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Supplementary Material

Modelling sorption processes of 10-h dead *Pinus pinaster* branches

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Weather characteristics during 2020 and 2021

Table 1- Summary of weather characteristics during 2020 and 2021

	Month	Temperature (°C)			Relative Humidity (%)			Wind speed (Kmh^{-1})		Rainfall (mm)	
		Mean	Max.	Min.	Mean	Max.	Min.	Mean	Max.	Total	Max.
2020	February	11.0	24.6	2.6	73.2	94.7	24.7	3.7	15.1	13.4	5.0
	March	11.2	24.2	1.2	69.0	94.6	20.4	6.5	27.7	94.5	5.6
	April	12.2	20.9	2.1	77.9	93.9	35.3	4.6	13.1	151.9	12.9
	May	18.0	30.9	8.1	66.1	94.2	21.0	5.0	14.3	77.2	16.1
	June	17.5	34.2	8.2	67.5	92.8	22.8	5.1	13.6	1.0	0.5
	July	24.5	36.1	11.1	49.0	99.9	13.8	5.2	14.7	16.4	10.7
	August	20.7	35.4	11.4	62.9	93.7	16.9	5.0	12.9	7.8	3.4
	September	19.8	33.7	8.5	57.3	93.4	15.1	5.0	15.1	19.2	4.4
	October	13.5	25.4	6.0	74.8	100.0	26.5	4.6	16.5	159.3	17.2
	November	12.2	22.0	5.6	77.4	100.0	38.5	3.7	14.0	120.7	13.6
	December	8.2	15.9	-1.3	81.1	100.0	27.7	4.2	24.5	90.9	5.6
2021	January	6.7	16.6	-2.4	74.5	93.0	24.3	6.1	26.3	104.8	8.3
	February	10.1	19.1	1.2	78.1	92.7	35.3	5.9	21.7	218.8	10.8
	March	11.8	26.3	2.3	58.1	91.6	18.6	6.1	17.1	0.4	0.2
	April	13.7	24.2	4.2	64.9	91.7	18.5	4.8	15.2	115.6	9.4
	May	14.6	28.7	3.7	65.3	92.5	22.2	5.1	17.3	55.2	10.8
	June	18.4	32.2	8.0	62.8	91.5	23.3	5.1	13.2	63.0	16.9
	July	20.0	35.9	10.9	61.9	98.2	16.6	5.1	13.5	0.2	0.08
	August	21.3	36.9	9.7	63.9	100.0	7.5	6.8	19.4	0.2	0.2
	September	18.3	33.2	9.7	69.1	91.9	19.1	4.7	16.2	83.7	12.5
	October	16.1	27.6	7.3	67.2	100.0	21.2	5.2	26.3	138.7	12.0
	November	9.7	20.2	0.5	69.6	100.0	36.0	6.2	18.5	8.0	1.0
	December	10.1	20.2	1.0	77.7	100.0	34.6	7.0	22.9	24.4	3.2

Dead Pinus pinaster branches fuel moisture content modelling algorithm

The equilibrium moisture content (EMC) is calculated by equation 1:

$$EMC = a(RH)^b + ce^{\frac{RH-100}{d}} + e_1(21.1 - T)(1 - e^{fRH}) \quad (1)$$

Where:

- RH (%) is the air relative humidity and T (°C) is the air temperature.
- *a, b, c, d, e_1* and *f* are Van Wagner model coefficients for desorption and adsorption processes.

Table 2 - Van Wagner model coefficients for desorption and adsorption processes

	a	b	c	d	e_1	f
Desorption	1.473	0.531	24.304	8.442	-389.814	0.00000274
Adsorption	0.218	0.958	68.193	2.863	0.094	-0.042

The fuel moisture in time t, $FMC_{(t)}$, is calculated by equation 2:

$$FMC_{(t)} = \text{EMC} + (FMC_{t-\Delta t} - \text{EMC})\left[a_1 e^{(-k_1 \Delta t)} + a_2 e^{(-k_2 \Delta t)} + a_3 e^{(-k_3 \Delta t)}\right] \quad (2)$$

Where:

- $FMC_{(t-\Delta t)}$ (%) is the previous fuel moisture content, in time t-Δt.
- Δt (h) is the modelling time-step.
- EMC (%) is the equilibrium moisture content.
- *k, k_1, k_2* and *k_3* (h^{-1}) are drying constants and *a_1, a_2* and *a_3* are empirical dimensionless constants for Modified Henderson and Pabis for desorption and adsorption processes.

Table 3 - Drying constants and empirical dimensionless constants for Modified Henderson and Pabis for desorption and adsorption processes.

	a_1	a_2	a_3	k_1	k_2	k_3
Desorption	0,257	0,544	0,007	0,398	0,106	0,215
Adsorption	0,622	0,071	0,312	0,171	0,809	0,014

The calculation procedure is:

1) Define an initial fuel moisture $FMC_{(t-\Delta t)}$ in time 0.
2) Calculate the modelling time-step Δt in hours
3) Calculate the EMC for the desorption process ($EMC_{desorption}$) and adsorption process ($EMC_{adsorption}$) for the air temperature and relative humidity of the modelling time-step Δt by equation 1.
4) Calculate the fuel moisture in time t for the desorption process ($FMC_{(t)\ desorption}$) and adsorption ($FMC_{(t)\ adsorption}$) process by equation 2.
5) If $FMC_{(t-\Delta t)} > EMC_{desorption}$ thus $FMC_{(t)} = FMC_{(t)\ desorption}$
   If $EMC_{desorption} > FMC_{(t-\Delta t)} > EMC_{adsorption}$ thus $FMC_{(t)} = FMC_{(t-\Delta t)}$
   If $FMC_{(t-\Delta t)} < EMC_{adsorption}$ thus $FMC_{(t)} = FMC_{(t)\ adsorption}$
6) $FMC_{(t)}$ becomes the $FMC_{(t-\Delta t)}$ of the next modelling time-step