Supplementary Tables & Figures

Table S3: List of description & criteria of different Koppen's climate types[20].

S. No.	1st	2nd	3rd	Description	Criteria
1	A			Tropical	$T_{cold} \geq 18$
2		f		Rainforest	$P_{dry} \geq 60$
3		m		Monsoon	Not (Af) & $P_{dry} \geq 100\text{-}MAP/25$
4		w		Savannah	Not (Af) & $P_{dry} < 100\text{-}MAP/25$
5	B			Arid	$MAP < 10 (P_{threshold})$
6		W		Desert	$MAP < 5 (P_{threshold})$
7		S		Steppe	$MAP \geq 5 (P_{threshold})$
8			h	Hot	$MAT \geq 18$
9			k	Cold	$MAT < 18$
10	C			Temperate	$T_{hot}>10$ & $0 <T_{cold} <18$
11		s		Dry summer	$P_{sdry}<40$ & $P_{sdry} < P_{wwet}/3$
12		w		Dry winter	$P_{wdry}< P_{swet}/10$
13		f		Without dry season	Not (Cs) or (Cw)
14			a	Hot summer	$T_{hot} \geq 22$
15			b	Warm summer	Not (a) & $T_{mon10} \geq 4$
16			c	Cold summer	Not (a or b) & $1 \leq T_{mon10} <4$
17	D			Cold	$T_{hot}>10$ & $<T_{cold} \leq 0$
18		s		Dry summer	$P_{sdry}<40$ & $P_{sdry} < P_{wwet}/3$
19		w		Dry winter	$P_{wdry}< P_{swet}/10$
20		f		Without dry season	Not (Ds) or (Dw)
21			a	Hot summer	$T_{hot} \geq 22$
22			b	Warm summer	Not (a) & $T_{mon10} \geq 4$
23			c	Cold summer	Not (a, b or d)
24			d	Very cold winter	Not (a or b) & $T_{cold} <-38$
25	E			Polar	$T_{hot} <10$
26		T		Tundra	$T_{hot} >0$
27		F		Frost	$T_{hot} \leq 0$

Acronym: MAT, mean annual temperature; MAP, mean annual precipitation; T_{hot}, temperature of hottest month; T_{cold}, temperature of coldest month; T_{10}, number of months where temperature is above 10; P_{dry}, precipitation of driest month; P_{sdry}, precipitation of driest month in summer; P_{wdry}, precipitation of driest month in winter; P_{swet}, precipitation of wettest month in summer; P_{wet}, precipitation of wettest month in winter; $P_{threshold}$, logical (if 70% of map occurs in winter, then $P_{threshold} = 2(MAT)$, if 70% of map occurs in summer, then $P_{threshold} = 2(MAT)+28$, else $P_{threshold} = 2(MAT)+14$. Summer (winter) is defined as the warmer (cooler) six months period of ONDJFM (October-March) & AMJJAS (April-September).

Table S4: List of Koppen's Symbol for each climate type[20]:

Af	Tropical rainforest climate
Am	Tropical monsoon climate
Aw or As	Tropical wet & dry or savanna climate
BWh	Hot desert climate
BWk	Cold desert climate
BSh	Hot semi-arid climate
BSk	Cold semi-arid climate
Cfa	Humid subtropical climate
Cfb	Temperate oceanic climate
Cfc	Subpolar oceanic climate
Cwa	Monsoon-influenced humid subtropical climate
Cwb	Subtropical highland climate or Monsoon-influenced temperate oceanic climate
Cwc	Cold subtropical highland climate or Monsoon-influenced subpolar oceanic climate
Csa	Hot-summer Mediterranean climate
Csb	Warm-summer Mediterranean climate
Csc	Cold-summer Mediterranean climate
Dfa	Hot-summer humid continental climate
Dfb	Warm-summer humid continental climate
Dfc	Subarctic climate
Dfd	Extremely cold subarctic climate
Dwa	Monsoon-influenced hot-summer humid continental climate
Dwb	Monsoon-influenced warm-summer humid continental climate
Dwc	Monsoon-influenced subarctic climate
Dwd	Monsoon-influenced extremely cold subarctic climate
Dsa	Mediterranean-influenced hot-summer humid continental climate
Dsb	Mediterranean-influenced warm-summer humid continental climate
Dsc	Mediterranean-influenced subarctic climate
Dsd	Mediterranean-influenced extremely cold subarctic climate
ET	Tundra climate
EF	Ice cap climate

Table S5: Koppen climate type & their characteristics adapted by SARS-CoV-2[20].

Koppen Climate Type	Characteristics
Humid-subtropical (Cfa):	The Koppen's symbol for the climate is 'Cfa', the 'C' of Cfa, denotes the temperature of the coldest month should be in between 0°C & 18°C, & the temperature of the hottest month is > 10°C. The 'f' is denoted for continuous rainfall throughout the year & 'a' means temperature of the hottest month temperature ≥ 22°C2.
Marine-temperate (Cfb):	The 'C' & 'f' have the same definition as above, 'b' denotes hottest month's mean temperature < 22°C2.
Mediterranean (Csa-Csb):	The 'C' has the same definition, 's' denotes dry winter, i.e., no rainfall during winters, 'a' & 'b' has similar meaning as above2.
Humid-continental (Dfa & Dfb):	The 'D' represents, temperature of hottest month is greater than 10°C & the temperature of the coldest month is ≤ 0°C. 'f', has similar meaning & 'a', denotes temperature of hottest month is more than 22°C while 'b' denotes temperature of hottest month is < 22°C but temperature of 10 months is ≥ 4°C2.
Tropical savannah (Aw)	The 'Aw' climate have monthly mean temperatures above 18 °C in all months of the year with a typically a pronounced dry season, precipitation in the driest month is less than 60 mm.

Supplementary Figures

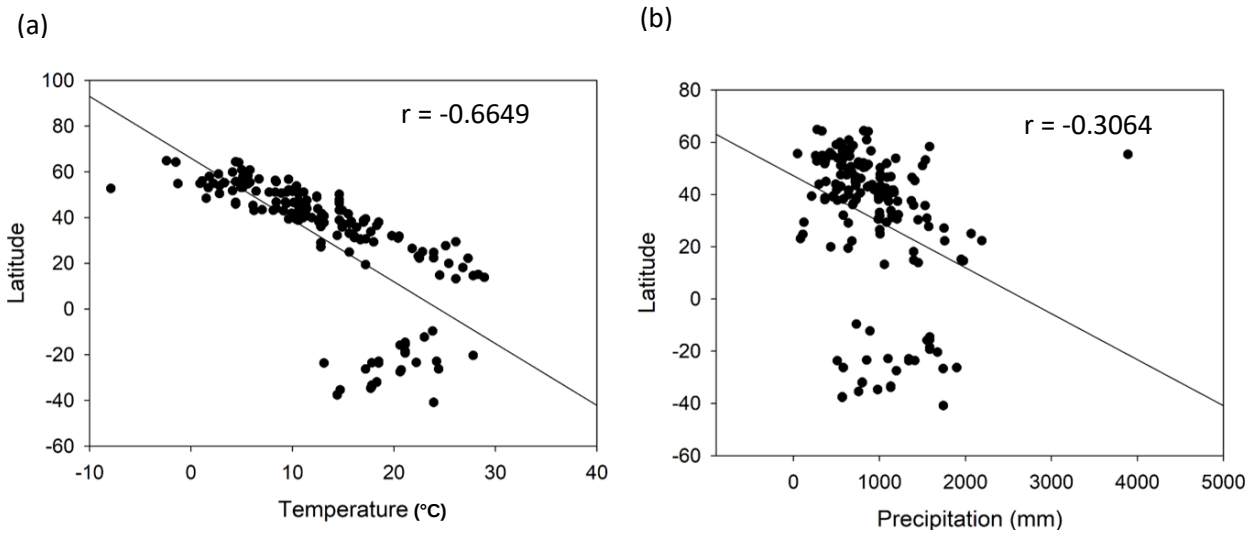

Figure S1: Relationship between climatic variables. Correlation between (a) latitude & temperature & (b) latitude & precipitation for SARS-CoV-2 strains (n=176) is estimated by calculating Pearson correlation coefficient (r).

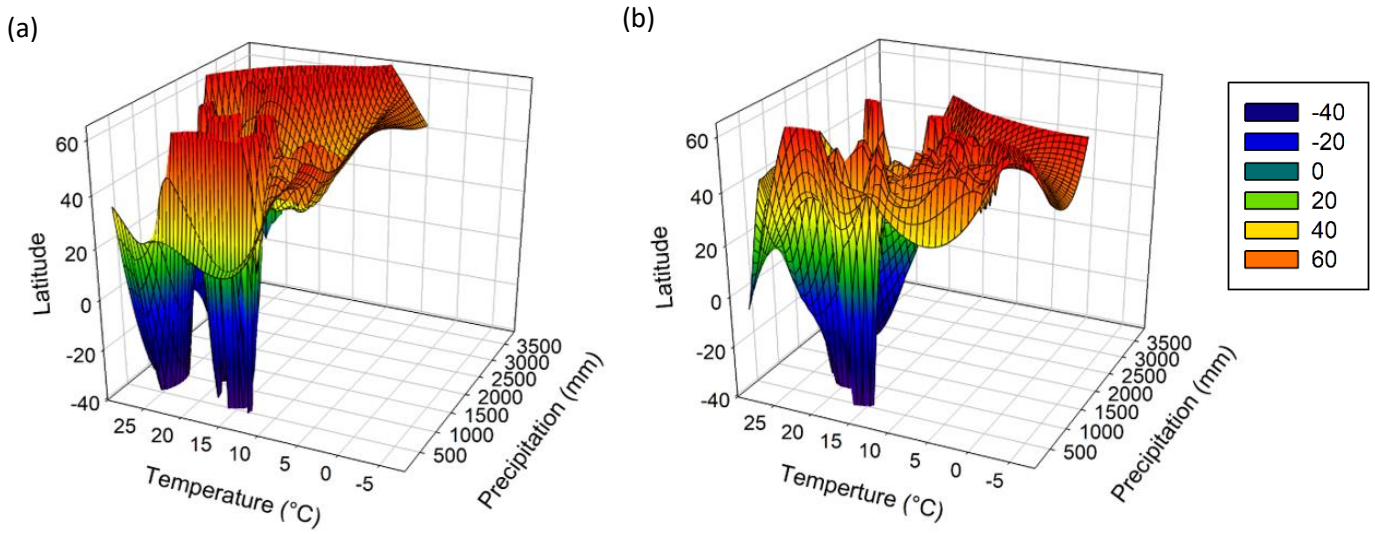

Figure S2: Comparing climatic parameters such as latitude, temperature & precipitation for each SARS-CoV-2 isolate (n=176). (a-b) Color code for the mesh plot is mentioned in the box & is according to latitude from which each SARS-CoV-2 strain was isolated. Latitude, temperature & precipitation values for each virus isolate are mentioned in Table S2. Relationship between latitude, temperature & precipitation for each SARS-CoV-2 strain belonging to (a) G1 variant group (Strain ID: 1-58) & (b) G2 variant group (Strain ID: 59-176).

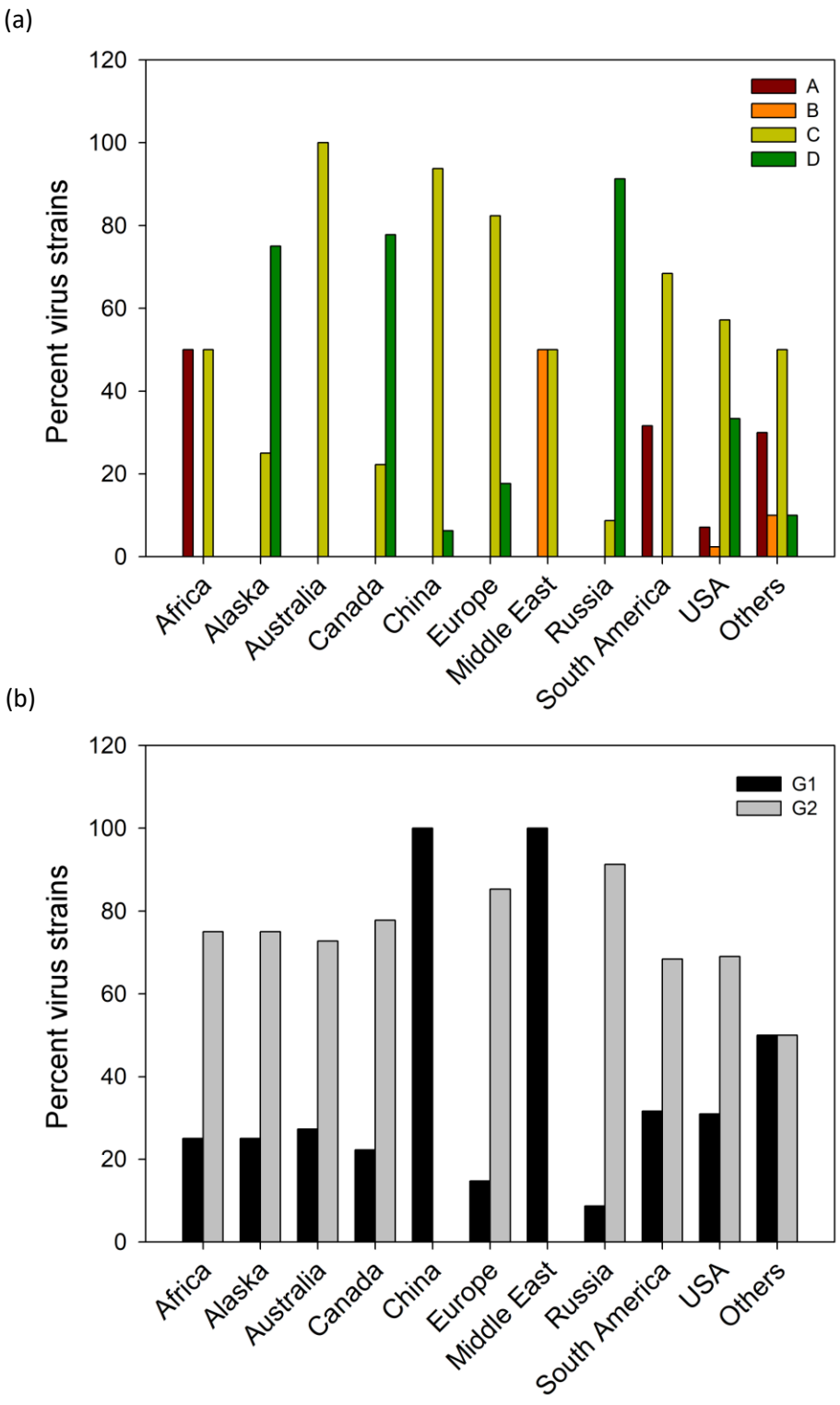

Figure S3: Interpretation of Koppen's climate map country &/or continent wise: Height of the bar represents percentage of virus strains (a) across A, B, C, & D Koppen's climate & (b) distribution of virus strains falling in G1 & G2 variant groups in major regions of the Earth. The G1 strains are abundant in China having specifically C climate. In Russia G2 strains are present in abundance having specifically D climate.

Detailed interpretation & distribution of the strains on Koppen's map in major parts of the world (Figure4, Supplementary FigureS3)

China: The entire southeast China has "*humid-subtropical" (Cfa)* climate also referred in the text as Wuhan-type climate. This climate grades into the cold deserts in the north & the land is separated from ocean in the south which isolates SARS-CoV-2 strains (n=16) in '*Cfa'* climate. All strains (15/16) from China belong to G1 group (Figure 4). One G1 strain have appeared near to the C to D climate gradation near Beijing, suggesting G1 population favours (Chi-square test, *P* <.001) *'Cfa'* climate type of C climate.

Europe: The western coast of Europe consists of *"marine-temperate" (Cfb)* climate, a climate similar to Wuhan's climate i.e., '*Cfa*'. In UK, Spain, France, & Switzerland mainly *'Cfb'* climate persists, whereas Portugal has *"Hot-summer Mediterranean*" *(Csa)* climate. Towards west of Germany the '*Cfb'* climate dominates which grades into *"humid-continental" (Dfa-Dfb)* climate towards east which continues as a belt up to Japan. From the total strains (n=34), around 14.7% of G1 & 85.3% of G2 strains lie in Europe. All G1 strains (n=5) of Europe belong to C climate, of which 60% belongs to Cfb, 40% to Csa. Among G2 strains (n=29), 79.3% of G2 strains belongs to C climate (65.5% Cfa,10.3% Csa, & 3.4% Cfc) & 20.6% to Dfb climate type of D climate.

Russia: Majority (21/23) of strains (n=23) from Russia are present in the "*humid-continental" (Dfa-Dfb)* climate belt which begins from Germany & enters into the continent interior as a long (~8500 km) wide (~600-1700 km) belt, grading to *(Dwb-Dwc)* & tapering towards eastern side but continuing all along the southern boarders of Russia up to Japan. From Russia, ~8.7% of total strains (n=23), belongs to G1 & 91.3% to G2. All G1

(2/23) strains are present in '*Dfb'* climate, one strain is present near the gradation of C to D (Strain ID: 4) climate & another (Strain ID: 31) in the interior of the continent. Of G2 strains, 91.3% of the strains are present in D climate (61.9% Dfb, 9.5% Dfa, 9.5% Dfc, 4.7% Dwb, 4.7% Dwc) & 9.5% in Cfa of C climate, suggesting a strong preference (Chi-square test, *P*<.001) of G2 strains towards D climate.

North America:

USA: Of all the continents North America USA has the most diverse climate, especially towards the western side[1]. The strains are mainly present in the eastern & western coasts of USA. The eastern coast of USA is one of the largest regions (~2.4 $x10^6$ Km^2) of the world having *"humid-subtropical" (Cfa)* climate (Wuhan's climate). From the eastern coast, the strains enters into the continent interior through a long (~3800 km), wide belt (~600-1000 km) lying in the northern extremities of the USA, extending roughly in NW-SE direction initially following borders between USA & Canada & entering to Canada from southern side. This belt belongs to "*humid–continental" (Dfa-Dfb)* climate; is similar to that of Russia (mentioned above). The strains in the western coast of USA are aligned roughly parallel to the coastline & shows bulging towards the south (Figure 4), the western coast of USA has mainly C climate, the buldged out portion has a bulged *"Hot-summer mediterranean*" *(Csa)* climate, which grades into *"humid-continental" (Dfa-Dfb)* towards its east. Between the western coast strains & eastern coast strains lies the cold desert, where SARS-CoV-2 strains are not present. In USA, ~31% of strains (n=42) belong to G1 while ~69% of the strains belongs to G2. Among G1 strains (n=13), 46.15% of strains belong to C climate (23% Cfa, 23% Cfb), 38.4% to D climate (15.3% Dfa, 23.07% Dfb) & 7.6% in both *"tropical-monsoon" (Am)* & "*cold-desert" (BSk)* climate. The G1 strains of D

& A zones mainly lie near boundaries of C & D climate around the eastern & western coasts (Figure 4). Within G2 strains (n =29), ~62% strains lie in C climate (55% Cfa, 6.8% Csb), ~31% in D climate (20.6% Dfa, 10.3% Dfb) & remaining 6.8% are equally distributed in tropical climate (3.4% Am, 3.4% Aw).

Canada: The strains of Canada (n=9) are mainly distributed along the western coasts & towards the southern side. The western coasts of Canada has *"humid-subtropical" (Cfa)* climate & south of Canda has *"humid-continental" (Dfa-Dfb)* climate, which is an extension of '*Dfa-Dfb'* belt initiating from eastern side of USA near New York (mentioned above). 22.2% of the strains belong to G1 & 77.8% to G2. Within G1 (n=2), 50% strains belong to the '*Cfa'* & remaining to '*Dfb'*. Within G2 (n=7) variant group, ~14.2 % strains belong to *"marine-temperate" (Cfb)* & ~85.7% of strains belong to *"humid-continental" (Dfb)* climate.

South America: Majority (18/19) of South America's strains (n=19 of strains are present in the eastern coast of South America, The G1 population is concentrated in the Sao Paulo & one G1 strain (Strain ID: 3) is visible in the western coast of Chile, in both the places C climate is dominant, mainly *"humid-subtropical" (Cfa) & "marine-temperate" (Cfb).* Other than these two places the C climate is not present in the entire South America. The position & extent of South America in the globe is unique in itself as it connects the C climate with all A (tropical) climate through land. Both G1 & G2 strains are present in the C climate, however G2 strains have shifted towards the *"tropical-savannah" (Aw)* climate towards north, this shift is not visible towards the desert climate in south. Around ~31.5% of G1 strains & 68.4% of G2 strains are present in South America. Within G1 (n=6), ~66% are present in the C climate (33.3% Cfa, 16.6% Cfb, 16.6% Csb), 33.3% in A climate (Aw). Within G2 (n=13), 69.23% of G2 strains are present in C climate

(46.15% Cfa, 23% Cfb), while 30.73% of the strains are present in A climate (23% Aw, 7.6% Am).

Africa: Strains from Africa (n=4), are mainly (3/4) from G2 group. One G1 strains belongs to C climate (Cwb). Within G2, 66.66% of strains are present in A climate (Aw), & 33.33% in C climate (Csa).

Australia: All strains (n=11) from Australia are present either in the eastern or in the western coasts consisting of C climate. In the eastern coast the main climate is "*humid-subtropical" (Cfa)* & "*marine-temperate" (Cfb)* climate & western coast consists of *"Hot-summer mediterranean" (Csa)* climate of C climate. The rest of Australia has a desert climate. All strains from Australia are confined to this narrow belt of C climate. ~27% of the strains in Australia belong to G1 & ~73% of the strains belong to G2. Within G1 66.6% of strains are present in Cfa & 33.3% in Cfb. In G2, 50% of strains are present in Cfa, 25% in Cfb & 25 % in Csa climate type.

Japan: Japan has mainly two climates i.e., *"marine-temperate" (Cfb)* towards south & *"humid-continental" (Dfb)* towards north. Strains (n=2), one G1 & another G2 strain from Japan belongs to Cfa climate.

Middle East: The entire Middle East consists of B climate (desert). A very small portion of Middle East consists of C climate in the regions around Turkey. All strains (n=4) of Middle East belong to G1 group, among which 50% belongs to C climate (25% Csa, & 25% Csb) while the remaining are present in the "hot-desert" (BWh) climate.

South Asia & South Asian Islands

The G2 strains are present in India, Thailand & Vietnam, are mainly from "*tropical-savannah" (Aw)* climate, except strains from north-west India with a desert climate (BSh). The G1 strains are present in Philippines & South Korea are having "*tropical-savannah" (Aw)* & "*humid-continental"* (Dfa) climate respectively. The South Korea strain lies in the transition of *'Cfa'* climate (China) to '*Dfa'* climate (South Korea). Most of the strains in the South Asia & South Asian Islands belong to G2. Of total, around 80% of G2 & 20% of G1 strains are present in South Asia & South Asian Islands.