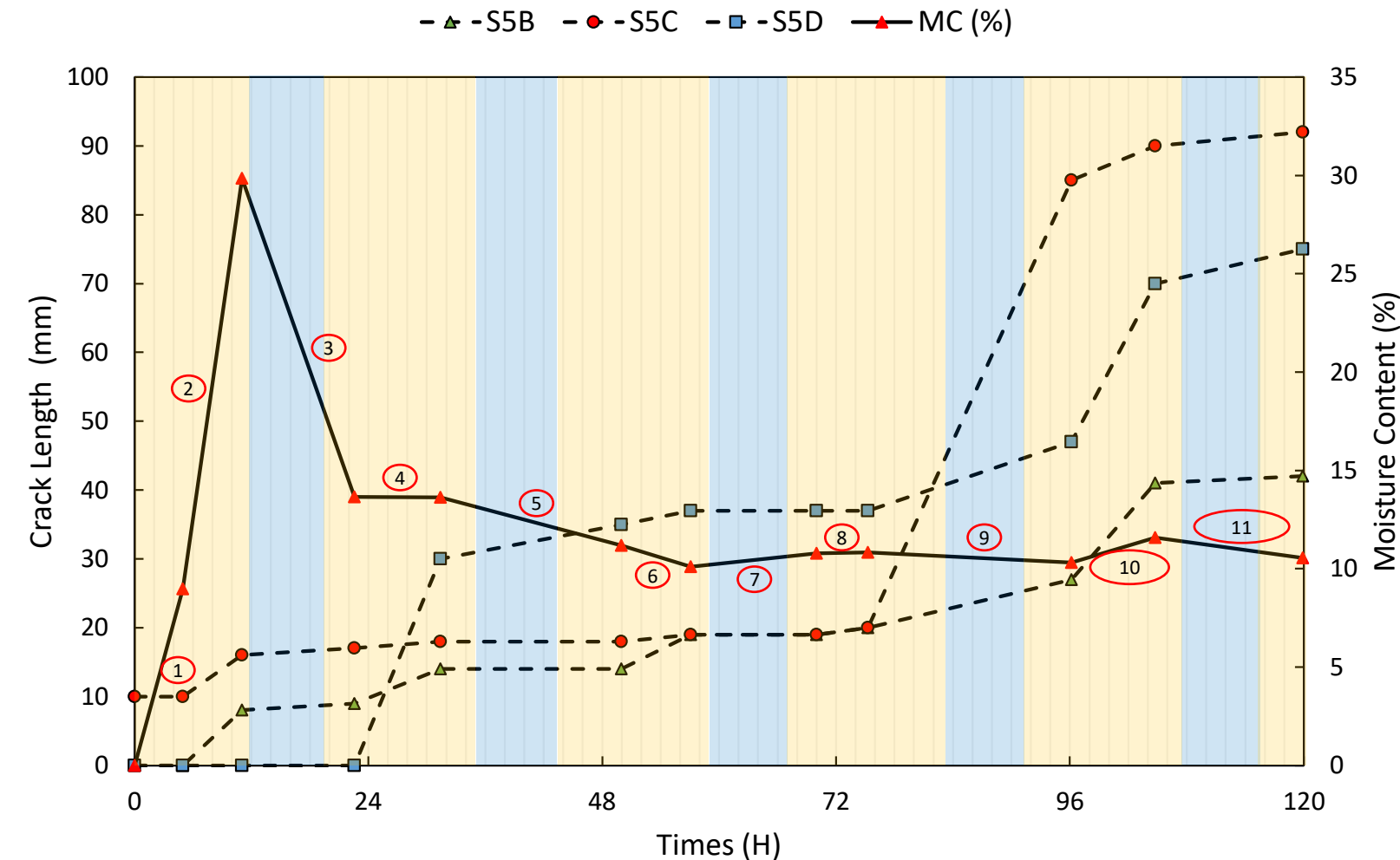
➤ Crack opening evolution of AAM Vs T and HR



Day
 Night

11 : Thermal cycles

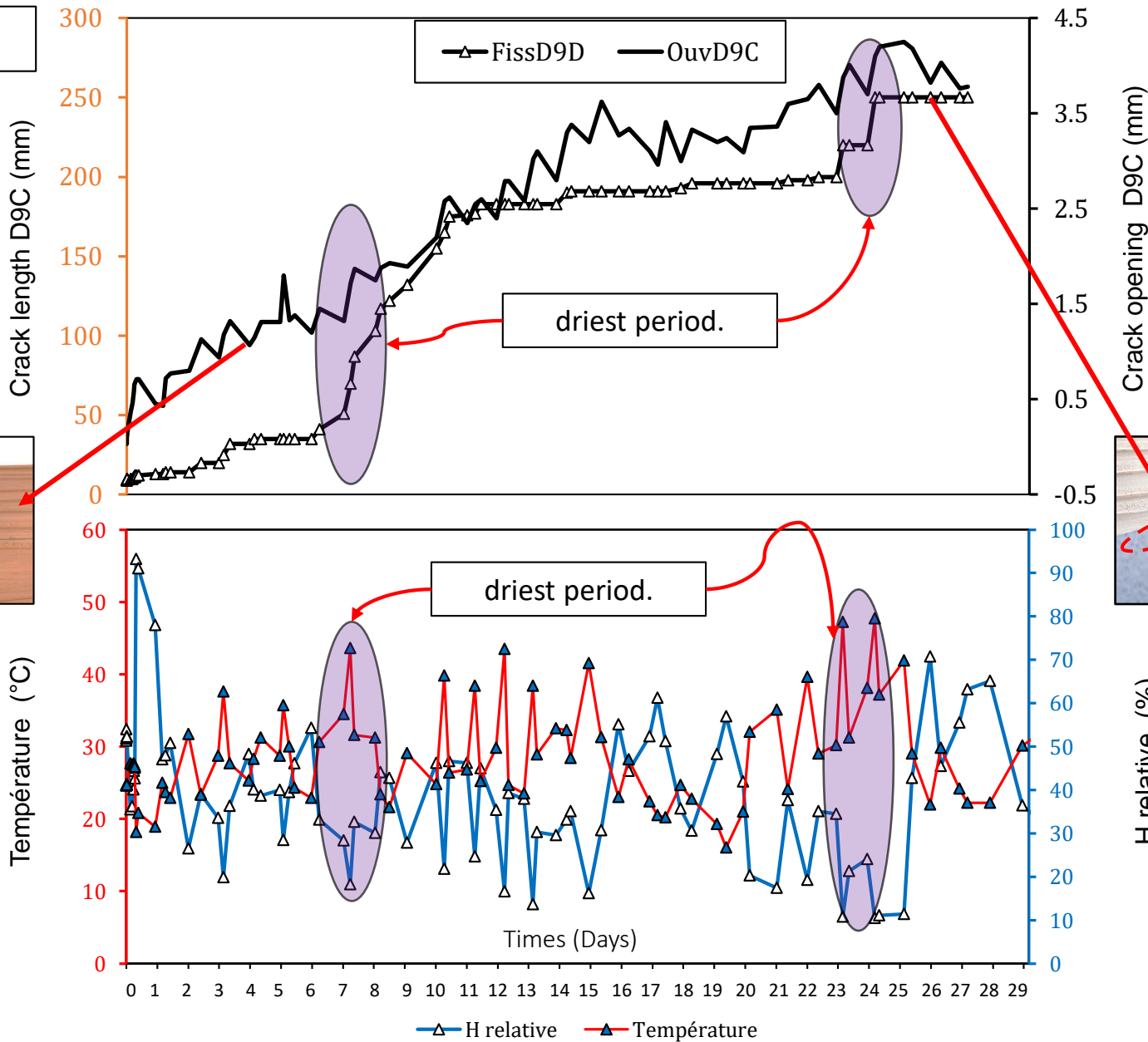
➤ Crack length evolution of AAM Vs MC



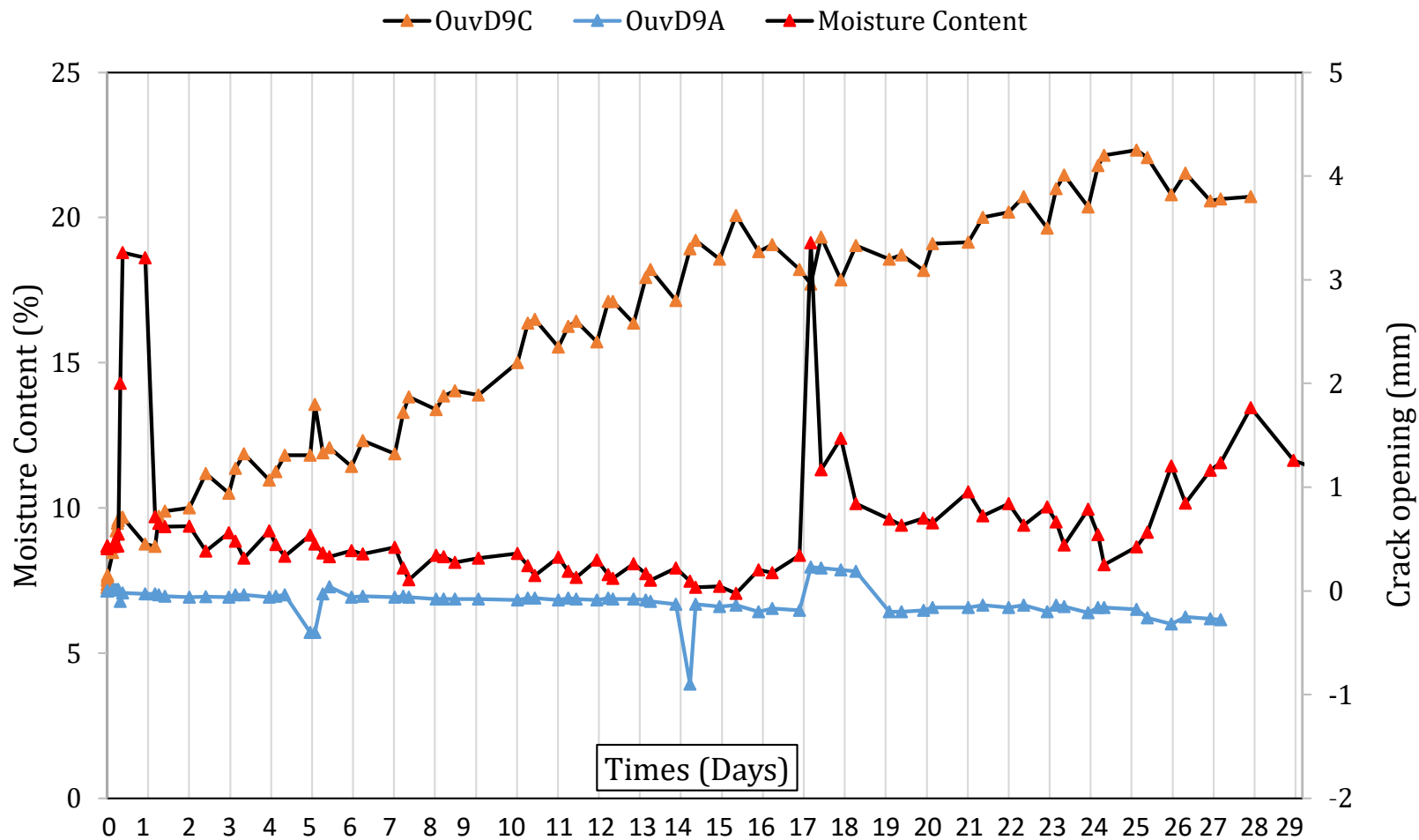
Day
Night

$i_{i=1}^{11}$: Moisture cycles

Douglas



➤ Evolution of crack opening of PM Vs MC



❑ The first results obtained show

- ✓ Strong correlation of wood degradation parameters (crack opening, crack length) and environmental parameters (HR, T, MC).
- ✓ Correlation between HR and T with the evolution of the deflection of the creep
- ✓ Influence of the parameters (HR, T and MC) on the mechanical behavior of the beam and in the long term the lifetime of the structure.

❑ Coming works

- ✓ Find the impact of the spatial arrangement of wood defects coupled with climatic variations on mechanical behavior
- ✓ Perform the same tests on little notched samples on controlled environment
- ✓ Propose a numerical mechanosorptive model on CAST3M software

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