Approved: 16 December 2025

DOI: 10.2903/j.efsa.2026.9859

efsa JOURNAL

SCIENTIFIC REPORT

Update of the Köppen–Geiger climate classification for EFSA PLH risk assessment

European Food Safety Authority (EFSA) | **Eugenio Rossi** | **Andrea Maiorano** | **Alex Gobbi**

Correspondence: Ask a Question

The declarations of interest of all scientific experts active in EFSA's work are available at https://open.efsa.europa.eu/experts.

Abstract

The Köppen–Geiger climate classification is widely used for characterising global climatic conditions. At EFSA, in the context of Plant Health Risk Assessment, the Köppen–Geiger system is used as a preliminary step to delineate zones of potential pest establishment across EU territories, providing a first screening prior to more detailed analyses. The version currently used by EFSA is the one by Kottek et al. rescaled after Rubel et al. which is now nearly one decade old. Since its publication, several refined and improved Köppen–Geiger datasets were made available, incorporating broader climate datasets, finer spatial resolutions and updated methodologies for climate variables interpolation. Among these, the recent Beck et al. version provides a globally consistent dataset based on the latest observation-based gridded climate products and satellite-derived data, offering improved accuracy particularly in regions with heterogeneous topography and significant climatic gradients. This report highlights the main differences between the version by Kottek et al. and Rubel et al. and the Beck et al. version, with a focus on their relevance for EU plant health risk assessment. The transition to Beck et al. results in notable shifts in classification boundaries within Europe, including adjustments in the extent of temperate, continental and Mediterranean climate zones. These changes are particularly relevant for forecasting the potential distribution of plant pests whose establishment is constrained by specific climatic thresholds. EFSA will therefore be adopting the climate classification developed by Beck et al. enhancing the scientific consistency of its early stage risk assessments, ensuring alignment with the most current and robust climate data available.

KEYWORDS

climate classification, climate suitability, Köppen–Geiger, plant health, risk assessment

CONTENTS

Abstract....1

1. Introduction....3

2. Köppen–Geiger Climate Classification Versions....3

   2.1. Differences among the 'Kottek & Rubel version' and Beck et al. (2023)....4

      2.1.1. Climate type As....7

      2.1.2. Definition of temperate climate *C*....*7*

      2.1.3. Extremely continental climates *Csd*, *Cwd* and *Cfd*....*7*

      2.1.4. Definition of arid climate *B*....*8*

   2.2. Definition of climate types in the EU....8

3. Conclusions....9

Requestor....9

Question number....9

Copyright for non-EFSA content....9

Generic map disclaimer....9

Specific map disclaimer....9

References....9

1 | INTRODUCTION

The Plant Health Risk Assessment Team (hereafter PLH-RA Team) of the European Food Safety Authority (EFSA) relies on the use of Köppen–Geiger climate classification (KGc) as an initial and explorative step to assess the suitability of the EU climatic conditions to alien plant pests and diseases. The global distribution of an organism (extracted from the available scientific literature) is used to identify the KGc climates where the organism occurs, which also exist in the EU.

The Köppen–Geiger climate classification system was first developed by Wladimir Köppen in 1900 (Köppen, 1900) and later refined by his student and collaborator Rudolf Geiger in the mid-20th century (Geiger, 1954). The initial system was designed so that each climate corresponded to a major vegetation zone, identified by a capital letter: A (Tropical), B (Dry), C (Temperate), D (Continental) and E (Polar). A second letter for precipitation patterns, and a third for air temperatures were added by Geiger in 1954 to refine the initial Köppen's classification, leading to five main climate divisions and a total of 31 sub-climates. The KGc has been widely used in climatology, ecology, agriculture, urban planning and civil engineering (Kayacetin et al., 2019; Peres et al., 2022; Poulter et al., 2011; Wang et al., 2022; Yang & Matzarakis, 2016). Its adaptability and ease of use make it one of the most influential climate classification systems in scientific and practical applications.

The objective of this report is to compare and describe the main differences between the KGc version used so far by the EFSA's PLH-RA team, i.e. Kottek et al. (2006) downscaled by Rubel et al. (2017) (herein referred as the 'Kottek & Rubel version', https://koeppen-geiger.vu-wien.ac.at/present.htm), and the most recent version by Beck et al. (2023) (Köppen-Geiger - GloH2O), in order to justify the transition to the newer classification in EFSA Pest risk assessments and highlight implications for climate suitability assessment based on the Köppen–Geiger approach for the EU.

2 | KÖPPEN–GEIGER CLIMATE CLASSIFICATION VERSIONS

Over time, different versions of KGc have been developed. After the first versions developed by Köppen (Köppen, 1918, 1936) and the further refinements by Geiger (Geiger, 1954; Geiger, 1961), the KGc remained largely unchanged until the 21st century, when advances in climate analysis and computational methods led to significant updates. In 2006, Kottek et al. produced a digital global climate classification map using high-resolution (0.5°) 20th-century climate data. Shortly after, Peel (2007), refined the classification to improve its application to hydrology and environmental studies. In 2010, Rubel & Kottek used historical datasets and future climate projections to create maps for the period 1901–2100, while Kriticos et al. in 2012 developed a version tailored for ecological and agricultural applications, integrating it into species distribution models. In 2017 Rubel et al. developed a downscaling algorithm to refine the resolution of KGc produced by Kottek et al. (2006) from 0.5° to 0.083°. The most substantial updates came with the versions of Cui et al. (2021) and Beck et al. (2018) who used multiple modern climate reanalysis datasets to enhance the classification's spatial accuracy and temporal consistency. The latest version of the classification (Beck et al., 2023) includes a more recent climate 30-year period (1991–2020) and future climate model projections (2041–2099). Table 1 summarises the main characteristics of the cited KGc versions.

TABLE 1 Comparison of modern global Köppen–Geiger versions.

Author	Spatial resolution *	Climate data sources **	Period	Future projection
Kottek et al. (2006)	0.5°	CRU TS 2.1 VASClimO v1.1	1951–2000	NA
Peel (2007)	0.1°	GHCN 2.0	1909–1983	NA
Rubel and Kottek (2010)	0.5°	CRU TS 2.1 GPCC FDR V4	1901–2010	2001–2100
Kriticos et al. (2011)	0.167°	WorldClim V1	1961–1990	2030–2080
Kottek et al. (2006), downscaling after Rubel et al. (2017)	0.083°	CRU v4.03 GPCC V8	1986–2010	NA
Beck et al. (2018)	0.0083°	CHELSA V1.2 CHPclim V1 WorldClim V1 & V2 CRU TS V4.01 GPCC FDR V7	1980–2016	2071–2100
Cui et al. (2021)	0.0083°	CRU TS V 4.03 UDEL – NOAA PSL WorldClim V1 & V2 CHELSA V1.2 GPCC FDR V7 PREC/L GHCN_CAMS	1979–2013	2020–2100

(Continues)

TABLE 1 (Continued)

Author	Spatial resolution *	Climate data sources **	Period	Future projection
Beck et al. (2023)	0.0083°	WorldClim V2 CHELSA V1.2 CHELSA V2.1 CHPclim V1 CRU TS V4.07 GPCC FDR V2022	1901–2020	2041–2099

*Corresponding linear resolution at the equator: 0.5° ~ 56 km; 0.1° ~ 11 km; 0.167° ~ 19 km; 0.083° ~ 9 km; 0.0083° ~ 0.9 km. **Climate data sources: CRU TS (Mitchell & Jones, 2005), GHCN (Menne et al., 2017), GPCC (Schneider et al., 2013), WorldClim (Fick & Hijmans, 2017), CHELSA 1.2 (Karger et al., 2017) and 2.1 (Brun et al., 2022), CHPclim (Funk et al., 2015), UDEL (Willmott & Matsuura, 2001), PREC/L (Chen et al., 2002).

2.1 | Differences among the 'Kottek & Rubel version' and Beck et al. (2023)

The 'Kottek & Rubel version' is based on the classification described in Kottek et al. (2006) using two global climate datasets at the resolution of 0.5° latitude/longitude, one for temperature and one for precipitation, namely the CRU TS V4.03 by the Climatic Research Unit of the University of East Anglia (Mitchell & Jones, 2005) and the GPCC's Full Data Reanalysis Version 8 for the period 1901–2018 by the Global Precipitation Climatology Centre (Fuchs, 2008). The 'Kottek & Rubel version covers a time span from 1986 to 2010 and it was downscaled to 0.083° using the downscaling algorithm developed by Rubel et al. (2017). It comprises 31 different climate subdivisions.

Beck et al. (2023) published 4 observation-based climatology maps, one for each 30-years period between 1901 and 2020 (1901–1930, 1931–1960, 1961–1990, 1991–2020). They were obtained from seven high-resolution, topographically corrected, observation-based climatic datasets, three for near-surface air temperature and four for precipitation, taken from five main historical data sources (Table 1). The resulting Köppen–Geiger maps are distributed at different resolution, the highest resolution being 0.0083°. For every 30-year period, 12 Köppen–Geiger maps were generated from all combinations of temperature and precipitation datasets. The climate type assigned to each pixel represents the most frequent climate (statistical mode) computed on that very pixel. Additionally, the KGc maps are associated with confidence level maps that report the degree of agreement of the 12 combinations on a single pixel classification (Beck et al., 2023). They also generated maps for future periods such as 2041–2070 and 2071–2099 combining seven shared socio-economic pathways (SSPs), with projections from 42 CMIP6 models (Eyring et al., 2016).

The differences between the Kottek et al. (2006) and Beck et al. (2023) Köppen–Geiger classification rules are summarised in Table 2. These mostly entail refinements in classification formulas, recalibration of parameters, incorporation of more modern climatic datasets and number of climatic datasets used for the classification. These differences impact several important aspects of the climate classification system such as its resolution, data coverage, elaboration and boundaries of the climatic zones (Figures 1 and 2). Here we describe the key aspects of these differences to highlight the changes in the classification of the areas.

TABLE 2 Comparison between the parameters of the Köppen–Geiger climate classification by Kottek et al. (2006) and Beck et al. (2023). Differences are highlighted in grey.

Letter symbol				Criterion	
1st	**2nd**	**3rd**	**Description**	**Kottek et al. (2006)**	**Beck et al. (2023)**
A			Tropical	$T_{min} \geq +18°C$	$T_{min} \geq +18°C$
	f		- Rainforest	$P_{min} \geq 60$ mm	$P_{min} \geq 60$ mm
	m		- Monsoon	Pann ≥ 25 (100 − P_{min})	Not (Af) and P_{min} ≥100−P_{ann}/25
	s		- Savannah Dry-Summer	P_{min} < 60 mm in summer	*Not included*
	w		- Savannah Dry-Winter	P_{min} < 60 mm in winter	Not (Af) and P_{min} < 100-Pann/25
B			Arid	Pann < 10 Pth	Pann < 10 × Pth
	W		- Desert	Pann ≤ 5 Pth	Pann < 5 × Pth
	S		- Steppe	Pann > 5 Pth	Pann ≥ 5 × Pth
		H	- Hot	Tann ≥ +18°C	Tann ≥ 18°C
		K	- Cold	Tann < +18°C	Tann < 18°C
C			Temperate	−3°C < T_{min} < +18°C	Not (B) and T_{max} >10 & 0 < T_{min} <18
	s		- Dry Summer	Psmin < Pwmin, Pwmax > 3 Psmin and Psmin <40 mm	Psmin < 40 & Psmin < Pwmax/3
	w		- Dry winter	Pwmin < Psmin and Psmax > 10 Pwmin	Pwmin < Psmax/10
	f		- Without dry season	neither Cs nor Cw	Not (Cs) or (Cw)
		a	- Hot summer	$T_{max} \geq +22°C$	$T_{max} \geq 22°C$
		b	- Warm summer	Not (a) and at least 4 Tmon ≥ +10°C	Not (a) & Tmon10 ≥ 4

TABLE 2 (Continued)

Letter symbol				Criterion	
1st	**2nd**	**3rd**	**Description**	**Kottek et al. (2006)**	**Beck et al. (2023)**
		c	- Cold summer	Not (b) and $T_{min} > -38°C$	Not (a or b) & 1 ≤ Tmon10 < 4
		d	- Extremely continental	Like (c) but $T_{min} \leq -38°C$	*Not included*
D			Cold	$T_{min} \leq -3°C$	Not (B) & T_{max} >10 & T_{min} ≤ 0°C
	s		- Dry summer	Psmin < Pwmin, Pwmax >3 Psmin and Psmin < 40 mm	Psmin < 40 & Psmin < Pwmax/3
	w		- Dry winter	Pwmin < Psmin and Psmax > 10 Pwmin	Pwmin < Psmax/10
	f		- Without dry season	Neither Ds nor Dw	Not (Ds) or (Dw)
		a	- Hot summer	$T_{max} \geq +22°C$	T_{max} ≥22°C
		b	- Warm summer	Not (a) and at least 4 Tmon ≥ +10°C	Not (a) & Tmon 10 ≥ 4
		c	- Cold summer	Not (b) and $T_{min} > -38°C$	Not (a, b, or d)
		d	- Very cold winter	Like (c) but $T_{min} \leq -38°C$	Not (a or b) & $T_{min} < -38°C$
E			Polar	$T_{max} < +10°C$	Not (B) & T_{max} ≤10°C
	T		- Tundra	$0°C \leq T_{max} < +10°C$	T_{max} >0°C
	F		- Frost	T_{max} <0°C	T_{max} ≤0°C

Abbreviations: P_{ann}, Accumulated annual precipitation; P_{min}, Precipitation of the driest month; Ps_{max}, highest monthly precipitation values in summer half-year; Ps_{min}, lowest monthly precipitation values for summer half-year; *Pth*, dryness threshold function of Tann and precipitation cycle; Pw_{max}, highest monthly precipitation values in winter half-year; Pw_{min}, lowest monthly precipitation values for winter half-year; T_{ann}, mean annual temperature; T_{max}, monthly mean temperature of the warmest month; T_{min}, monthly mean temperature of the coldest month; T_{mon}, monthly mean temperature; $Tmon_{10}$, number of months with air temperature ≥ 10°C.

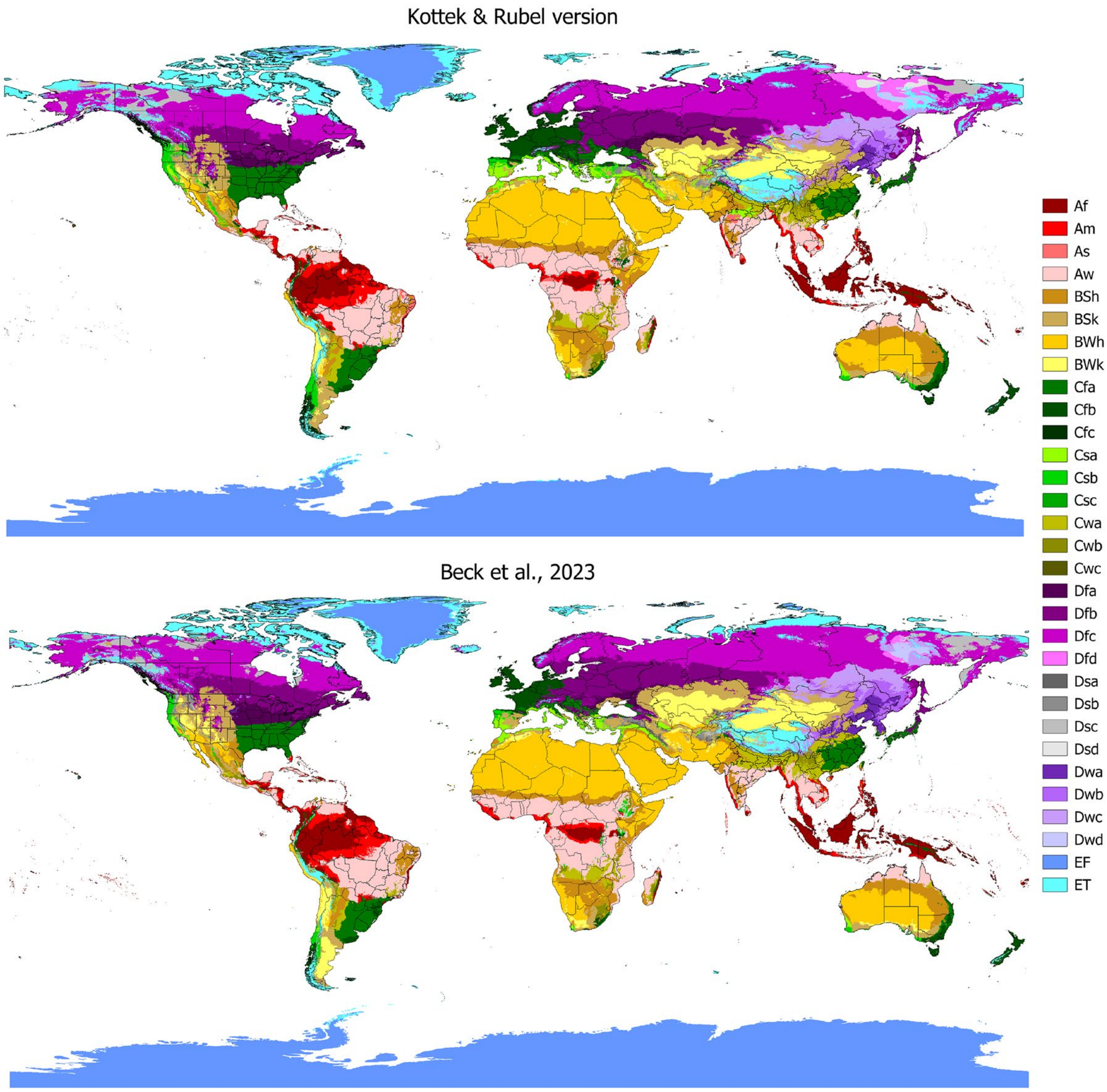

FIGURE 1 World Köppen–Geiger climate classifications from Kottek & Rubel version, above) and Beck et al. (2023), below.

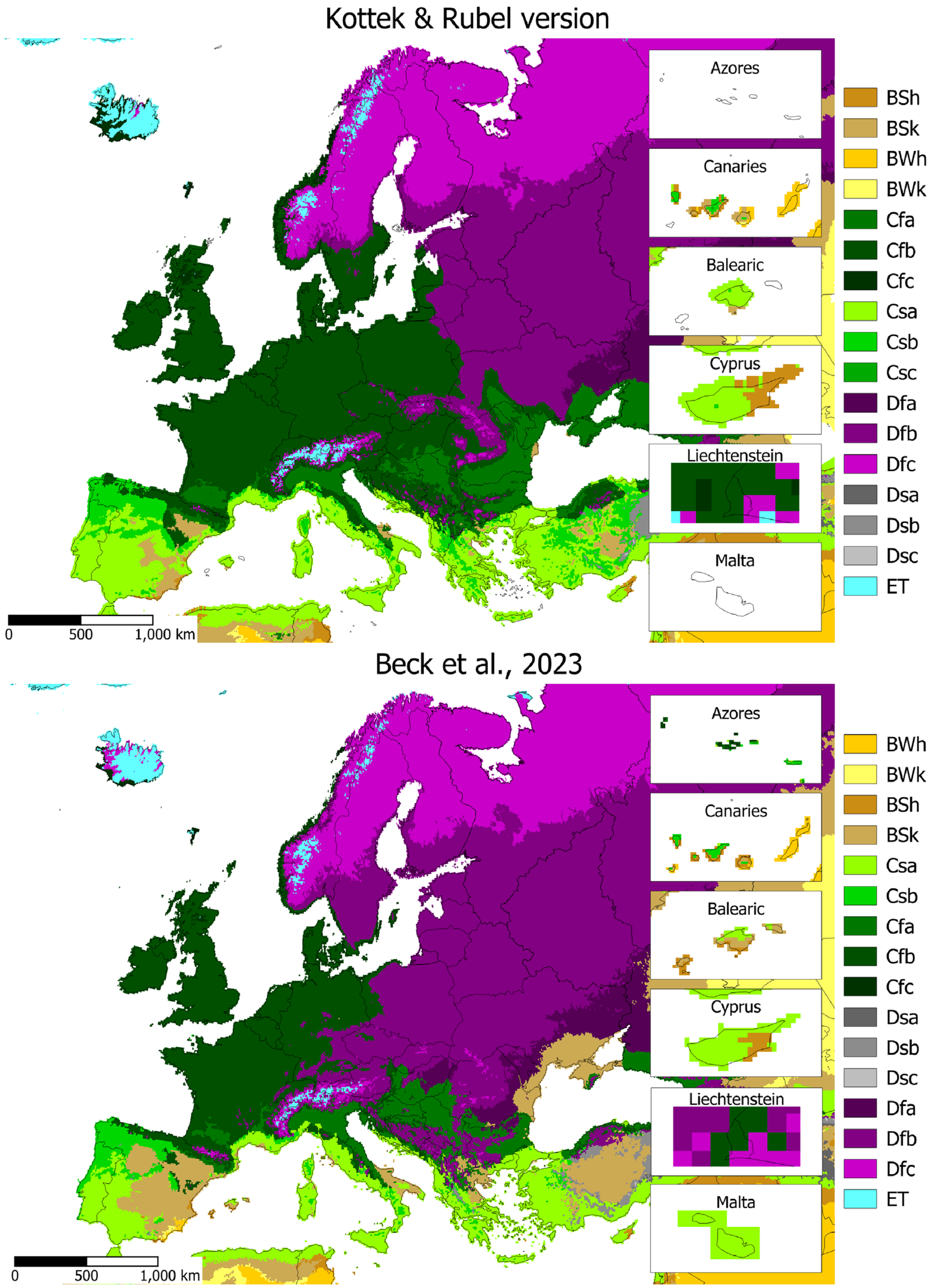

FIGURE 2 Köppen–Geiger climate classifications: Kottek & Rubel version (above) vs. Beck et al. (2023) (below) for Europe. Note that the 'Kottek & Rubel version' map does not provide the climate types for Malta, the Azores and only partially for the Balearic Islands.

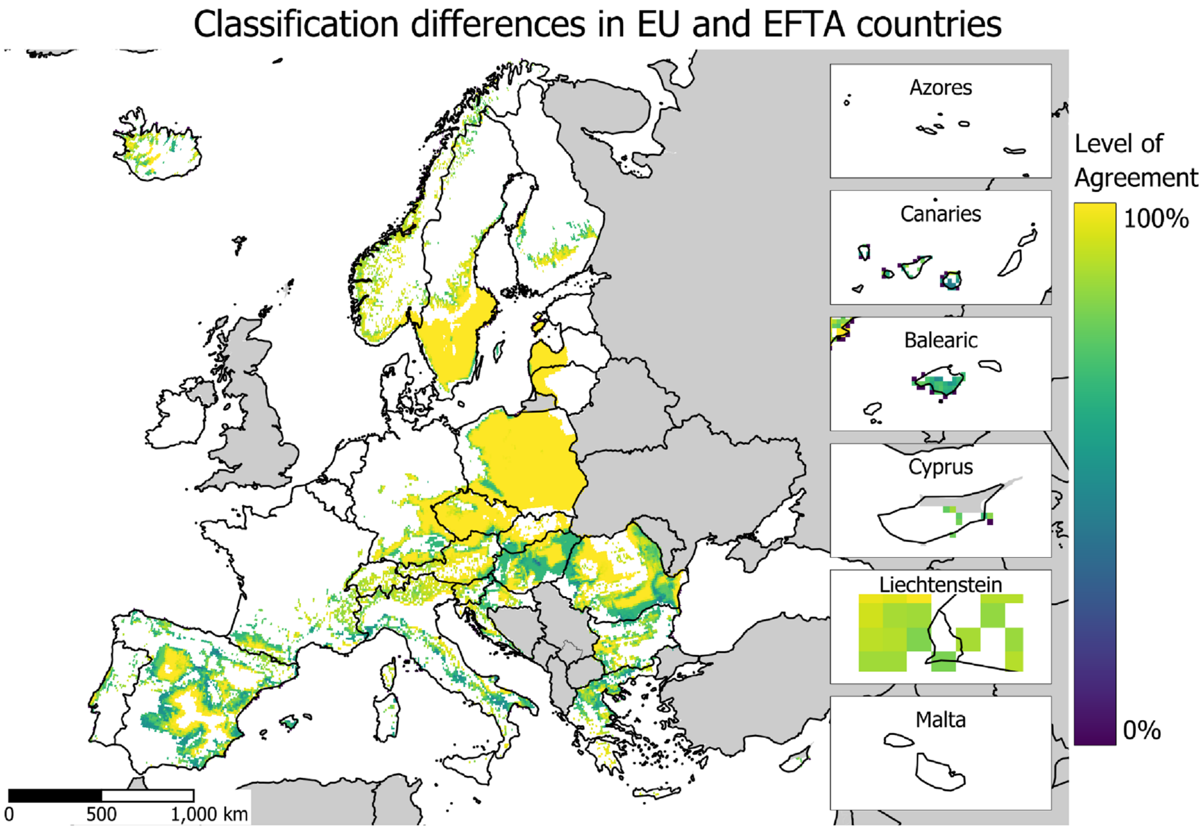

FIGURE 3 Pixels in the EU and EFTA countries that were reclassified from Kottek et al. (2006) rescaled after Rubel et al. (2017) to Beck et al. (2023). The level of agreement is the agreement between the different models used by Beck et al. (2023).

2.1.1 | Climate type As

The climate type classified as *As* in the 'Kottek & Rubel version' is no longer reported in Beck et al. (2023). Higher resolution dataset, better interpolation techniques and a reformulation of the parameters to favour the creation of larger and more widely applicable classification resulted in the integration of *As* into *Aw*.

2.1.2 | Definition of temperate climate *C*

The definition of the temperate climate (C) has seen a change in the minimum threshold temperature, from −3°C to 0°C. This is due mainly to practical and historical reasons. While initially Kottek et al. (2006), based on the original Köppen classification, considered −3°C aligning with the natural boundary of snow cover persistence in mid-latitude regions, follow up discussions made by Russel in 1931, then Wilcock in 1968 and Essenwanger in 2001 indicated 0°C as a more meaningful value to discriminate between temperate and cold climates since it reflects the freezing point of water in the transition between climates dominated by rainy rather than snowy events. Furthermore, the 0°C mark is important to define the vegetation zones and biomes. Since then, 0°C became the threshold between C and D climates for most versions of KGc, with its first implementation in the modern era being made by Peel (2007). For completeness, it should be noted that Russel (1931) suggested that a − 5°C coldest-month threshold may better delineate European climatic regions, although this adjustment has not been systematically validated, and it is not used in global Köppen–Geiger applications.

2.1.3 | Extremely continental climates *Csd*, *Cwd* and *Cfd*

Another difference that lies between the two KGc versions is the presence of extremely continental *Csd*, *Cwd* and *Cfd* climates. While these are mentioned in Kottek et al. (2006), and defined as C climates with a $T_{min} \leq -38°C$, they do not appear in any pixel worldwide and were removed from the KGc of Beck et al. (2023). The removal is therefore consistent with the choices made for the *As* climate.

2.1.4 | Definition of arid climate *B*

The last difference concerns the definition of the parameters of arid (B) climates, which relies on the precipitation threshold (Pth) to assess aridity. While Kottek et al. (2006) defined the threshold as two-thirds (66.7%) of the annual precipitation occurring during summer or winter, Beck et al. (2023) used the threshold value defined by Peel (2007), i.e. 70%. This increase helps to better differentiate between transitional climates such as deserts and steppes and reduces the misclassification of semi-arid zones in subtropical and Mediterranean regions.

2.2 | Definition of climate types in the EU

The differences listed in Section 2.1 affect the distribution of all climates across the world and in particular in the EU (Figure 2). To quantify differences between the two Köppen–Geiger classifications, a pixel-wise comparison was conducted on the aligned rasters. Figure 3 shows the pixels in the EU and EFTA countries that have been reclassified from the 'Kottek & Rubel version' to the Beck et al. (2023) version with the level of agreement among the 12 KG classifications considered by Beck et al. (2023) (see Section 2.1). For each climate type in the 'Kottek & Rubel version', the number of pixels that were reclassified by Beck et al. (2023) was calculated and displayed in Figure 4. It is evident how the pixels classified as *Cfb* in the 'Kottek & Rubel version' were mostly reclassified as *Dfb* (10,496 pixels) in Beck et al. (2023). This large contribution is mostly due to the different minimum temperature threshold explained in Section 2.1.2. Another noticeable shift in the EU and EFTA countries is represented by the reduction of *Cfa* (490 pixels) and *Csa* (1643 pixels) in favour of *Bsk*, which is due to the updated climatic dataset and the change of arid climates threshold.

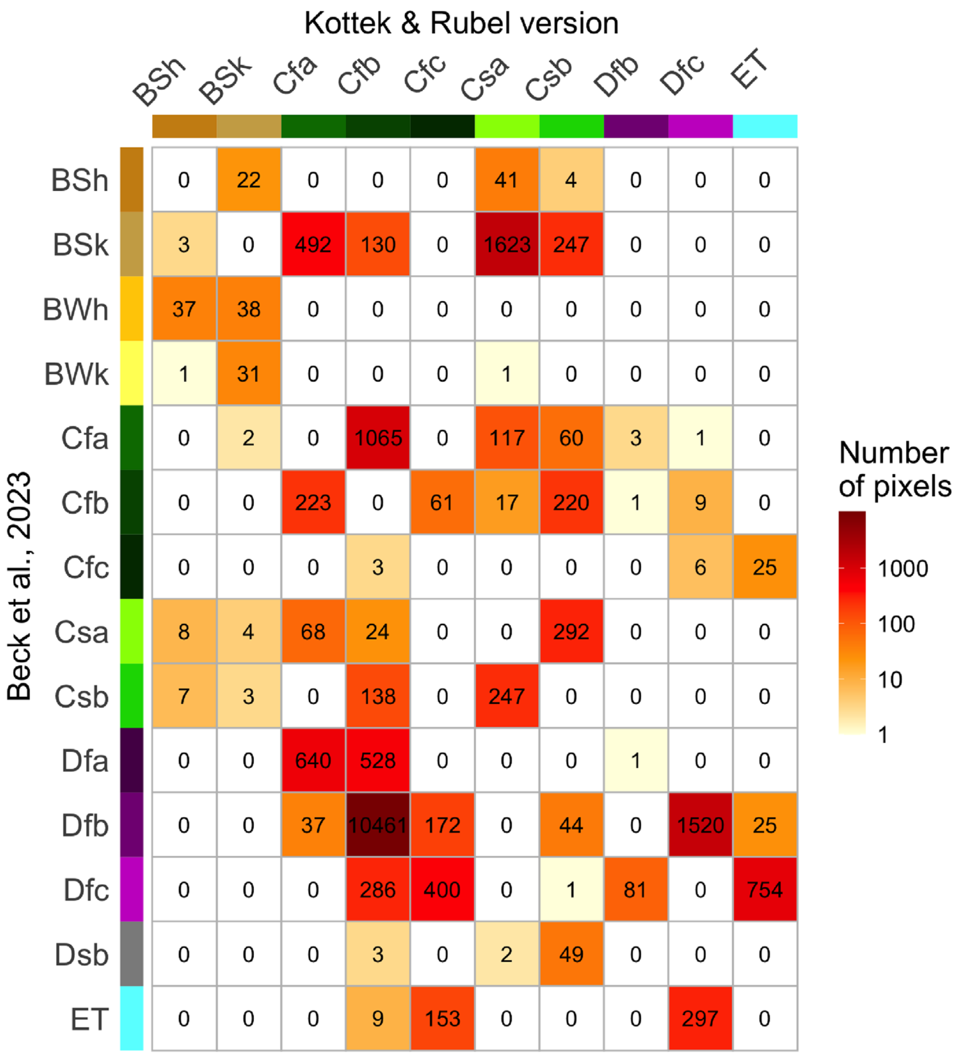

FIGURE 4 Number of pixels that were reclassified to a different climate type in the Beck et al. (2023) version compared to the Kottek & Rubel version in the EU and EFTA countries.

3 | CONCLUSIONS

The variety of KGc versions available, spanning from regional to global maps, at different temporal and spatial resolutions make the Köppen–Geiger among the most widely used climate classifications worldwide, with applications across multiple scientific domains. In this document, we compared two of the most used versions, focusing on both the changes in definitions of climate types and the climate datasets employed. The Beck et al. (2023) version will be implemented in the future EFSA pest risk assessments for two main reasons: (i) the inclusion of a more recent 30-years period (1991–2020); (ii) the use of inputs from multiple observation-based reanalysis climatological datasets and the provision of related confidence maps, which makes the classification more robust; and (iii) the availability of maps for climate change. Given the pace at which the effects of global warming are changing climates worldwide, the Beck et al. (2023) KGc version is regarded as the most suitable in the scope of EFSA risk assessments.

REQUESTOR
European Commission

QUESTION NUMBER
EFSA-Q-2025-00668

GENERIC MAP DISCLAIMER
The designations employed and the presentation of material on any maps included in this scientific output do not imply the expression of any opinion whatsoever on the part of the European Food Safety Authority concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

SPECIFIC MAP DISCLAIMER
Any designation of Kosovo is without prejudice to positions on status and is in line with United Nations Security Council Resolution 1244 and the International Court of Justice Opinion on the Kosovo Declaration of Independence.

REFERENCES
Beck, H. E., McVicar, T. R., Vergopolan, N., Berg, A., Lutsko, N. J., Dufour, A., Zeng, Z., Jiang, X., van Dijk, A., & Miralles, D. G. (2023). High-resolution (1 km) Köppen-Geiger maps for 1901-2099 based on constrained CMIP6 projections. *Scientific Data*, *10*(1), 724. https://doi.org/10.1038/s41597-023-02549-6

Beck, H. E., Zimmermann, N. E., McVicar, T. R., Vergopolan, N., Berg, A., & Wood, E. F. (2018). Present and future Köppen-Geiger climate classification maps at 1-km resolution. *Sci Data*, *5*, 180214. https://doi.org/10.1038/sdata.2018.214

Brun, P., Zimmermann, N. E., Hari, C., Pellissier, L., & Karger, D. N. (2022). *CHELSA-BIOCLIM+ A novel set of global climate-related predictors at kilometre-resolution*. https://doi.org/10.16904/envidat.332

Chen, M., Xie, P., Janowiak, J. E., & Arkin, P. A. (2002). Global land precipitation: A 50-year monthly analysis based on gauge observations. *Journal of Hydrometeorology*, *3*, 17.

Cui, D., Liang, S., Wang, D., & Liu, Z. (2021). A 1 km global dataset of historical (1979–2013) and future (2020–2100) Köppen–Geiger climate classification and bioclimatic variables. *Earth System Science Data*, *13*(11), 5087–5114. https://doi.org/10.5194/essd-13-5087-2021

Eyring, V., Bony, S., Meehl, G. A., Senior, C. A., Stevens, B., Stouffer, R. J., & Taylor, K. E. (2016). Overview of the coupled model Intercomparison project phase 6 (CMIP6) experimental design and organization. *Geoscientific Model Development*, *9*(5), 1937–1958. https://doi.org/10.5194/gmd-9-1937-2016

Fick, S. E., & Hijmans, R. J. (2017). WorldClim 2: New 1-km spatial resolution climate surfaces for global land areas. *International Journal of Climatology*, *37*(12), 4302–4315. https://doi.org/10.1002/joc.5086

Fuchs, T. (2008). The Climate Data Guide: GPCC: Global Precipitation Climatology Centre.

Funk, A. V., Michaelsen, J., Peterson, P., Pedreros, D., & Husak, G. (2015). A global satellite assisted precipitation climatology. *Earth System Science Data Discussions*, *8*, 24. https://doi.org/10.5194/essdd-8-401-2015

Geiger, R. (1954). Ch. Klassifikation der Klimate nach W. Köppen. *Landolt-Börnstein – Zahlenwerte und Funktionen aus Physik, Chemie, Astronomie, Geophysik und Technik, alte Serie*, 3, 4.

Geiger, R. (1961). *Überarbeitete Neuausgabe von Geiger R: Köppen–Geiger. Klima der Erde (Wandkarte 1: 16 Mill.)(Revised reissue of Geiger R: Köppen-Geiger/ Climate of the Earth (Wall map 1: 16 Mill.))*. Klett-Perthes.

Karger, D. N., Conrad, O., Böhner, J., Kawohl, T., Kreft, H., Soria-Auza, R. W., Zimmermann, N. E., Linder, H. P., & Kessler, M. (2017). Climatologies at high resolution for the earth's land surface areas. *Scientific Data*, *4*, 170122.

Kayacetin, F., Önemlİ, F., Yilmaz, G., Khawar, K. M., Kinay, A., Hatlpoglu, H., Kivilcim, M. N., Kara, N., Kose, A., Sefaoglu, F., & Özaydin, K. A. (2019). Growing degree day and seed yield relationships in mustard (Brassica juncea L.) under different sowing seasons and locations of Turkey. *Tarım Bilimleri Dergisi*, 298–308. https://doi.org/10.15832/ankutbd.424218

Köppen, W. (1900). Versuch einer Klassifikation der Klimate, vorzugsweise nach ihren Beziehungen zur Pflanzenwelt. *Geographische Zeitschrift*, *6*(11. H), 593–611.

Köppen, W. (1918). Klassifikation der klimate nach Temperatur, Niederschlag und Yahreslauf. *Petroleum Mitteilungen*, *64*, 193–203;243–248.

Köppen, W. (1936). *Das geographische System de Klimate. Handbuch der klimatologie*.

Kottek, M., Grieser, J., Beck, C., Rudolf, B., & Rubel, F., (2006). World Map of the Koppen-Geiger climate classification updated. *Meteorologische Zeitschrift*, *15*, 259–263.

Kriticos, D. J., Webber, B. L., Leriche, A., Ota, N., Macadam, I., Bathols, J., & Scott, J. K. (2011). CliMond: Global high-resolution historical and future scenario climate surfaces for bioclimatic modelling. *Methods in Ecology and Evolution*, *3*(1), 53–64. https://doi.org/10.1111/j.2041-210X.2011.00134.x

Menne, M. J. G., Byron, E., Lawrimore, J., Rennie, J., & Williams, C. N. (2017). *Global Historical Climatology Network - Monthly Temperature*. https://doi.org/10.7289/V5XW4GTH

Mitchell, T. D., & Jones, P. D. (2005). An improved method of constructing a database of monthly climate observations and associated high-resolution grids. *International Journal of Climatology*, *25*(6), 693–712. https://doi.org/10.1002/joc.1181

Peel, F. a. M. (2007). Updated world map of the Köppen-Geiger climate classification. *Hydrology and Earth System Sciences*, *11*, 11.

Peres, K. K., Guicho, R., Medeiros, G., Amaral, M. W. W., da Silva, T. T., Pilatti, M. C., Prior, M., & Bueno, N. C. (2022). Environmental fragility as an indicator of the risk of contamination by human action in watersheds used for public supply in western Paraná, Brazil. *Environmental Earth Sciences*, *81*(20), 486. https://doi.org/10.1007/s12665-022-10619-y

Poulter, B., Ciais, P., Hodson, E., Lischke, H., Maignan, F., Plummer, S., & Zimmermann, N. E. (2011). Plant functional type mapping for earth system models. *Geoscientific Model Development*, *4*(4), 993–1010. https://doi.org/10.5194/gmd-4-993-2011

Rubel, F., Brugger, K., Haslinger, K., & Auer, I. (2017). The climate of the European Alps: Shift of very high resolution Köppen-Geiger climate zones 1800–2100. *Meteorologische Zeitschrift*, *26*(2), 115–125. https://doi.org/10.1127/metz/2016/0816

Rubel, F., & Kottek, M. (2010). Observed and projected climate shifts 1901–2100 depicted by world maps of the Köppen-Geiger climate classification. *Meteorologische Zeitschrift*, *19*(2), 135–141. https://doi.org/10.1127/0941-2948/2010/0430

Russel, R. J. (1931). *Dry climates of the United States*. University of California Press.

Schneider, D. P., Deser, C., Fasullo, J., & Trenberth, K. E. (2013). Climate data guide spurs discovery and understanding. *Eos, Transactions American Geophysical Union*, *94*, 2. https://doi.org/10.1002/2013eo130001

Wang, W., Pijl, A., & Tarolli, P. (2022). Future climate-zone shifts are threatening steep-slope agriculture. *Nature Food*, *3*(3), 193–196. https://doi.org/10.1038/s43016-021-00454-y

Wilcock, A. A. (1968). Köppen after 50 years. *Annals of the Association of American Geographers*, *58*(1), 17.

Willmott, C. J., & Matsuura, K. (2001). *Terrestrial air temperature and precipitation: monthly and annual time series (1950–1999)*.

Yang, S. Q., & Matzarakis, A. (2016). Implementation of human thermal comfort information in Köppen-Geiger climate classification-the example of China. *International Journal of Biometeorology*, *60*(11), 1801–1805. https://doi.org/10.1007/s00484-016-1155-6

How to cite this article: EFSA (European Food Safety Authority), Rossi, E., Maiorano, A., & Gobbi, A. (2026). Update of the Köppen–Geiger climate classification for EFSA PLH risk assessment. *EFSA Journal*, *24*(1), e9859. https://doi.org/10.2903/j.efsa.2026.9859