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Timber structures in french Caribbean Islands, impact of subtropical climate on design

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► To cite this version:

Paul Quistin, Oriel Bourgade, Eric Fournely, Joseph Gril, Gaël Godi, et al.. Timber structures in french Caribbean Islands, impact of subtropical climate on design. World conférence on timber Engineering 2021, Aug 2021, Santiago, Chile. hal-04040088

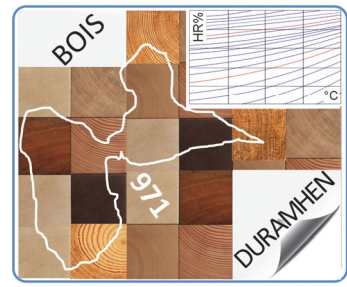
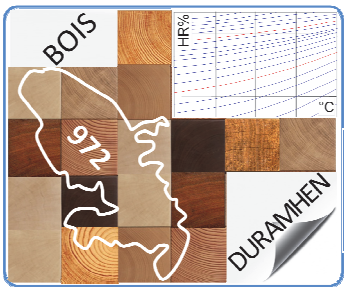
HAL Id: hal-04040088

<https://hal.science/hal-04040088v1>

Submitted on 23 Mar 2023

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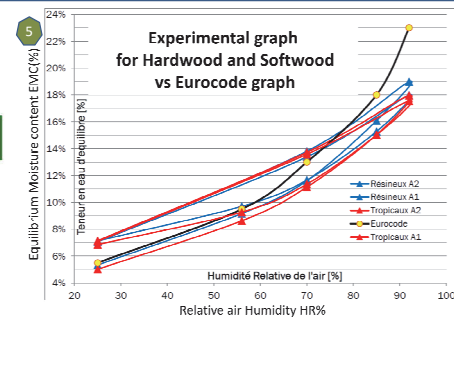
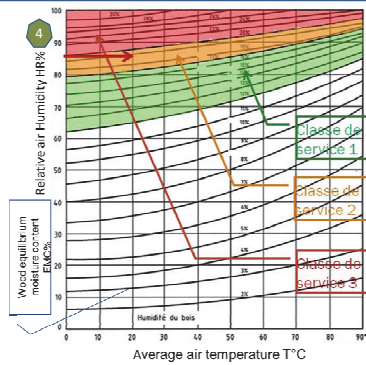
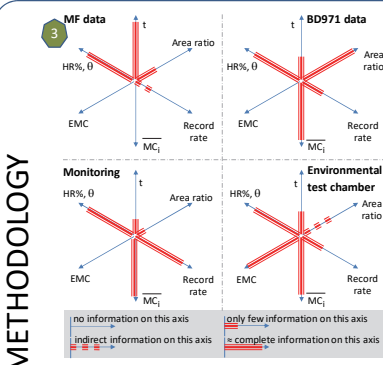
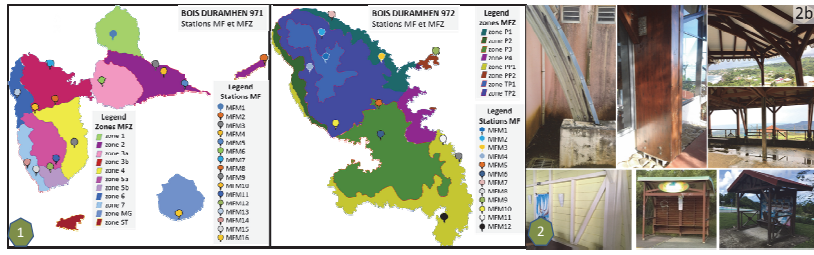


TIMBER STRUCTURES IN FRENCH CARIBBEAN ISLANDS, IMPACT OF SUBTROPICAL CLIMATE ON DESIGN : "BOIS DURAMHEN" PROGRAMS

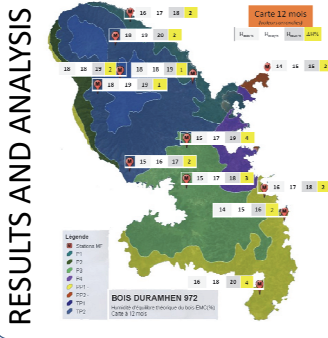
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LAMADON Thierry⁴, ROMANA Laurence⁵, RAMASSAMY Régis⁵

Context FWI

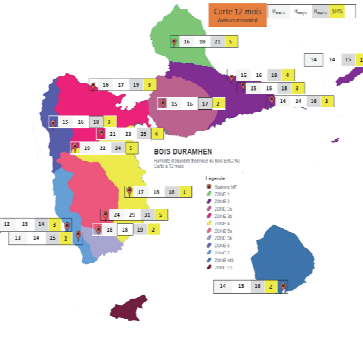
Mainly due to the lack of information on the local climate and its consequences on timber buildings, and regarding Eurocode standard, French West Indies islands remain considered as a service class 3 (SC3). Based on French meteorological institute data, *Météo-France* data (*Stations MF*), on moisture content measurements at less than 200 sites in the two islands and local surrounding air humidity and temperature, the two programs Bois Duramhen 971 (European Synergile) and 972 (French national PACTE) are devoted to give answers on the impact of this climate on soft and tropical woods integrated in traditional or new timber structures.



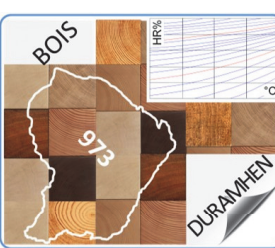
The first step of the study (3) is the acquisition of data, it is based on two sources: the set of measurement given by *Météo France* stations (1) (here Relative Humidity HR% and temperature θ of surrounding air) and measurements on sites (2) of the same parameters and also wood moisture content (For Guadeloupe: 100 sites, \approx 300 elements and \approx 500 faces are measured during 12 to 18 months; For Martinique: 71 sites, \approx 140 elements are measured during 13 months). Sites are recorded twice a month and one site for each island is under hourly monitoring (6). The sets of data are linked by Equilibrium Moisture Content diagram EMC (4), with the limits of EC5 moisture content: 12 and 20% are the upper limit of service class 1 and 2 respectively. MC measurements give an important data base for moisture content present in tropical hardwood and softwood used in FWI. HR% and θ give parameters to analyze the conventional EMC as used in European areas. All the tests in environmental chamber are performed for local hardwood and European softwood used in French West Indies islands with specimens (5), in order to obtain EMC vs relative humidity HR and temperature curves.



According to the conventional method, for each MF station, the EMC% equilibrium moisture content (Min, Mean, Max, Delta) map is provided for 12 months and 3 months valid for elements of sheltered structures located outside. It should be noted that a few singular cases for which the humidity measured on sites can be higher than the average; these cases are excluded from the exploitation of the general results in order to avoid the influence and distort the overall trends found, but they must be taken into account by the construction stakeholders when designing their wooden structure with the particularity of their influence on the wood moisture in service.
The BD971 and BD972 values averaged by months are a good reflection of the wood's moisture content level. The monitoring measures confirm the relevance of this path.
Tests in the climatic chamber allow to valid equilibrium moisture content and measurements on sites valid MC during a year regarding Eurocode limits for Service Classes. There is significant difference between experimental curves and the Eurocode curve for higher Humidity values (5). However, for high HR values the methodology needs to be refined.



The results obtained by the different approaches, the comparison of measurements, the calibration of measurement equipment lead to a wide data base and give interesting projections. On most of the MF stations and the different sites, the calculated and measured moisture content values fit well inside a MFZ. Thanks to the data collected from BOIS-DURAMHEN projects, an architect, for example, can define the class of service to be taken into account for his future wood construction according to its location by comparison with nearby sites and MF stations
In other zone(s) not covered, the service class have to be more deepen in order to propose a more accurate map; a working group has been created to draw up professional rules for the French West Indies, which will include a more accurate map based on the results of the projects
In terms of perspective, this work is extended to the department of French Guiana (2020-2022) with a new project supported by PACTE called "BOIS DURAMHEN 973, based on the same methodology.
To refine the forecast of moisture contents of woods, especially tropical hardwood, in a subtropical marine climate, a larger campaign in environmental test chamber with the construction of true sorption isotherms is devoted. New equipment to measure precisely high levels of HR (Chilled Mirror hygrometer) is integrated the climatic chamber in order to upgrade the results in this area.



ACKNOWLEDGEMENT

These works are supported for Martinique island by PACTE and for Guadeloupe island by FEDER Guadeloupe certified by the competitiveness cluster Synergile. Part of this work is based on Météo France data base.



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