Validation of Three Methods of Selecting Moisture Reference Years for Hygrothermal Simulations

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1 Introduction

One of the parameters that influences the moisture performance of the wall is the outdoor climate. However, having large number of climate parameters and estimating the effects of these parameters over the entire service life would result in large simulation effort. One of the approaches to cut down the simulation time and cost is to select a year or combination of years called Moisture Reference Year(s) (MRYs). Cornick *et al.* (2003) used an index called Moisture Index (MI) to categorize the years in terms of the severity. It uses wetting and drying function to compute the MI. A method suggested by (ASHRAE, 2010) uses the approach called the Severity Index (Isev) which involves using an equation to predict the RHT value as a damage function. Salonvaara *et al.* (2010) suggested Isev equation as a reliable method of selecting representative years. The Climatic Index method suggested by Zhou *et al.* (2016) comprises wetting and drying components. The objective of this study is to investigate three MRY selection methods in terms of their accuracy in predicting the worst year in terms of moisture performance among a series of long-term climate data.

Wood frame wall assembly with brick cladding was selected for the study and was simulated for 3 different Canadian cities. Orientation with least annual solar radiation *i.e.* a North-facing wall is chosen for each city. The climate data used include hourly climate for a consecutive 31 years: from 1986-2016 for historical scenario; and 31 years when the global temperature will increase by 3.5°C. For analyzing the moisture performance of wall assembly, mould index values (MoI) were computed at the exterior of the OSB layer. The accumulated number of hours when MoI > 3 were calculated for the each of the 31-year series for considered cities and climate scenario.

2 Results and Discussion

Figure 1 shows the total number of the hours throughout the year when the MoI value was above 3. The years selected by MRY selection methods are marked on the chart. For this case, it was observed that Isev method predict the year which performs the worst when simulated for moisture performance analysis. Summary of all the simulated cases, is shown in Table 1 and it is clear that closer the class of each method to the actual year, better the method is in its prediction. There is no risk of mould growth in Vancouver as there was an extremely low amount of WDR falling on a North facing wall which in turn imposes almost no risk of mould growth.

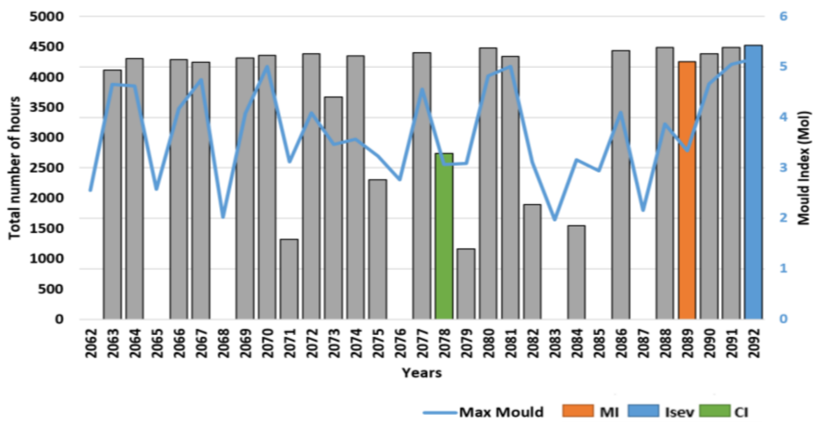

Figure 1. Total number of hours with MoI>3 for Brick wall in Calgary for future climate. Secondary axis shows the maximum value of MoI for each year.

Table 1. Summary of all the simulated cases. Year shows the year predicted by the method and class shows the range in which the corresponding year lies.

Simulated Cases	Actual		MI		Isev		CI	
	Year	Class (in 100s)	Year	Class (in 100s)	Year	Class (in 100s)	Year	Class (in 100s)
Ott_H	2009	42-44	2010	0-2	2009	42-44	2004	30-32
Ott_F	2081	>50	2085	0-2	2069	38-40	2070	46-48
Van_H	--	--	--	--	--	--	--	--
Van_F	--	--	--	--	--	--	--	--
Cal_H	1999	40-42	2005	34-36	1995	40-42	2014	40-42
Cal_F	2092	44-46	2089	42-44	2092	44-46	2078	26-28

None of the three methods predict the worst year with 100% accuracy when compared with the results from simulation over the 31-year data. The methods were compared against each other, it was observed that severity index method was better in predicting MRY than the other two methods.

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