SUPPLEMENTARY DATA
Doutreloup, S., Bois, B., Pohl, B., Zito, S., & Richard, Y. (2022). Climatic comparison between Belgium, Champagne, Alsace, Jura and Bourgogne for wine production using the regional model MAR. *OENO One, 56*(3)
https://doi.org/10.20870/oeno-one.2022.56.3.5356

Supplementary Materials:

Climatic comparison between Belgium, Champagne, Alsace, Jura and Bourgogne for wine production using the regional model MAR

TABLE S1. Weather stations used in this study with their true location (latitude, longitude, altitude), the location of the model grid cell containing the weather station, distance (in km) from the grid cell centre, difference between real and grid cell altitude and weather network of the station.

Weather Station	Real Latitude	Real Longitude	Real altitude (m)	MAR latitude	MAR longitude	MAR altitude (m)	Distance from the grid centre (km)	Difference altitude (m)	Weather Network
Ailleville	48.25	4.69	195	48.25	4.67	241.22	0	46.2	Météo-France
Amance	48.75	6.34	255	48.75	6.3	246.16	3.1	-8.8	Météo-France
Antwerpen-Deurne	51.2	4.47	12	51.2	4.49	10.2	2.2	-1.8	SYNOP Belgique
Arbois	46.9	5.74	313	46.88	5.73	420.02	2.2	107	Météo-France
Auberive	47.78	5.05	349	47.8	5.06	423.49	0	74.5	Météo-France
Augny	49.07	6.13	192	49.06	6.17	188.91	3.1	-3.1	Météo-France
Autun	46.97	4.26	303	46.98	4.22	326.92	3.1	23.9	Météo-France
Balemulhouse	47.6	7.52	270	47.59	7.54	297.62	3.1	27.6	SYNOP France
Barberey-Saint-Sulpice	48.32	4.02	112	48.31	4.04	116.84	3.1	4.8	Météo-France
Baudoncourt	47.79	6.36	271	47.8	6.39	298.05	2.2	27.1	Météo-France
Beauvechain	50.75	4.77	105	50.75	4.74	100.77	0	-4.2	SYNOP Belgique
Beitem	50.9	3.12	23	50.92	3.09	25.33	3.1	2.3	SYNOP Belgique
Belfahy	47.78	6.73	847	47.78	6.72	613.22	0	-233.8	Météo-France
Bergheim	48.22	7.35	309	48.25	7.35	314.32	3.1	5.3	Météo-France
Besancon	47.25	5.98	307	47.27	5.97	291.96	3.1	-15	SYNOP France
Besancon	47.25	5.99	307	47.27	5.97	291.96	3.1	-15	Météo-France
Bierset	50.65	5.45	186	50.64	5.46	149.16	0	-36.8	SYNOP Belgique
Bleneau	47.7	2.96	155	47.7	2.94	189.11	2.2	34.1	Météo-France
Blesmes	49.01	3.46	222	49.01	3.5	192.76	2.2	-29.2	Météo-France
Blotzheim	47.61	7.51	263	47.62	7.49	316.22	0	53.2	Météo-France
Bourdons-sur-rognon	48.16	5.35	304	48.16	5.35	386.49	0	82.5	Météo-France
Bourges	47.07	2.37	161	47.04	2.34	156.43	3.1	-4.6	SYNOP France
Bouzy	49.09	4.15	153	49.08	4.12	119.43	2.2	-33.6	Météo-France
Braine	49.35	3.53	61	49.34	3.55	101.33	0	40.3	Météo-France
Bruxelles-National	50.9	4.53	55	50.92	4.56	40.31	3.1	-14.7	SYNOP Belgique
Busson	48.33	5.36	387	48.35	5.33	349.06	3.1	-37.9	Météo-France
Buzenol	49.62	5.58	322	49.61	5.57	273.48	0	-48.5	SYNOP Belgique
Chablis	47.82	3.79	141	47.82	3.78	209.3	3.1	68.3	Météo-France
Chamblanc	47.03	5.17	182	47.04	5.15	179.78	2.2	-2.2	Météo-France
Chambrecy	49.18	3.82	150	49.19	3.82	179.47	0	29.5	Météo-France

Champagnole	46.76	5.89	537	46.79	5.88	587.25	3.1	50.3	Météo-France
Champforgeuil	46.83	4.83	187	46.83	4.8	197.69	0	10.7	Météo-France
Changis-sur-marne	48.96	3.01	70	48.98	3.02	113.39	0	43.4	Météo-France
Chargey-les-gray	47.51	5.6	244	47.5	5.57	219.61	3.1	-24.4	Météo-France
Charleroi-Gosselies	50.47	4.45	187	50.48	4.49	150.58	3.1	-36.4	SYNOP Belgique
Charleville	49.78	4.63	149	49.79	4.67	186.96	3.1	38	SYNOP France
Charnay-les-macon	46.29	4.79	219	46.31	4.77	240.76	3.1	21.8	Météo-France
Charnyoreedepuisaye	47.78	3.19	180	47.78	3.21	223.15	0	43.2	Météo-France
Chateau-Chinon	47.07	3.93	598	47.06	3.98	547.35	3.1	-50.7	Météo-France
Chatillon-sur-Marne	49.1	3.76	153	49.09	3.78	157.51	0	4.5	Météo-France
Chatillon-sur-Seine	47.85	4.58	262	47.83	4.58	277.44	2.2	15.4	Météo-France
Chessy-les-pres	48.03	3.91	119	48.05	3.89	132.32	3.1	13.3	Météo-France
Chevillon	48.52	5.11	170	48.53	5.12	241.34	0	71.3	Météo-France
Chevru	48.73	3.2	158	48.71	3.21	146.63	3.1	-11.4	Météo-France
Chievres	50.57	3.83	60	50.56	3.83	68.98	3.1	9	SYNOP Belgique
Cirfontaines-en-ornois	48.46	5.39	379	48.49	5.41	360.64	3.1	-18.4	Météo-France
Colmar	47.92	7.42	211	47.9	7.42	213.03	0	2	SYNOP France
Colmar	48.06	7.33	202	48.06	7.37	198.47	3.1	-3.5	Météo-France
Comberjon	47.64	6.2	360	47.63	6.17	299.89	3.1	-60.1	Météo-France
Coulours	48.16	3.61	228	48.16	3.58	223.35	3.1	-4.7	Météo-France
Cruzy-le-chatel	47.85	4.22	291	47.85	4.25	280.03	0	-11	Météo-France
Cunfin	48.04	4.68	315	48.03	4.65	265.1	3.1	-49.9	Météo-France
Danne-et-quatre-vents	48.77	7.31	377	48.76	7.31	349.03	0	-28	Météo-France
Dannemarie-sur-crete	47.2	5.87	267	47.2	5.88	262.91	0	-4.1	Météo-France
Diepenbeek	50.92	5.45	37	50.93	5.39	45.34	3.1	8.3	SYNOP Belgique
Dijon	47.26	5.08	222	47.26	5.08	217.55	0	-4.4	SYNOP France
Dogneville	48.21	6.45	317	48.25	6.44	345.54	3.1	28.5	Météo-France
Dosnon	48.61	4.22	115	48.61	4.24	121.09	0	6.1	Météo-France
Dourbes	50.1	4.6	231	50.11	4.65	230.27	3.1	-0.7	SYNOP Belgique
Elsenborn	50.47	6.18	564	50.47	6.2	572.84	0	8.8	SYNOP Belgique
Epenoy	47.13	6.37	752	47.13	6.4	791.41	3.1	39.4	Météo-France
Ernage	50.57	4.68	155	50.57	4.66	151.87	0	-3.1	SYNOP Belgique
Erneville-aux-bois	48.75	5.4	313	48.74	5.38	315.29	2.2	2.3	Météo-France
Esternay	48.74	3.58	185	48.73	3.59	183.08	0	-1.9	Météo-France
Fagnieres	48.94	4.31	105	48.93	4.29	109.04	0	4	Météo-France
Fayl-billot	47.78	5.62	347	47.79	5.58	318.26	3.1	-28.7	Météo-France
Fellering	47.92	7.03	1184	47.95	7.04	961.43	3.1	-222.6	Météo-France
Florennes	50.23	4.65	279	50.25	4.69	259.23	3.1	-19.8	SYNOP Belgique
Fontaine-macon	48.44	3.5	102	48.44	3.49	103.65	0	1.7	Météo-France
Fontainebleau	48.41	2.68	84	48.41	2.68	115.59	0	31.6	Météo-France
Fougerolles-saint-valbert	47.89	6.39	315	47.92	6.38	330.76	3.1	15.8	Météo-France
Fours	46.82	3.72	232	46.82	3.68	228.12	3.1	-3.9	Météo-France
Frignicourt	48.7	4.62	113	48.7	4.61	111.96	0	-1	Météo-France
Goin	48.98	6.24	260	48.97	6.23	223.48	3.1	-36.5	Météo-France
Grandpuits-bailly-carrois	48.59	3.01	128	48.57	3.04	126.82	3.1	-1.2	Météo-France
Holtzheim	48.55	7.64	150	48.54	7.66	146.67	0	-3.3	Météo-France
Humain	50.2	5.25	294	50.19	5.29	287.07	3.1	-6.9	SYNOP Belgique
Is-en-bassigny	48.02	5.46	403	48.04	5.46	398.21	2.2	-4.8	Météo-France

Jalogny	46.4	4.65	250	46.44	4.66	338.95	3.1	89	Météo-France
Joigny	47.98	3.37	75	47.98	3.37	113.66	0	38.7	Météo-France
Kleinebrogel	51.17	5.47	55	51.17	5.45	58.06	0	3.1	SYNOP Belgique
Koksijde	51.08	2.65	4	51.09	2.59	0.45	4.4	-3.6	SYNOP Belgique
Labrosse-montceaux	48.35	3.02	77	48.34	3.03	106.35	0	29.4	Météo-France
Lapesse	46.3	5.84	1133	46.28	5.84	1103.67	3.1	-29.3	Météo-France
Laselve	49.56	4	101	49.56	4.01	101.72	0	0.7	Météo-France
Lehohwald	48.4	7.33	591	48.41	7.29	681.85	3.1	90.9	Météo-France
Leshautsdeforterre	47.61	3.46	355	47.64	3.47	284.01	3.1	-71	Météo-France
Lormes	47.27	3.86	485	47.28	3.9	436.43	3.1	-48.6	Météo-France
Lucelle	47.44	7.27	690	47.45	7.27	713.91	0	23.9	Météo-France
Lyonbron	45.72	4.95	200	45.72	4.98	218.54	3.1	18.5	SYNOP France
Lyonsatolas	45.73	5.08	248	45.72	5.07	245.16	0	-2.8	SYNOP France
Macon	46.3	4.8	221	46.31	4.77	240.76	3.1	19.8	SYNOP France
Maiche	47.24	6.79	825	47.24	6.82	856.59	2.2	31.6	Météo-France
Mailly-champagne	49.16	4.12	182	49.15	4.12	194.82	0	12.8	Météo-France
Marzy	47	3.11	175	47.01	3.14	186.28	2.2	11.3	Météo-France
Mathaux	48.35	4.47	145	48.37	4.46	134.34	0	-10.7	Météo-France
Matour	46.3	4.48	415	46.3	4.5	565.96	0	151	Météo-France
Melle	50.98	3.82	13	50.98	3.8	32.53	0	19.5	SYNOP Belgique
Metznancylorr	48.98	6.25	264	49	6.27	254.43	3.1	-9.6	SYNOP France
Mont-rigi	50.52	6.07	671	50.51	6.08	653.95	0	-17.1	SYNOP Belgique
Mont-saint-vincent	46.63	4.48	601	46.65	4.5	406.03	3.1	-195	Météo-France
Montbard	47.63	4.33	209	47.63	4.32	308.36	0	99.4	Météo-France
Montereau-sur-le-jard	48.61	2.68	91	48.64	2.69	85.99	2.2	-5	Météo-France
Montmorot	46.69	5.52	298	46.71	5.51	253.55	2.2	-44.5	Météo-France
Mouroux	48.85	3.06	148	48.85	3.04	125.27	2.2	-22.7	Météo-France
Moutiers-en-puisaye	47.62	3.15	222	47.65	3.14	247.57	3.1	25.6	Météo-France
Mulhouse	47.75	7.29	245	47.74	7.29	274.58	0	29.6	Météo-France
Nancy (Essey)	48.68	6.22	225	48.68	6.21	241.24	0	16.2	SYNOP France
Nancy (Ochey)	48.58	5.97	336	48.58	5.98	340.54	2.2	4.5	SYNOP France
Nemours	48.27	2.71	73	48.29	2.7	86.91	3.1	13.9	Météo-France
Nevers	47	3.1	180	47.01	3.14	186.28	2.2	6.3	SYNOP France
Oberentzen	47.93	7.41	207	47.93	7.37	209.22	2.2	2.2	Météo-France
Oostendeairport	51.2	2.87	4	51.22	2.95	1.04	6.2	-3	SYNOP Belgique
Orbey	48.14	7.1	1080	48.11	7.08	923.68	3.1	-156.3	Météo-France
Ouges	47.27	5.09	219	47.26	5.08	217.55	0	-1.4	Météo-France
Pontarlier	46.9	6.34	831	46.94	6.33	852.16	3.1	21.2	Météo-France
Pouilly-en-auxois	47.25	4.56	412	47.26	4.56	412.83	0	0.8	Météo-France
Poussay	48.3	6.12	289	48.3	6.15	309.23	2.2	20.2	Météo-France
Premery	47.17	3.37	260	47.18	3.35	298.73	2.2	38.7	Météo-France
Reimsairport	49.2	4.15	95	49.21	4.11	133.71	3.1	38.7	SYNOP France
Retie	51.22	5.03	19	51.22	5.01	19.92	2.2	0.9	SYNOP Belgique
Rocroi	49.92	4.53	382	49.94	4.5	353.38	3.1	-28.6	Météo-France
Romilly-sur-seine	48.5	3.75	77	48.52	3.77	79.34	3.1	2.3	Météo-France
Rouffach	47.97	7.29	285	47.99	7.28	321.04	2.2	36	Météo-France
Roville-aux-chenes	48.38	6.61	278	48.38	6.62	297.95	0	20	Météo-France
Saint-andre-en-terre-plaine	48.08	4.06	300	47.48	4.06	305.97	0	6	Météo-France
Saint-dizier	48.63	4.9	139	48.62	4.87	141.9	3.1	2.9	Météo-France

Saint-mards-en-othe	48.17	3.79	227	48.17	3.77	231.55	0	4.6	Météo-France
Saint-martin-du-mont	47.4	4.78	578	47.43	4.77	522.59	3.1	-55.4	Météo-France
Saint-maurice-les-couches	46.88	4.59	300	46.88	4.61	305.77	3.1	5.8	Météo-France
Saint-pierre-le-moutier	46.8	3.11	218	46.78	3.13	214.54	3.1	-3.5	Météo-France
Saint-prix-les-arnay	47.12	4.5	396	47.13	4.48	382.76	2.2	-13.2	Météo-France
Saint-yan	46.41	4.02	242	46.4	4.02	246.33	0	4.3	Météo-France
Saints-geosmes	47.84	5.34	466	47.84	5.29	427.77	3.1	-38.2	Météo-France
Saulieu	47.26	4.22	586	47.24	4.19	554.01	3.1	-32	Météo-France
Savigny-les-beaune	47.06	4.84	246	47.05	4.82	286.6	0	40.6	Météo-France
Savigny-sur-clairis	48.09	3.1	184	48.06	3.12	177.15	3.1	-6.9	Météo-France
Schaffen	51	5.07	30	51	5.05	34.76	0	4.8	SYNOP Belgique
Selestat	48.27	7.48	173	48.28	7.49	169.93	0	-3.1	Météo-France
Semmerzake	50.94	3.67	37	50.93	3.67	18.83	3.1	-18.2	SYNOP Belgique
Semur-en-auxois	47.48	4.34	314	47.5	4.34	311.99	0	-2	Météo-France
Sens	48.17	3.29	70	48.2	3.29	96.68	3.1	26.7	Météo-France
Septsarges	49.28	5.15	293	49.27	5.17	256.81	0	-36.2	Météo-France
Somme-vesle	49.01	4.59	162	49.01	4.57	163.31	2.2	1.3	Météo-France
Soulaines-dhuys	48.4	4.67	138	48.42	4.7	151.45	2.2	13.5	Météo-France
Spa-lasauveniere	50.48	5.92	470	50.46	5.95	450.58	3.1	-19.4	SYNOP Belgique
St-hubert	50.03	5.4	563	50.04	5.4	552.62	0	-10.4	SYNOP Belgique
Stabroek	51.32	4.36	5	51.35	4.37	3.96	3.1	-1	SYNOP Belgique
Stdizier	48.63	4.9	139	48.62	4.87	141.9	3.1	2.9	SYNOP France
Strasbourg	48.55	7.63	153	48.54	7.66	146.67	2.2	-6.3	SYNOP France
Strasbourg	48.58	7.77	139	48.58	7.81	138.68	3.1	-0.3	Météo-France
Tavaux	47.04	5.43	195	47.05	5.43	194.73	0	-0.3	Météo-France
Thuilley-aux-groseilles	48.58	5.96	336	48.58	5.98	340.54	0	4.5	Météo-France
Til-chatel	47.54	5.2	283	47.55	5.19	277.48	3.1	-5.5	Météo-France
Tomblaine	48.69	6.22	212	48.68	6.21	241.24	0	29.2	Météo-France
Torcy	46.76	4.45	317	46.74	4.44	317.92	0	0.9	Météo-France
Torcy	48.86	2.65	43	48.8	2.81	117.75	13	74.8	Météo-France
Tournes	49.78	4.64	145	49.79	4.67	186.96	2.2	42	Météo-France
Troyes	48.33	4.02	118	48.31	4.04	116.84	3.1	-1.2	SYNOP France
Uccle	50.8	4.35	100	50.78	4.36	89.62	2.2	-10.4	SYNOP Belgique
Valsuran	46.39	5.45	361	46.38	5.46	428.96	0	68	Météo-France
Varennes-saint-sauveur	46.52	5.26	207	46.53	5.3	203.97	3.1	-3	Météo-France
Vassimont-et-chapelaine	48.78	4.16	179	48.77	4.17	164.93	0	-14.1	Météo-France
Villersexel	47.54	6.43	290	47.54	6.41	296.19	0	6.2	Météo-France
Villette	49.48	5.58	345	49.51	5.59	315.56	3.1	-29.4	Météo-France
Voulton	48.61	3.35	175	48.62	3.37	154.04	0	-21	Météo-France
Wangenbourg-engenthal	48.64	7.31	460	48.63	7.32	529.88	2.2	69.9	Météo-France
Zeebrugge	51.33	3.2	5	51.34	3.21	0.48	0	-4.5	SYNOP Belgique

TABLE S2. Contingency table intersecting observed and simulated values.

		Observed		
		Yes	No	Total
Simulated	Yes	*hits*	*false alarms*	*simulated yes*
	No	*misses*	*correct negative*	*simulated no*
	Total	*observed yes*	*observed no*	*Total*

TABLE S3. Models used to simulate Day-Of-Year (DOY) of grapevine's key phenological stages of theoretical maturity from 2m daily air temperature.

Grapevine's phenological or ripening stage	**Model**	**Parameters for *Vitis vinifera* L. cv Chardonnay B**	**Reference**
Bud break	SUWE	Cc = 199.02 Fc = 12.50	Morales-Castilla *et al.* (2020)
Flowering	GFV	F*=1217°C.days	Parker *et al.* (2011)
Veraison	GFV	F*=2547°C.days	Parker *et al.* (2011)
Theoretical maturity (sugar concentration in grapes reaching 200 $g.L^{-1}$)	GSR	F*=2892°C.days	Parker *et al.* (2020)

TABLE S4. Summary table of the different indicators analysed in this paper and the questions they answer.

This indicator...	...answers this question:
Mean annual temperature	What are the general thermal features of the area?
Mean annual precipitation	What are the general precipitation features of the area?
Mean spring minimum	What are the characteristics of the spring minimum temperatures?
Mean summer maximum	What are the characteristics of the summer maximum temperatures?
April to September rainfall	Is there enough precipitation neither too much (>400mm) nor too low (<200mm) during the vegetation and ripening phase of the grapevine?
Huglin's heliothermal index	Is this area suitable for a specific grape variety?
Number of spring frost days (from March to June)	Is there a risk of frost in the vineyard? (independently from grapevine phenology)
Percentage of year with frost days after bud break	Is there a risk of frost in the vineyard? (considering grapevine phenology)
Number of hot days (from June to September)	Is there a risk of sunburns damage on the grape and strong thermal stress on the grapevine?
Mean DOY of phenological stages (especially the theoretical maturity)	Will the different phenological stages be reached within a valid period for the cultivation of grapevine?
Percentage of year where the DOY of the maturity stage occurs before 31st October	Is there a risk that maturity will not be reached in some years?

SUPPLEMENTARY DATA
Doutreloup, S., Bois, B., Pohl, B., Zito, S., & Richard, Y. (2022). Climatic comparison between Belgium, Champagne, Alsace, Jura and Bourgogne for wine production using the regional model MAR. *OENO One, 56*(3)
https://doi.org/10.20870/oeno-one.2022.56.3.5356

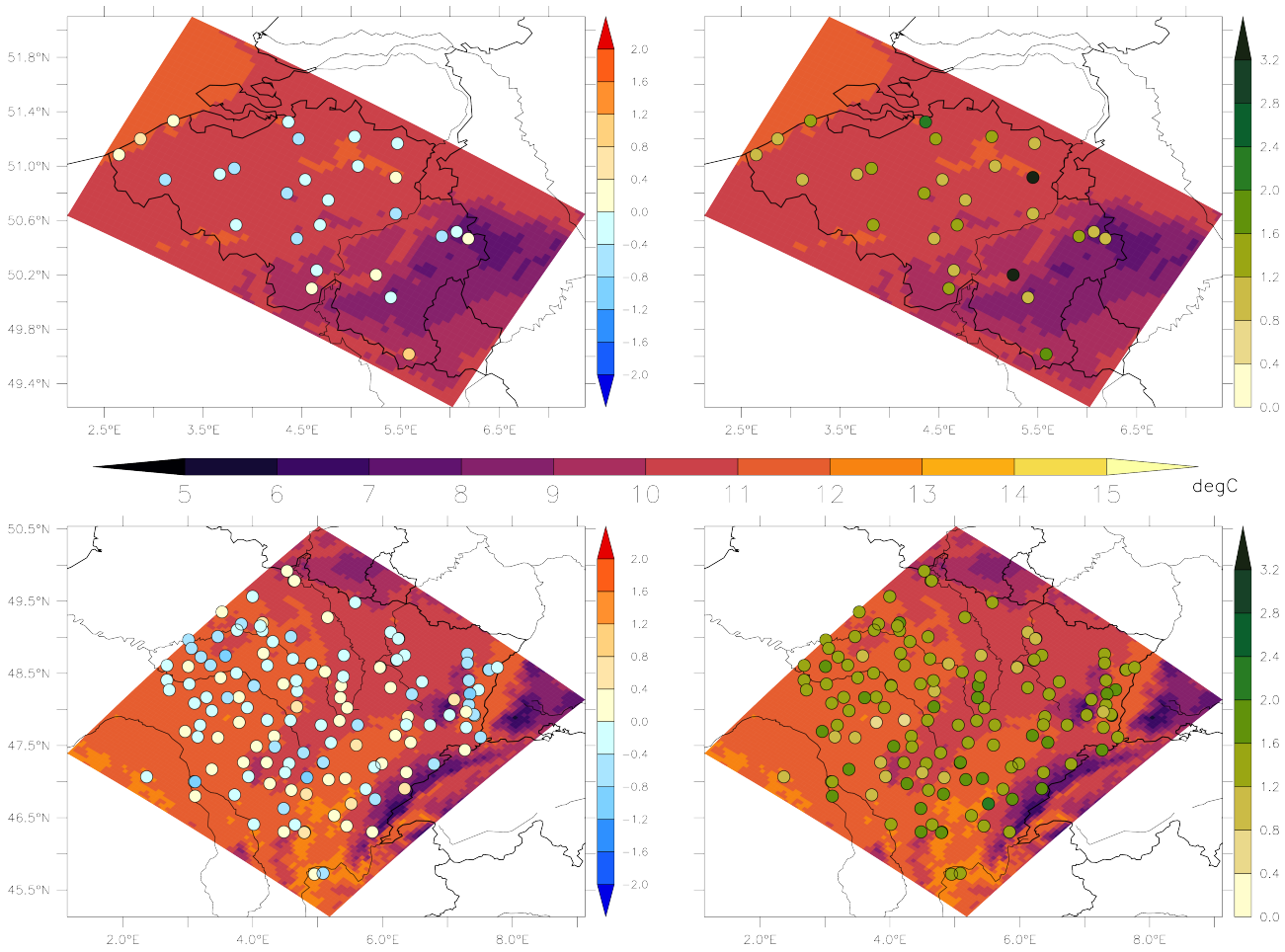


FIGURE S1. Mean annual temperature in °C (background map and central colour scale) simulated by MAR. Mean annual temperature biases (left, in °C) and RMSE (right, in °C) of MAR simulations compared to weather observations over the Belgian (upper) and French (lower) domains over the period 2000–2020.

Doutreloup, S., Bois, B., Pohl, B., Zito, S., & Richard, Y. (2022). Climatic comparison between Belgium, Champagne, Alsace, Jura and Bourgogne for wine production using the regional model MAR. *OENO One, 56*(3)
https://doi.org/10.20870/oeno-one.2022.56.3.5356

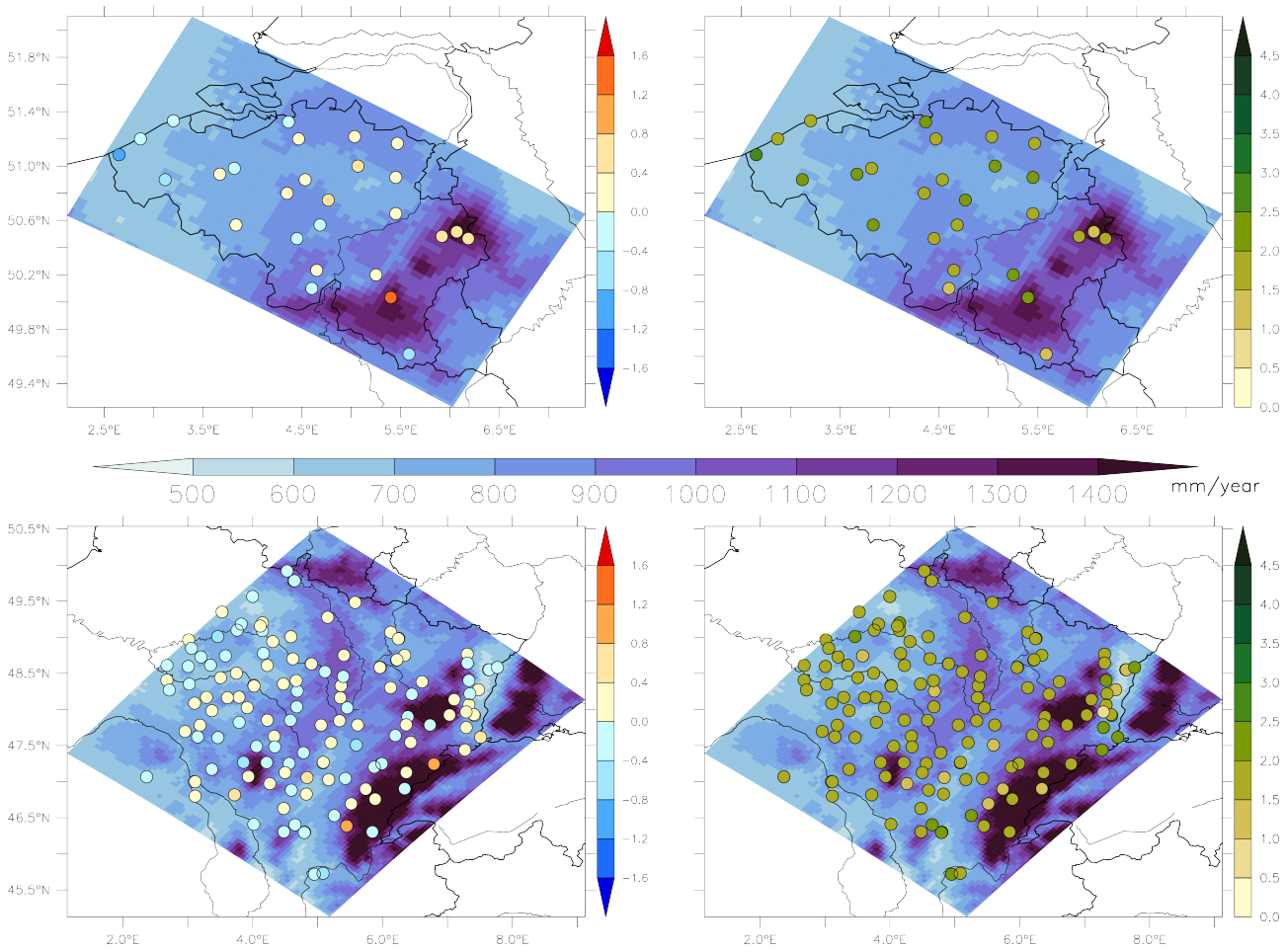


FIGURE S2. Mean annual precipitation (background map and central colour scale in mm/year) simulated by MAR. Mean annual precipitation biases (left, in mm/day) and RMSE (right, in mm) of MAR simulations compared to weather observations over the Belgian (upper) and French (lower) domains over the period 2000–2020.

Doutreloup, S., Bois, B., Pohl, B., Zito, S., & Richard, Y. (2022). Climatic comparison between Belgium, Champagne, Alsace, Jura and Bourgogne for wine production using the regional model MAR. *OENO One, 56*(3)
https://doi.org/10.20870/oeno-one.2022.56.3.5356

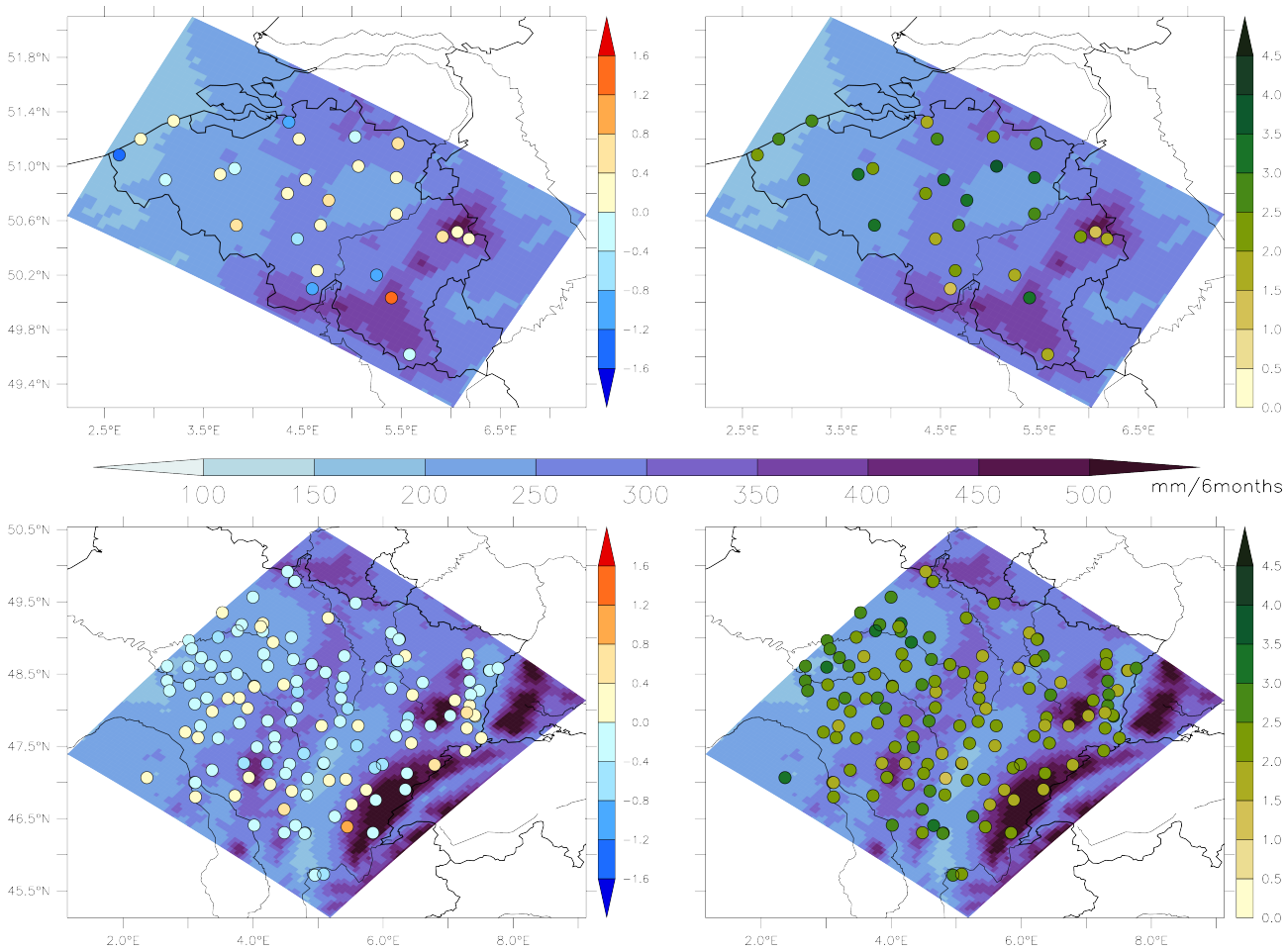


FIGURE S3. Mean cumulative precipitation in mm during April to September (background map and central colour scale) simulated by MAR. Mean cumulative precipitation biases (left, in mm/day) and RMSE (right, in mm) of MAR simulations compared to weather observations over the Belgian (upper) and French (lower) domains over the period 2000–2020.

TABLE S5. Mean efficiency index (EF, no unit) of Day-Of-Year (DOY) of each phenological stage between MAR simulations and weather stations for Chardonnay cultivar during the period 2000–2020.

	bud break	***flowering***	***Veraison***	***Theoretical maturity (200g/L)***
Belgian domain	*0.40*	*0.74*	*0.65*	*0.74*
French domain	*0.50*	*0.79*	*0.73*	*0.66*

TABLE S6. Mean RMSE (in day) of Day-Of-Year (DOY) of each phenological stage between MAR simulations and weather stations for Chardonnay cultivar during the period 2000–2020.

	bud break	***flowering***	***Veraison***	***Theoretical maturity (200g/L)***
Belgian domain	*5.50*	*3.07*	*3.57*	*4.62*
French domain	*4.07*	*2.39*	*4.64*	*4.77*

TABLE S7. Mean biases (in day) of Day-Of-Year (DOY) of each phenological stage between MAR simulations and weather stations for Chardonnay cultivar during the period 2000–2020.

	bud break	***flowering***	***Veraison***	***Theoretical maturity (200g/L)***
Belgian domain	*4.4*	*2.2*	*1.0*	*-0.2*
French domain	*2.8*	*0.3*	*-0.1*	*-2.5*