IN MARCH 2020

THE STOP OF THE

TRANSPORTATION

WORLD AIRLINE A SLOW THE THAW PERMAFROST

A TIPPING POINT

POSITIVE UPDATED, FOR COOL AND AIR CONDITION OUR PLANET

THE ARCTIC HIGH

- Forms for a significant part of the year over the Arctic Ocean and three very large continental areas: Siberia, Alaska, the Far North of Canada, and Greenland. It is predominant from November to March, weakens from April and throughout the summer, and gradually swells again in September and October.

- The Siberian High is the largest in size and pressure, with a pressure above 1030 millibars in January and February. It is formed by a vast area of high atmospheric pressure centered on Lake Baikal; the main city in this region is **Irkutsk.** Its area of influence on the climate extends south to Mongolia and its capital Ulaanbaatar and as far as northern China. To the northeast, it includes the Verkhoyansk Mountains and the Lena River plain, which flows into the Arctic Ocean, with **Yakutsk as its main city.** To the north, this area extends over the Central Siberian Plateau and to the west over the West Siberian Plain, with the city of **Novosibirsk** to the south and the city of **Yekaterinburg** at the foot of the Urals to the west.

- The Canadian and Greenland highs are smaller and have lower pressures of around 1020 millibars than the immense Siberian high, which we will be paying particular attention to.

AVERAGE TEMPERATURES IN SIBERIA

- By going off the beaten track and after consulting the historical-weather site of Russia, the average temperatures of the four Siberian cities of **Yakutsk, Irkutsk, Novosibirsk and Ekaterinburg were recorded month by month to establish an average temperature over a long period from 1961 to 1990 and then month by month over the last two decades from 2009 to 2020.**

- The years 2009 – 2013 are taken as a reference and it was calculated: the average (avg T/5 years), then the deviation from this average for each city and finally the average deviation of the four cities which measures the increase in the temperature of the anticyclone (t° anticyclone). The statistics are clear: the cold and dry Siberian anticyclone over the thirty years of the period 1961-1990 has been warming inexorably since 1990, initially **it is necessary to reduce or even eliminate the thawing of the permafrost.** In the longer term it will be necessary to fight against **the excess water vapor stored in the atmosphere and especially in the lower stratosphere,** water vapor produced by human activities but mainly by the overheating of oceanic surface waters by solar radiation in the equatorial belt of the globe which will allow humanity to **cool and therefore air-condition the planet.**

- Reducing **water vapor produced by human activities by 45% in the northern hemisphere** is a more easily achievable objective than the total elimination of CO_2 emissions by 2050 and at a much lower cost for rich countries.

REMINDERS ABOUT THE GREENHOUSE EFFECT

As early as 1861, Irish physicist John Tyndall identified that water vapor and carbon dioxide in the atmosphere were the cause of the mechanism that would later be called the "greenhouse effect." This physicochemical mechanism isolates the Earth from the sidereal vacuum at minus 274 Kelvin. Thus, this greenhouse effect is beneficial and makes the planet habitable. Without an atmosphere, the average temperature of the Earth would be minus 45° Celsius, and life would not have been able to develop.

The lifetime of water vapor in the atmosphere is about 10 days and that of carbon dioxide is more than a century.

Thirty-five years later in 1896, Swedish chemist Svante August Arrhenius proposed an estimate of the level of carbon dioxide (CO2) produced by the massive use of fossil fuels since the industrial revolution, based on the inexorable evolution of the planet's temperature: if the level of this gas doubled, the average temperature of the Earth would increase by more than 4° Celsius.

In 2015, the work of the Intergovernmental Panel on Climate Change (IPCC) confirmed that the planet has warmed by 1.5° Celsius over more than a century and a half and that the carbon dioxide content has increased from 280 ppm before the industrial revolution to 415 ppm today. (Five scientific institutions confirm this trend in the graph " Temperature Anomaly (°C)" attached in appendix table 20).

THAWING OF PERMAFROST

Global warming linked to CO_2 of 1° per century is therefore on the slope of the prediction of the end of the 19th century.

The thawing of permafrost that has been observed over the past decade is being described by scientists **as a climate time bomb.** They tell us that the permanently frozen soils of Greenland, Canada, Alaska, and Siberia, as they melt, will release **viruses forgotten for millennia** and billions of tons of carbon dioxide and methane (CH_4) into the atmosphere.

Given that methane is a greenhouse gas 23 times more powerful than CO_2 and that it is estimated that the quantity of CO_2 trapped in the permafrost is equivalent to four times that emitted by human activities since the industrial revolution of the mid-19th century, we can deduce that humanity is facing **an imminent and almost irreversible risk of runaway greenhouse gases.**

Furthermore, it is observed that the ice pack and continental ice of Arctic seas are melting faster than those in the Antarctic.

The IPCC has noted the approximate contributions to the greenhouse effect of main gases.

THE CONTRIBUTION OF THE MAIN GAS TO THE GREENHOUSE EFFECT...

.is 60% for water vapor, 26% for carbon dioxide, 8% for ozone (O3) and 6% for methane and nitrous oxide (N2O).

The first observation is that the main greenhouse gas in our atmosphere is **water vapor which, as it rises, transforms into suspended water droplets. Its potential to Accelerate Global Warming (PARCEL) or in clouds. CO2 equivalent which allows us to measure the harmfulness of each greenhouse gas, is 8 times greater** the mass of a carbon atom (C=12 **than that of carbon dioxide.** Another unit used is the Carbon equivalent obtained by multiplying the GWP by the ratio between g.mol-1) and that of a carbon dioxide molecule (CO2= 44g.mol-1) during a given period which is generally 100 years. (We find: carbon equivalent of CO2=0.273 GWP=1, carbon equivalent of H2O=2.02 average PARCEL=8, carbon equivalent of CH4=6.27 GWP=23, carbon equivalent of N2O=81 GWP=296)

Average global warming increases the evaporation of surface ocean waters, which are overheated at the level of the volcanic islands located between the two tropics. And the more the atmosphere warms, the more it stores and transports moisture throughout each hemisphere through the atmospheric circulation linked to the Hadley, Ferrel and Polar cells. When the thermal machine of the planet EARTH was not disrupted, the powerful cold thermal anticyclones of the Antarctic and the Arctic managed to air-condition the planet through this atmospheric circulation.

Climate change would therefore no longer be due solely to excess CO2 produced by humans, but also **to excess water vapor in the stratosphere,** a natural phenomenon but also resulting from human activities.

KEROSENE COMBUSTION DURING CRUISE AIR CONDITIONING BETWEEN 10,000 AND 12,000 METERS We can now examine the work of scientists who have been interested in **the long-term impact of CO_2 and H_2O emissions produced by jet aircraft at high altitudes** at the tropopause (the boundary between the troposphere and the stratosphere) and in the lower stratosphere between 10,000 and 13,000 meters, the cruising levels normally used in air transport.

To burn one kilogram of kerosene, three kilograms of oxygen are needed. In combustion, nothing is lost and the product of this chemical reaction mainly gives 3.84 kg of CO_2 (including 0.66 kg for the extraction, refining and transport of this aviation fuel), 1.25 kg of water and small but very harmful residues (nitrous oxide N_2O).

From an altitude of 8,000 metres, this supply of water in the form of vapour causes condensation trails if the humidity exceeds 68%, for a temperature of minus 40 degrees Celsius.

These condensation trails give rise to homogenous cirrus clouds acting as a heat trap with a powerful warming effect for the planet, greater than that of the concomitant CO_2 emissions, especially at night by retaining in the atmosphere the infrared rays reflected by the Earth's surface.

If we translate this quantity of water produced into CO_2 equivalent, we have 1.25*8 = 10 Kg of CO_2 equivalent. Therefore, **1 Kg of kerosene** consumed in the lower stratosphere just above the tropopause between 10 and 13 Km corresponds to **a carbon footprint of 13.84 Kg of CO_2** (3.84+10).

THE DIFFERENCE IN CARBON FOOTPRINT between cruising at 11,500 and 7,500 m

On the other hand, cruising at roughly the same speed but at an altitude of 7500/8000 meters, or approximately 4000 meters below the tropopause, would result in excess fuel consumption of 25%.

Or by expanding, the combustion of 1.25 kg of kerosene would give 4.8 kg of CO_2 and 1.56 kg of water. At this altitude 1.56 kg of water does not generate cirrus homogenitus so no additional greenhouse effect and no warming of the anticyclone or the tundra at ground level.

We can thus calculate that the **carbon footprint of cruising at 7500/8000 meters is 65% lower than cruising at high altitude,** which is very good for the planet.

The additional fuel expense can be offset by increased flight crew productivity as operating aircraft at this lower cruising altitude generates less fatigue, which is good for both flight crew and passengers.

Some statistics from 2006 which are still relevant to give an idea: - 93% of aviation kerosene was burned in the northern hemisphere, - and 69% between 30° and 60° North latitude.

- Three regions of the world concentrated 50% of global emissions, USA 26%, Europe 15% Extreme East 11%.

This distribution of kerosene consumption alone can explain the greater warming of the Arctic + 4.2°C compared to the Antarctic +1°C. (see photo NASA/GISS Anomaly of the period 2015/2019 compared to the reference 1951-1980 table 21)

MARCH 2020: COVID 19 STOPS GLOBAL AIR TRANSPORT

The second observation in December 2019 appeared in Wuhan in southern China (in a wild animal market or through uncontrolled genetic manipulation, information not verifiable) a new virus called Covid 19. In an attempt to limit the spread of this new virus of unknown origin, the Chinese authorities completely confined the populations of the city and its province and all other countries subsequently faced with this pandemic followed the Chinese example of total confinement. By the beginning of April 2020, more than half of the world's population was completely confined.

Since January 31, 2020, these drastic measures have shut down the most polluting factories in China, and **global air travel has gradually ground to a halt.** NASA satellite photos have shown that there is no longer any pollution over Beijing and in the Po Valley in the two countries that suffered the first severe contamination.

The study conducted therefore allows us **to immediately measure the impact of air transport in real conditions on global warming** by comparing the average temperatures recorded mainly in winter in the Siberian anticyclone in **December, January, February and March** over the last decade in the four Siberian cities mentioned above. **Yakutsk is on the trajectory of North America-Far East flights, Irkutsk, Novosibirsk and Ekaterinburg are on the trajectory of Europe-Far East flights** (data taken from the site historique-meteo.net, tables and figures attached as well as the Google Earth photo of the flight over Siberia (tables 22 to 37)).

The months of December 2013 and 2015 in all four cities reported abnormally high temperatures compared to the historical average. As well as during the months of January 2015 and 2017, then in 2019 and especially **2020,** the differences climbed to more than 6° compared to the average. The same trend for the months of February since 2015 and especially in **2020,** which was particularly less cold than usual, with even a quite exceptional difference of 4° in Yakutsk, 6° in Irkust, 10.4° in Novosibirsk and 9° in Yekaterinburg.

For the months of March, we have observed a warming since 2014 and a key observation: March 2019 was the least cold of the decade in these four cities after 2017. The Siberian high pressure system warms inexorably during the four winter months of the polar night. **And the heat accumulates during these four months because the infrared rays reflected by the Earth's surface no longer escape into space.**

THE IMPACT OF GLOBAL AIR TRANSPORT ON THE SIBERIAN HIGH

It is also noted that the average temperature differences of the Siberian anticyclone in spring and summer are very low, around plus 1°. The significant thaw of the permafrost observed during the summer of 2019 therefore results from much less cold winters for six to seven years, namely since 2013, climate change is therefore a reality in the Arctic Ocean.

The average temperature readings for March 2020 are surprising **in the total absence overflight of Siberia as before 1985 when the former USSR did not authorize this route air to reach the Far East,** happy coincidence or divine surprise the trend reversed in three out of four cities. It was 5°C colder in Yakutsk, 3°C colder in Irkutsk, 2° in Novosibirsk compared to March 2019. On the western edge of the Siberian high and at the foot of the Urals only Ekaterinburg saw its temperature average increase of 1°. **The phenomenal warming observed in January and February 2020 previously reported is stopped dead.**

No more condensation trails from aircraft in Siberia for a year and therefore without man-made homogenitus clouds, infrared is no longer blocked, it are thrown back into space. The ground temperature drops on a rolling average from March 2020 to February 2021 of 1.36 per month. In December 2020, we noted the fall of the average temperature of 2 compared to December 2019, in January 2021 drop in the average temperature of 8.75° compared to January 2020, in February 2021 fall of the average temperature of 6.75° compared to February 2020. After three winters at this rate the Siberian anticyclone, whose CO_2 content remains unchanged, would have become cold again and dry as before 1990, just by removing the contribution of water vapor from air transport.

ARCTIC FLIGHTS ARE RESPONSIBLE FOR RUNAWAY CLIMATE CHANGE

It has just been highlighted that the exponential development of air transport to the Far East from 2009 to 2019 is **largely responsible for:**

- global warming in the Arctic. - **thawing permafrost in Siberia, Greenland, Alaska and the Great Northern Canada.**

- the melting of the Arctic Ocean ice - **and the rapid spread of the Covid 19 pandemic.**

The NASA/GISS photo (on the anomaly of the period 2015/2019 table 20) confirms this dramatic observation and shows a difference of more than 3° and up to 4.2° C between the Arctic (dark orange and brown) and the Antarctic 1° (light yellow). There is practically no overflight of the Antarctic continent.

The planet can no longer support this exponential growth in air transport of 5% per year, and a doubling every 14 years of passengers transported across the world.

FOR A TREATY ON THE SANCTUARIZATION AND NO-OVERFLY OF THE ARCTIC: A POINT OF POSITIVE TIPPING POINT

To minimize this global warming, the thawing of the permafrost and the risk of possible release of other viruses just as dangerous as Covid 19, and to no longer block infrared radiation reflected by the Earth's surface, **the UN must be contacted as soon as possible by EUROPE, RUSSIA, CANADA and the USA** to decide on the following precautionary measures, enacted in an Arctic Treaty modeled on the 1959 Antarctic Treaty signed in the midst of the Cold War:

1-Limit the cruising altitude of aircraft to 7500/8000 meters for all flights above 45 degrees north or south latitude and on the rest of the globe to the altitude of the tropopause less four thousand meters.

2-Protect the Arctic zone delimited by a circle with a radius of 2400 NM centered on the North Pole, i.e. at the level of the parallel of 50° north latitude, in order to divide by 3 or 4 the deviation from the average of global warming in the Arctic which reaches 4.2°C.

Global air transport should no longer use polar routes to connect continents.

3-Define new air routes to avoid the Arctic Sanctuary. Examples attached: AMN-EXO table 23, EUROPE-EXO table 24, (cf EUROPE-AMN table 25)

4-Set the size of global air traffic that the planet can support to limit global warming to 1.5°/2° in 2100.

DECISION 1

Decision No. 1 alone reduces the carbon footprint of air transport by 65% and its effect is immediate.

This is a very simplified contribution to stay within the limit of a 1500-word text that I sent to the Citizens' Climate Convention at the beginning of January 2021. It appears in the latest summary in the "getting around" section; as a reminder, the Citizens' Climate Convention had a mandate to reduce greenhouse gas emissions by at least 40% by 2030.

DECISION 2

Regarding **decision #2,** as a partial and very slow recovery of global air transport was expected after the pandemic, we could have used these few months or years of respite without too many planes in the airspace of Siberia, Alaska and the far north of Canada to monitor the temperatures month after month of the winter of 2020 / 2021 and following in order to confirm that the thawing of the permafrost continues to slow down. In reality, the recovery of global air transport has been phenomenal and the immense Siberian anticyclone has resumed its previous warming.

Russian scientists from the Permafrost Institute in Yakutsk are monitoring this process daily, as the thawing of deep permafrost is causing enormous damage to Siberian infrastructure (cities, bridges, railway and road infrastructure, and factories are built on permanently frozen ground), and the costs to the Russian economy are considerable.

It should be noted that Russian air transport is the only one that continues to fly into the Arctic sanctuary to serve Siberian cities, as well as Canadian air transport to serve Inuit territories and American air transport to Alaska, and also to the far north of Europe: Norway, Sweden, and Finland. But these sanctuary territories must not see the development of mass tourism. This is what we are beginning to see in South Antarctica with the development of Antarctic cruises departing from Ushaïa, which must be stopped urgently.

This is reflected on the global warming map in table 20 by an orange zone, namely +2°C, while the dominant colours on this continent are yellow, white or even blue.

The immense anticyclones that form in winter in Antarctica and the Arctic are the two thermal engines that naturally regulate the planet's temperature. Human presence and activities there must be reduced to the bare minimum, that is, reserved solely for the domain of science.

DECISION 3

Regarding **decision no. 3,** it is up to EUROPE to ensure the survival of its air transport as a whole.
The constrained growth of air transport in Europe and worldwide must be strictly regulated by international authorities. The new air routes to avoid the Arctic sanctuary are longer, especially between Asia and North America, with a turning point of 40°N 180°W in the middle of the Pacific. They must be shared according to predefined market shares at the global level because of the strategic domain in order to avoid any trade war.

Non-stop flights, New York-Beijing 4:20 p.m., New York-Tokyo 2:10 p.m., New York-Shanghai 4:15 p.m., New York-Hong Kong 5:30 p.m., will be difficult to endure in economy class without the comfort of a reclining seat and a little more space, which Premium class offers. Chinese, Japanese airlines and all those who still have an Airbus 380 fleet will be at an advantage. The post-Covid 19 period may revive the concept of the very large carrier which gave birth to the A380, an aircraft acclaimed by all passengers for its lack of noise and comfort, and which, moreover, has not killed anyone. Disparaged by European airlines that have failed to make it profitable, there is a fleet of around 50 Airbus 380s (ex IAG, Lufthansa, Air France KLM) practically new, in perfect working order, stored in various French, Spanish, Portuguese or Irish airports.

These planes will no longer fly under their colors; the crews at the end of their careers have been dismissed or forced into compulsory retirement. And these planes and crews taken over by non-European companies should not be allowed to compete with the unrivaled comfort of national airlines restructured at great expense by European states with planes that consume less kerosene to comply with the low-carbon energy transition.

DECISION 4

Regarding decision No. 4, the sizing of European and global air traffic, coordination between all countries is required because the planet cannot hope for better days **without limiting air travel.** We are increasingly seeing that **"The house is burning" since 2002 "and we are looking elsewhere,"** President Chirac's shock phrase is still relevant today.

In July 2019, a worrying historical record should have alerted us: the thermometer exceeded 32°C in Anchorage, Alaska, which had never been seen before, so the air route via Anchorage was not a fallback solution. In September 2019, and for four months, gigantic forest fires in Australia destroyed biodiversity across millions of hectares. In May 2020, Siberia was in flames, pockets of methane exploded and dug deep, impressive craters.

So, as the **President of the High Council for Climate** said in her reasoned opinion to the government, **"This is not the time to support aviation at all costs, but to open the debate on reducing air travel ."** Not to mention **the Citizens' Convention for Climate,** which has completed its work, interrupted by the lockdown, and which, on a number of current issues for the transition to a low-carbon strategy, proposes solutions that are, to say the least, radical against air transport.

The President of the European Commission also established **the European Green Deal** in January 2020 and it is this body that must be consulted before any final and coordinated decision at European level.

That said, the airplane is a fabulous asset that must be preserved. Climbing and sitting in an airplane is buying a dream, but above all, it is a strategic tool for development and freedom, and humanity will not return to animal traction and sailing ships to cross oceans and continents.

8 YEARS OF EXHUBERANT AND IRRATIONAL GROWTH

Table 21 summarizes the periods of runaway climate change in the Arctic and Antarctic observed over the period 2016-2025. These runaway climates are linked to the presence of water vapor in the stratosphere, which has a lifetime of 1500 days and not just 10 days as in the troposphere.

In Antarctica, the water vapor is due to the explosion of the underwater volcano Hunga Tonga on January 15, 2022, which sent 140 million tons of water vapor into the stratosphere of the southern hemisphere. This water vapor is evacuated in winter by the polar vortex and it will take 1,500 days, a little over 4 years, or around February 2026, to see the reduction of the climate runaway and the recovery of the extent of the Antarctic ice pack, which the NSIDC will publish in early February.

In the Arctic, water vapor is due to overflight of the area in the lower stratosphere by World Air Transport until 2019. Since the cessation of this overflight from March 2020 following the covid 19 pandemic and then the war in Ukraine, the climatic runaway has been reduced considerably. But the quantity of water vapor in the Arctic is equivalent to two annual explosions of a Hunga Tonga-type underwater volcano, which explains the difference between the Arctic runaway (7.8°), and only 4.7° in the Antarctic.

To extinguish the fire on our one and only habitable planet, we must return, by the start of the 2027 season, to an average air traffic level substantially limited to that reached in 2025.

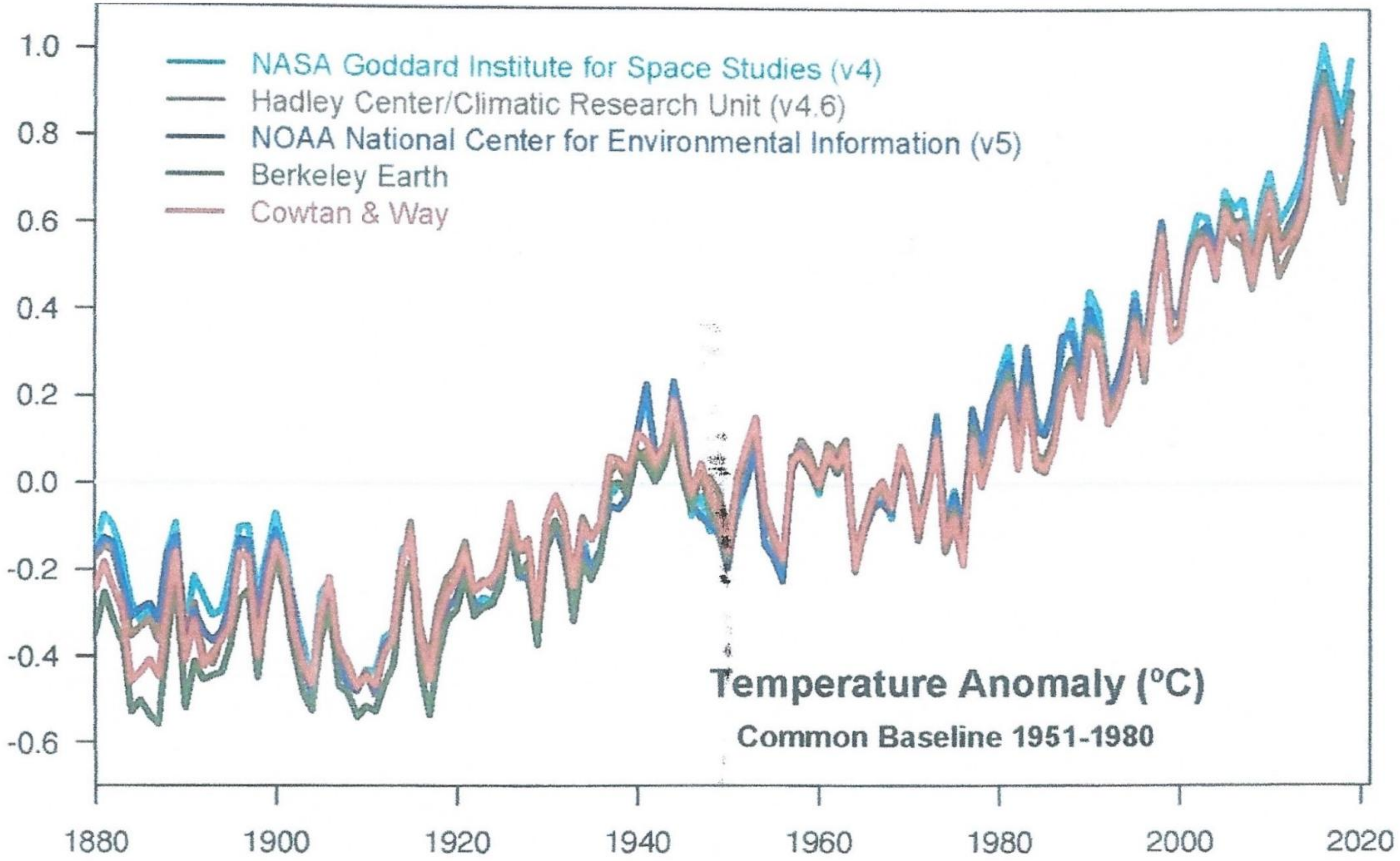
Which amounts to cancelling the future, exuberant and irrational growth of the NEXT 25 YEARS and not seeing global air transport double and reach 9 billion passengers in 2050.

In Europe and around the world, with this limitation on the growth of air transport for the survival of the planet, the tourism industry, aircraft manufacturers and subcontractors, airlines, and cruise lines with their 8,000-passenger floating palaces will be seriously impacted. But we cannot revive the growth of these activities without worrying about their impact on the climate.

CONCLUSION

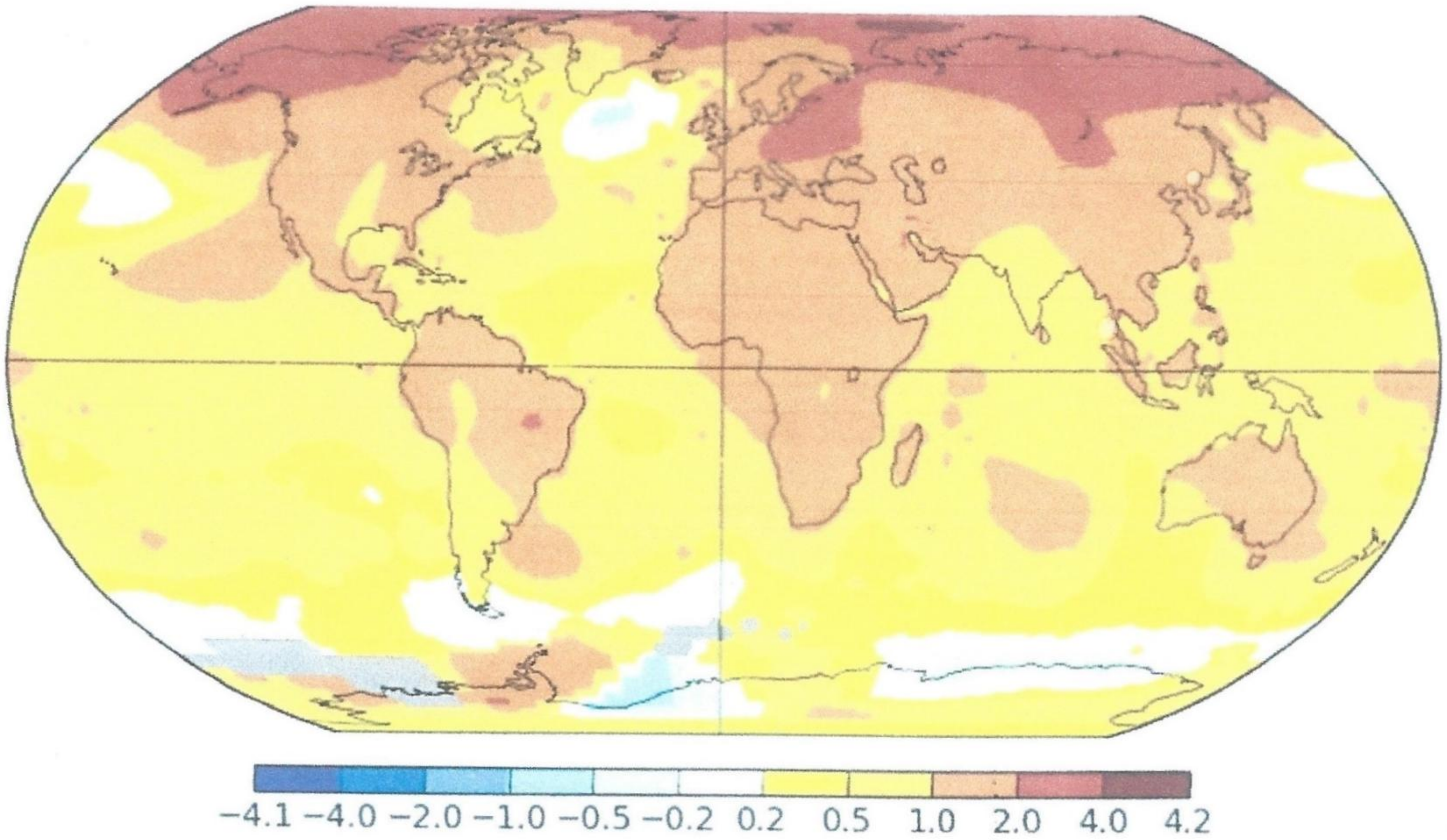
A formidable battle against an invisible enemy was waged in hospitals by the public and private health services of each country. As front-line infantrymen and with limited resources, they ended up admirably overcoming the first wave (the loss of human life is significant but should be put into perspective compared to the 50 million deaths in three successive waves of the Spanish flu of 1918/1919. The constraints are badly experienced by the populations but these populations not being immune it was necessary to wait for the vaccine to declare victory and resume activity in air transport without closing borders. The States to restart the economic machine have committed astronomical sums, we are talking about 5000 billion dollars but we must not forget that what is before us is the **total war against the climate runaway** which will cause millions of deaths (natural disasters, cyclones, tornadoes, rising waters, floods, climate refugees, shortages, pandemics, famines ...) if humanity does not manage to contain global warming to less than 2 degrees in 2100. And it is this war that will have to be won, it will take perhaps ten years until 2035. This requires a general mobilization of businesses, political decision-makers, banks, researchers, engineers, technicians, workers, builders and farmers. The rich countries and their global oil companies, whose activities are largely responsible for global warming, currently have all the technical and financial means and know-how to **cool and air-condition the planet** (IPCC RCP2.6 scenario) so that it can accommodate and feed the world population expected in 2050.

TEMPERATURE ANOMALY



Évolution des températures globales entre 1880 et 2019 selon 5 jeux de données différents. Les valeurs sont données en anomalie par rapport à la référence 1951-1980. Crédits : NASA GISS/Gavin Schmidt.

GLOBAL GLOBAL WARMING PERIOD 2015-2019/ REF 1951-1980

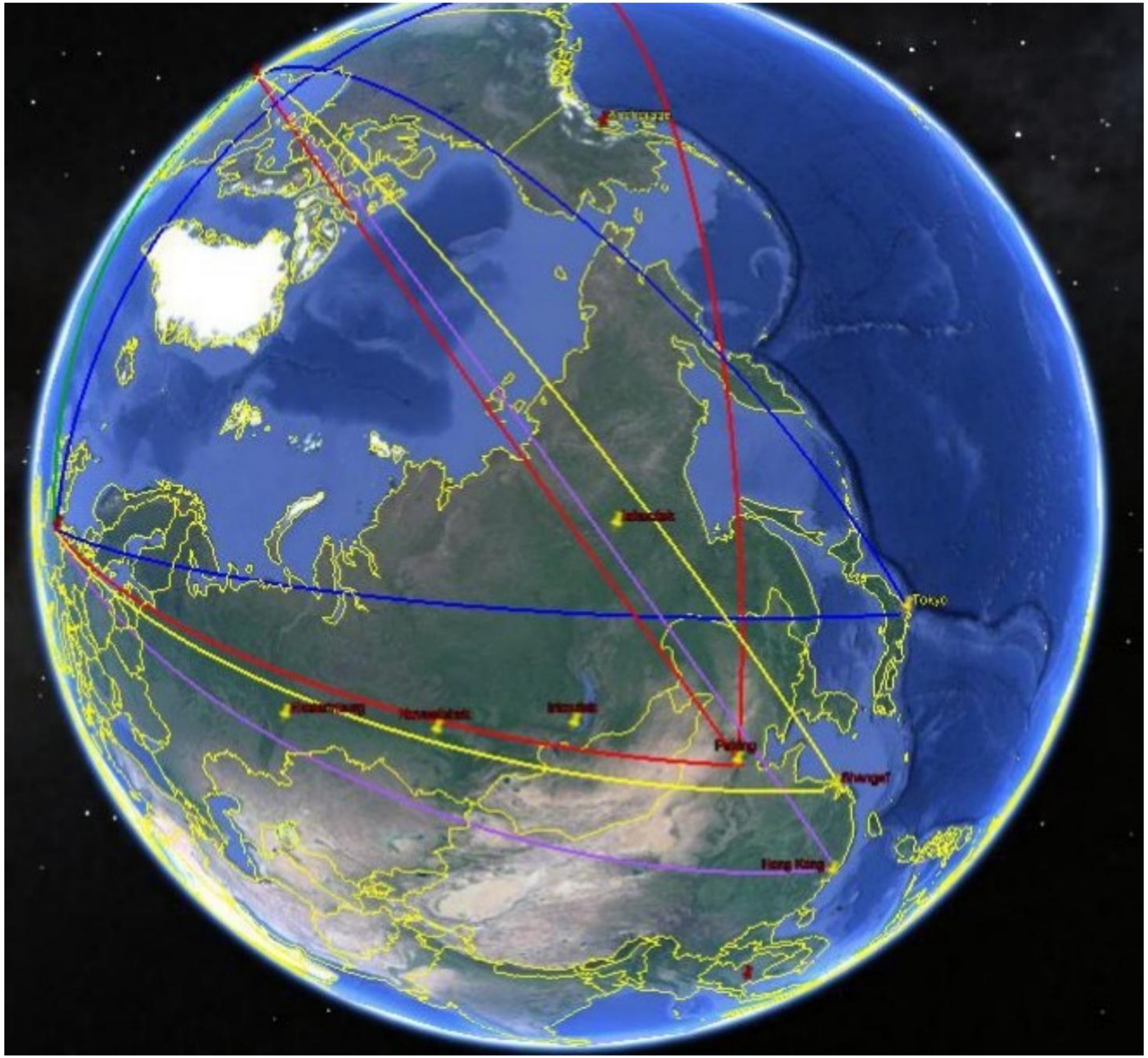


Anomalie de la période 2015-2019 par rapport à la référence 1951-1980.
En outre, notez la petite plage froide dans le nord-atlantique. Une signature éventuelle du ralentissement de la circulation océanique dans ce secteur.
Crédits : NASA/GISS.

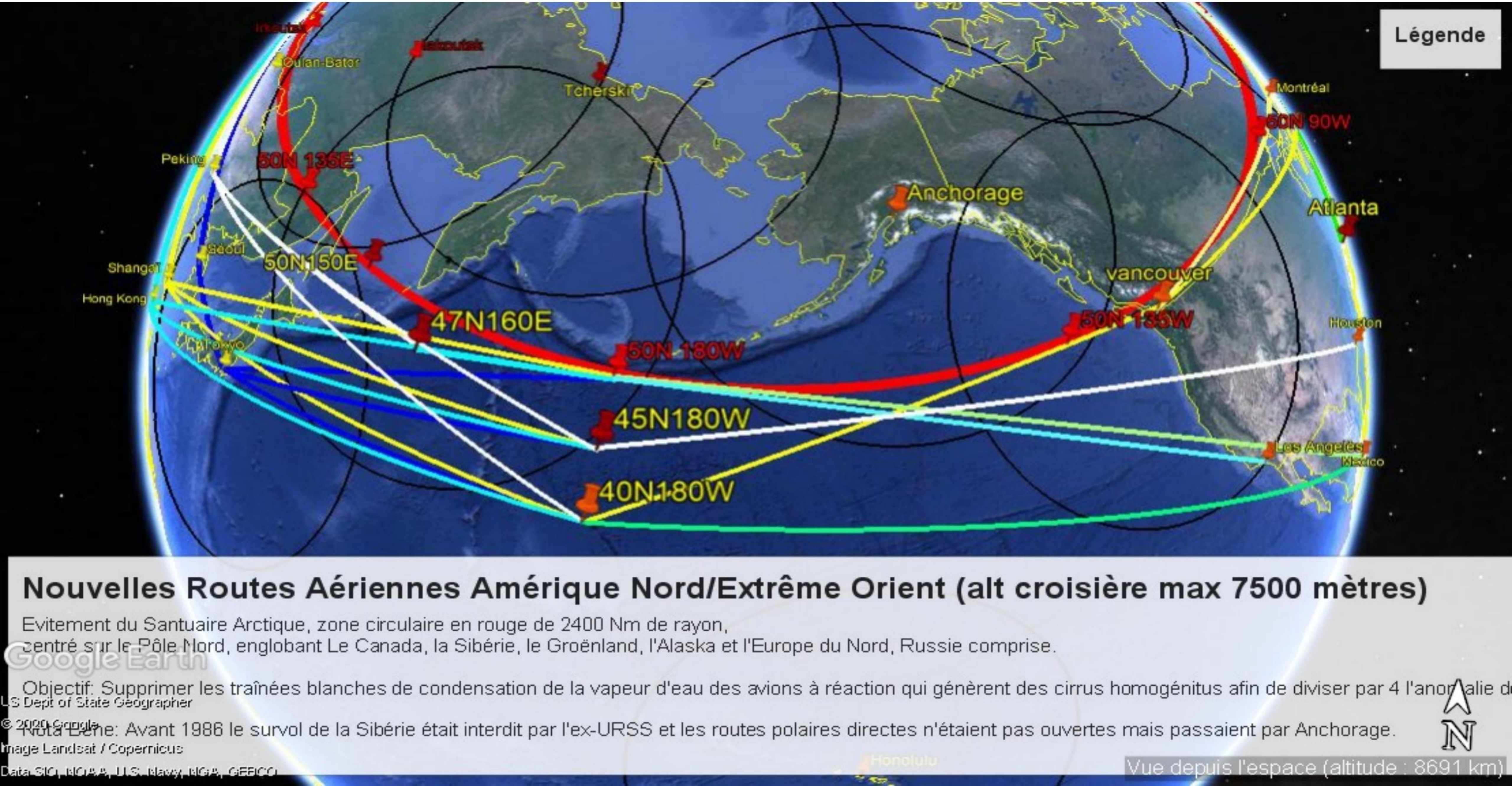
ARCTIC AND ANTARCTIC CLIMATE RUNAWAY

Years	Season	Temperature Range			Temperature Range			Temperature	Notes/Origin/Causes
		Arcti Ice Shelf	Arctic Ice Shelf	Antar Ice Shelf	Antarctic Ice Shelf			Average Annual	
		Mkm2	Mini	Maxi	Mkm2	Mini	Maxi	terrestrial globe	
2015 Year	Nov Oct	10,566	0.5°	4°	12,414	_1°	2° 0.79°		
	HN winter Nov Apr		2°	4.6°		_1°	1°	0.78°	
	HN summer. May Oct		0.5°	4°		_1°	2°	0.79°	
2016 Year	Nov Oct	10,163 2°		4.6°	11,202	_0.5°	1°	0.94°	
	HN winter Nov Apr		2°	6.2°		0	1°	1.02° 1st	Winter with runaway air conditioning
	HN summer. May Oct		2°	4°		_1°	1°	0.87°	Arctic at +6.2°
2017 Year	Nov Oct	10,393	2°	5.1° 10.749 7.8°		0.2°	1°	0.99°	
	HN winter Nov Apr		2°			0.5°	2°	1.11°	Warmest winter in the Arctic at +7.8°
	HN summer. May Oct		0.5°	4°		0	2°	0.86°	
2018 Year	Nov Oct	10,355	2°	4.5°	11	0.5°	2°	0.89°	
	HN winter Nov Apr		2°	6.8°		1°	2°	0.95°	very warm winter in the Arctic at +6.8°
	HN summer. May Oct		1°	4°		0.5° 1°	2°	0.83°	
2019 Year	Nov Oct	10,201	2°	4° 10.876 6.9° 4°			2°	0.90°	
	HN winter Nov Apr		2°			1°	2°	0.93°	Winter still very warm Arctic at 6.9°
	HN summer. May Oct		2°			0.5°	4°	0.88°	
2020 Year	Nov Oct	10.15	2°	4.7°	11,602	0.5°	4°	0.99°	Covid 19 pandemic (11/16/2019)
	HN winter Nov Apr		2°	5.4°		1°	2°	1.06°	Arctic Flight Stop March 2020
	HN summer. May Oct		2°	4°		0.2	2°	0.92	From summer 2020, the rush is dropping
2021 Year	Nov Oct	10,552	2°	4.7°	11,579	_05°	2°	0.94°	Arctic climate due to decline in
	HN winter Nov Apr		2°	5.7°		0	1°	0.99°	water vapor in the stratosphere
	HN summer. May Oct		1°	4°		_0.5° 0°	2°	0.90°	
2022 Year	Nov Oct	10,661	1°	4°	10,726		2°	0.89°	01/15/2022 Underwater volcano exploration
	HN winter Nov Apr		2°	5°		0°	1°	088°	HungaTonga 140 Million T steam 0.91 of water
	HN summer. May Oct		1°	4°		0°	2°		sent into the stratosphere
2023 Year	Nov Oct	10,469	1°	4°	9,931	0.2°	4.1°	1°	In full year 2nd Stop Arctic runaway after
	HN winter Nov Apr		1°	4.5° 4°		_0.5°	2°	0.93°	2022
	HN summer. May Oct		1°			0.5°	4.7°	1.07°	Winter HS Climate change
2024 Year	Nov Oct	10,391	1°	4°	10,461	0°	4°	1.19°	Antarctica +4.7° but less significant temperature rise
	HN winter Nov Apr		2°	5°		_1°	2°	1.15°	
	HN summer. May Oct		2°	4°		1°	4°	1.22°	24 hottest year on Earth
2025 Year	Nov Oct								

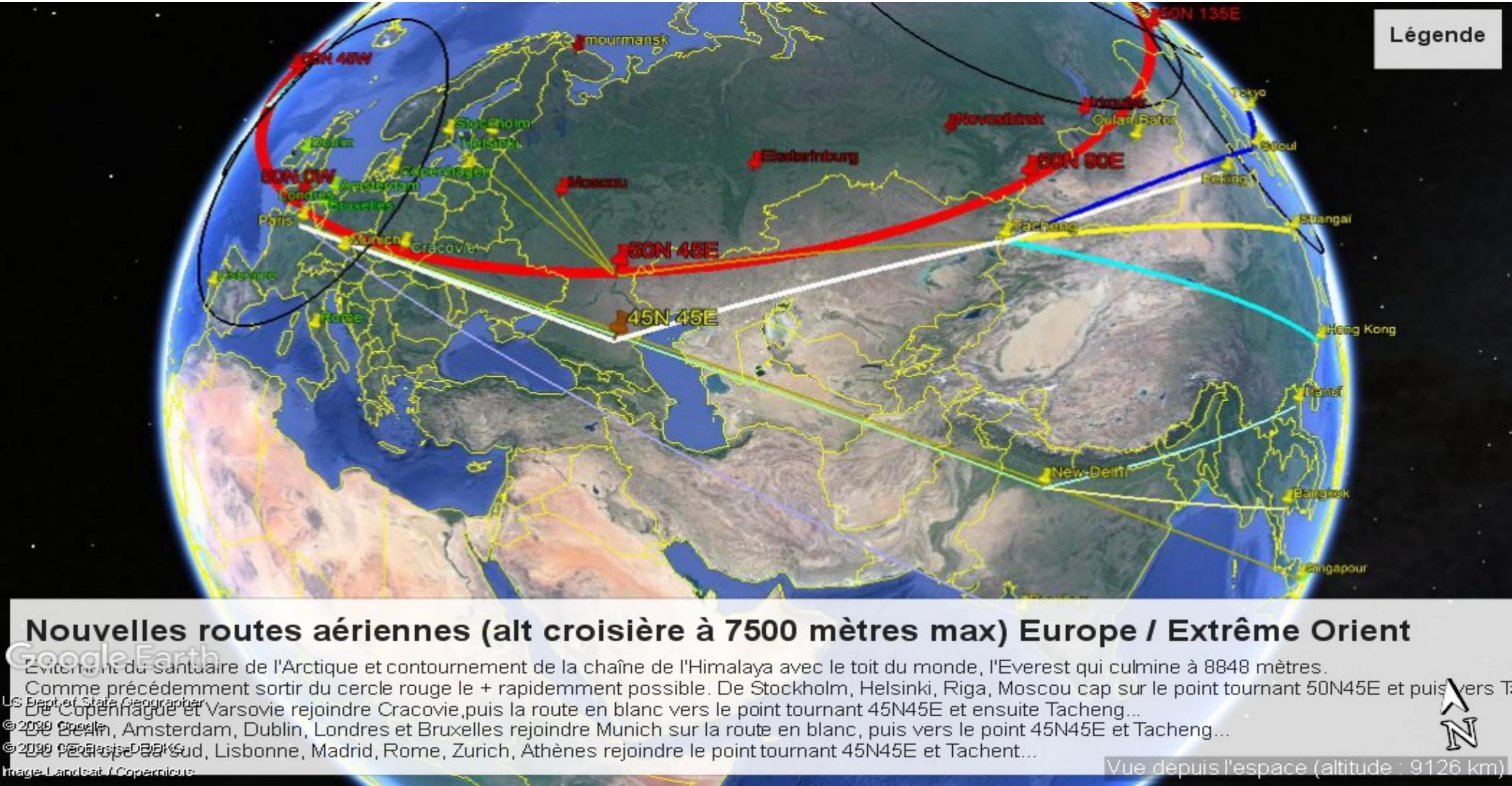
CURRENT OVERFLIGHT OF SIBERIA FLIGHTS EUROPE FAR EAST NORTH AMERICA



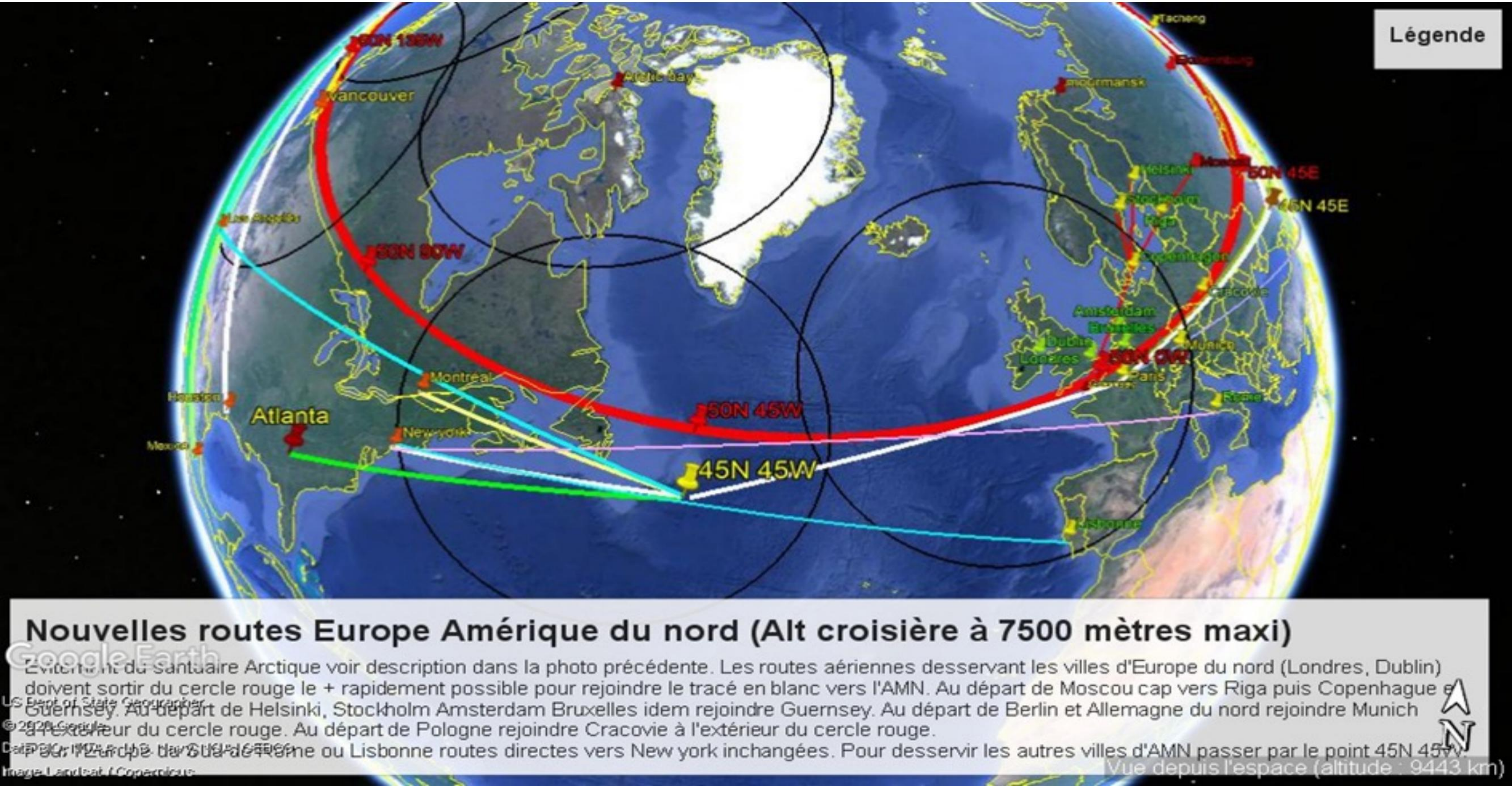
NEW AMN-EXO AIR ROUTES (max cruising altitude 7500 meters)



NEW AIR ROUTES EUROPE –EXO (max cruising altitude 7500 meters)



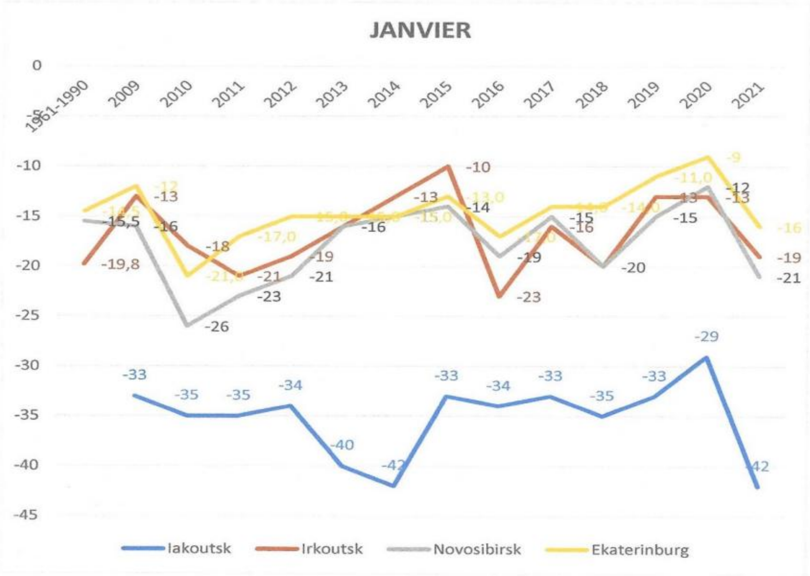
NEW EUROPE AMN AIR ROUTES (max cruising altitude 7500 meters)



JANUARY

Relevé de température moyenne de l'anticyclone sibérien de 2009 à 2020

JANVIER	Iakoutsk	Irkoutsk	Novosibi	Ekaterinl	écart Iako	à la Irko	moy Novo	mois Ekat	écart moy t°anticyclone		
1961-1990		-19,8	-15,5	-14,5		-2,4	4,9	1,5	1,33	moy mens	
2009	-33	-13	-16	-12	2,4	4,4	4,4	4,0	3,80	réchauf	
2010	-35	-18	-26	-21,0	0,4	-0,6	-5,6	-5,0	-2,70	climat	
2011	-35	-21	-23	-17,0	0,4	-3,6	-2,6	-1,0	-1,70	depuis	
2012	-34	-19	-21	-15,0	1,4	-1,6	-0,6	1,0	0,05	1961/1990	
2013	-40	-16	-16	-15,0	-4,6	1,4	4,4	1,0	0,55		
2014	-42	-13	-15	-15,0	-6,6	4,4	5,4	1,0	1,05		
2015	-33	-10	-14	-13,0	2,4	7,4	6,4	3,0	4,80		
2016	-34	-23	-19	-17,0	1,4	-5,6	1,4	-1,0	-0,95		
2017	-33	-16	-15	-14,0	2,4	1,4	5,4	2,0	2,80		
2018	-35	-20	-20	-14,0	0,4	-2,6	0,4	2,0	0,05		
2019	-33	-13	-15	-11,0	2,4	4,4	5,4	5,0	4,30		2,97
2020	-29	-13	-12	-9	6,4	4,4	8,4	7,0	6,55		5,22
2021	-42	-19	-21	-16	-6,6	-1,6	-0,6	0,0	-2,20		-3,53
moy T /5 ans	-35,4	-17,4	-20,4	-16,0							
2019											
moy P /mois	1029	1037,0	1034	1023							
moy H /mois	0,96	0,89	0,95	0,92							
2020											
moy P /mois	1025	1031	1025	1016							
moy H /mois	0,99	0,91	0,96	0,93							
2021											
moy P /mois	1034	1037,00	1040,00	1031,00							
moy H /mois	0,98	0,95	0,96	0,95							



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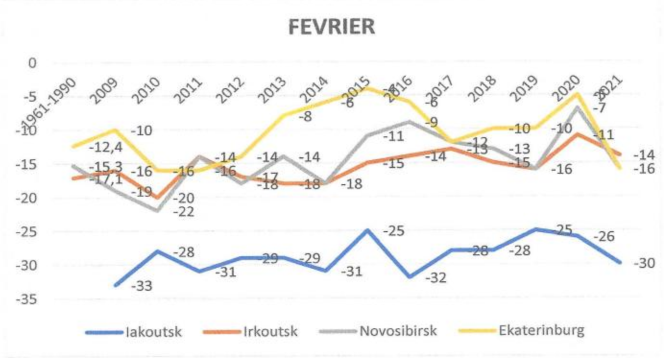
FEBRUARY

Relevé de température moyenne de l'anticyclone sibérien de 2009 à 2020

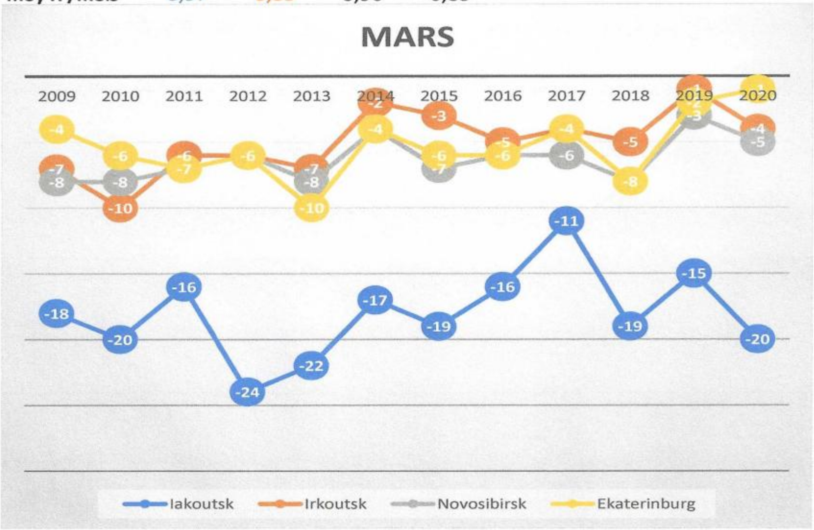
FEVRIER	Iakoutsk	Irkoutsk	Novosibi	Ekaterinl	écart Iako	à la Irko	moy Novo	mois Ekat	écart moy t°anticyclone	
1961-1990		-17,1	-15,3	-12,4		-0,1	2,1	0,4	0,80	moy mens
2009	-33	-16	-19	-10	-3,0	1,0	-1,6	2,8	-0,20	réchauf
2010	-28	-20	-22	-16	2,0	-3,0	-4,6	-3,2	-2,20	climat
2011	-31	-14	-14	-16	-1,0	3,0	3,4	-3,2	0,55	depuis
2012	-29	-17	-18	-14	1,0	0,0	-0,6	-1,2	-0,20	1961/1990
2013	-29	-18	-14	-8	1,0	-1,0	3,4	4,8	2,05	
2014	-31	-18	-18	-6	-1,0	-1,0	-0,6	6,8	1,05	
2015	-25	-15	-11	-4	5,0	2,0	6,4	8,8	5,55	
2016	-32	-14	-9	-6	-2,0	3,0	8,4	6,8	4,05	
2017	-28	-13	-12	-12	2,0	4,0	5,4	0,8	3,05	
2018	-28	-15	-13	-10	2,0	2,0	4,4	2,8	2,80	
2019	-25	-16	-16	-10	5,0	1,0	1,4	2,8	2,55	1,75
2020	-26	-11	-7	-5	4,0	6,0	10,4	7,8	7,05	6,25
2021	-30	-14	-16	-16	0,0	3,0	1,4	-3,2	0,30	-0,50
moy T /5 ans	-30,0	-17,0	-17,4	-12,8						
1019										
moy P /mois	1021	1038	1033	1022						
moy H /mois	0,92	0,87	0,94	0,93						
2020										
moy P /mois	1029	1033	1027	1017						
moy H /mois	0,97	0,91	0,96	0,92						
2021										
moy P /mois	1028	1032	1030	1021						
moy H /mois	0,96	0,93	0,95	0,94						
moy H /mois	1,0									



MARCH

Relevé de température moyenne en Russie de 2009 à 2020

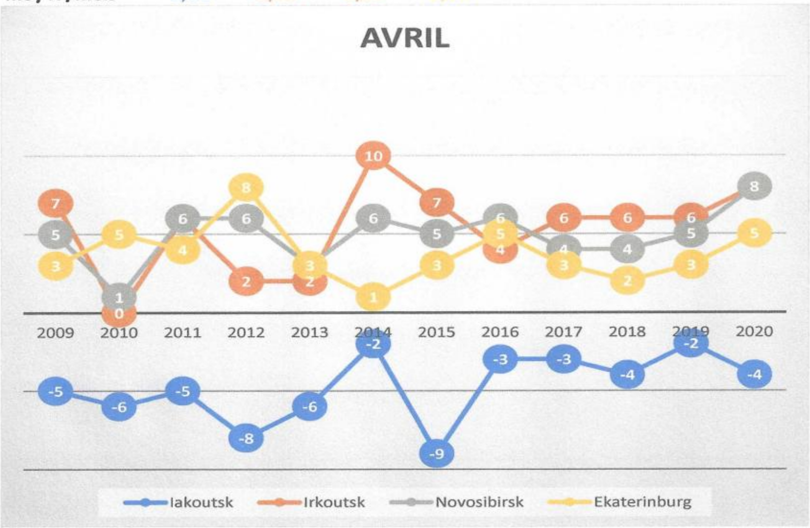
					écart	à la	moy	mois	écart moy	
MARS	Iakoutsk	Irkoutsk	Novosibi	Ekaterinl	Iako	Irko	Novo	Ekat	t°anticyclone	
1961-1990		-9,1	-7,4	-5,4		**-1,9**	**0,0**	**1,2**	-0,23	moy mens
2009	-18	-7	-8	-4	2	0,2	-0,6	2,6	1,05	réchauf
2010	-20	-10	-8	-6	0	-2,8	-0,6	0,6	-0,70	climat
2011	-16	-6	-7	-7	4	1,2	0,4	-0,4	1,30	depuis
2012	-24	-6	-6	-6	-4	1,2	1,4	0,6	-0,20	1961/1990
2013	-22	-7	-8	-10	-2	0,2	-0,6	-3,4	-1,45	
2014	-17	-2	-4	-4	3	5,2	3,4	2,6	3,55	
2015	-19	-3	-7	-6	1	4,2	0,4	0,6	1,55	
2016	-16	-5	-6	-6	4	2,2	1,4	0,6	2,05	
2017	-11	-4	-6	-4	9	3,2	1,4	2,6	4,05	
2018	-19	-5	-8	-8	1	2,2	-0,6	-1,4	0,30	
2019	-15	-1	-3	-2	5	6,2	4,4	4,6	5,05	5,28
2020	-20	-4	-5	-1	0	3,2	2,4	5,6	2,80	3,03
2021										
moy T /5 ans	-20,0	-7,2	-7,4	-6,6						
2019										
moy P /mois	1019	1028	1028	1017						
moy H /mois	0,87	0,89	0,96	0,87						
2020										
moy P /mois	1015	1027	1027	1022						
moy H /mois	0,97	0,85	0,96	0,89						



APRIL

Relevé de température moyenne en Russie de 2009 à 2020

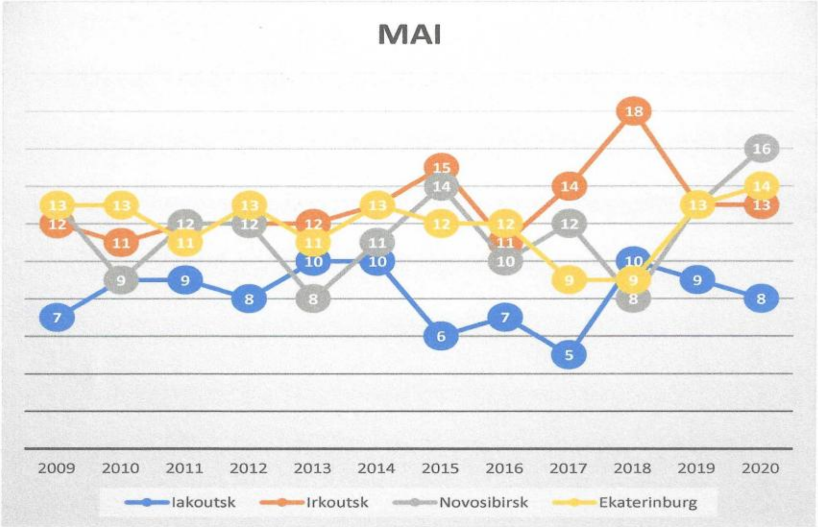
AVRIL	Iakoutsk	Irkoutsk	Novosibi	Ekaterin	écart à la moy mois Iako	Irko	Novo	Ekat	écart moy t°anticyclone	
1961-1990		0,3	1,2	3,4		-3,1	-3,0	-1,2	-2,43	moy mens
2009	-5	7	5	3	1	3,6	0,8	-1,6	0,95	réchauf
2010	-6	0	1	5	0	-3,4	-3,2	0,4	-1,55	climat
2011	-5	6	6	4	1	2,6	1,8	-0,6	1,20	depuis
2012	-8	2	6	8	-2	-1,4	1,8	3,4	0,45	1961/1990
2013	-6	2	3	3	0	-1,4	-1,2	-1,6	-1,05	
2014	-2	10	6	1	4	6,6	1,8	-3,6	2,20	
2015	-9	7	5	3	-3	3,6	0,8	-1,6	-0,05	
2016	-3	4	6	5	3	0,6	1,8	0,4	1,45	
2017	-3	6	4	3	3	2,6	-0,2	-1,6	0,95	
2018	-4	6	4	2	2	2,6	-0,2	-2,6	0,45	
2019	-2	6	5	3	4	2,6	0,8	-1,6	1,45	3,88
2020	-4	8	8	5	2	4,6	3,8	0,4	2,70	5,13
2021										
moy T /5 ans	-6,0	3,4	4,2	4,6						
2019										
moy P /mois	1013	1023	1022	1023						
moy H /mois	0,74	0,62	0,65	0,72						
2020										
moy P /mois	1022	1028	1025	1012						
moy H /mois	0,91	0,69	0,86	0,85						



MAY

Relevé de température moyenne de l'anticyclone sibérien de 2009 à 2020

MAI	Iakoutsk	Irkoutsk	Novosibi	Ekaterinl	écart Iako	à la Irko	moy Novo	mois Ekat	écart moy t°anticyclone	
1961-1990		8,3	10,1	9,7		-3,5	-0,7	-2,5	-2,23	moy mens
2009	7	12	13	13	-1,6	0,2	2,2	0,8	0,40	réchauf
2010	9	11	9	13	0,4	-0,8	-1,8	0,8	-0,35	climat
2011	9	12	12	11	0,4	0,2	1,2	-1,2	0,15	depuis
2012	8	12	12	13	-0,6	0,2	1,2	0,8	0,40	1961/1990
2013	10	12	8	11	1,4	0,2	-2,8	-1,2	-0,60	
2014	10	13	11	13	1,4	1,2	0,2	0,8	0,90	
2015	6	15	14	12	-2,6	3,2	3,2	-0,2	0,90	
2016	7	11	10	12	-1,6	-0,8	-0,8	-0,2	-0,85	
2017	5	14	12	9	-3,6	2,2	1,2	-3,2	-0,85	
2018	10	18	8	9	1,4	6,2	-2,8	-3,2	0,40	
2019	9	13	13	13	0,4	1,2	2,2	0,8	1,15	3,38
2020	8	13	16	14	-0,6	1,2	5,2	1,8	1,90	4,13
2021										
moy T /5 ans	8,6	11,8	10,8	12,2						
2019										
moy P /mois	1010	1021	1021	1018						
moy H /mois	0,42	0,53	0,45	0,63						
2020										
moy P /mois	1010	1018	1019	1017						
moy H /mois	0,78	0,71	0,79	0,78						



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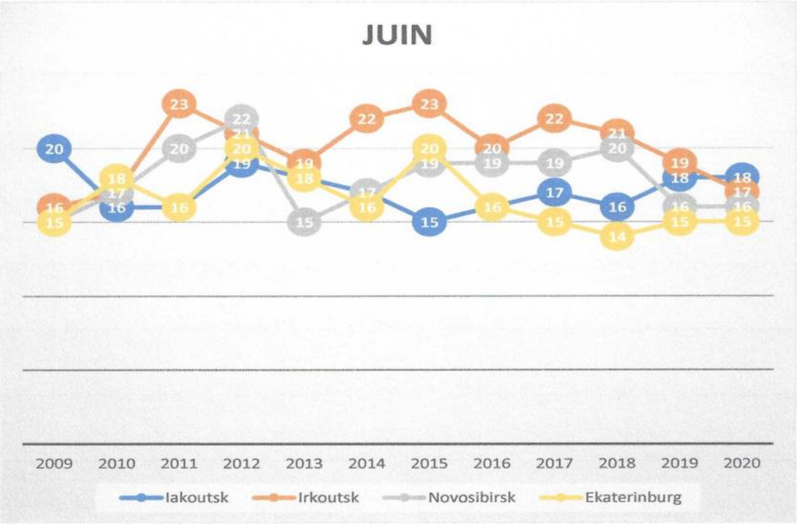
JUNE

Relevé de température moyenne de l'anticyclone sibérien de 2009 à 2020

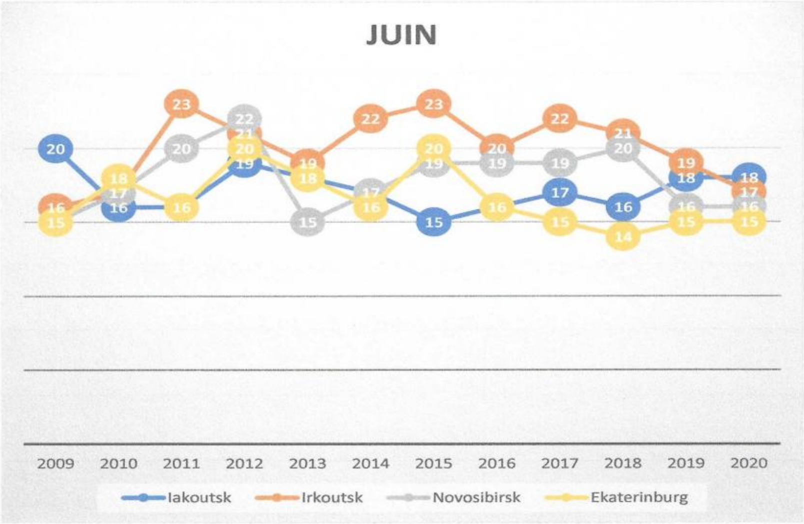
moyenne/an					ecart	à la	moy	mois	écart moy		
JUIN	Iakoutsk	Irkoutsk	Novosibi	Ekaterinl	Iako	Irko	Novo	Ekat	t°anticyclone		
1961-1990		13,3	16	16,7		-5,9	-1,8	-0,7	-2,80	moy mens	
2009	20	16	15	15	2,2	-3,2	-2,8	-2,4	-1,55	réchauf	
2010	16	17	17	18	-1,8	-2,2	-0,8	0,6	-1,05	climat	
2011	16	23	20	16	-1,8	3,8	2,2	-1,4	0,70	depuis	
2012	19	21	22	20	1,2	1,8	4,2	2,6	2,45	1961/1990	
2013	18	19	15	18	0,2	-0,2	-2,8	0,6	-0,55		
2014	17	22	17	16	-0,8	2,8	-0,8	-1,4	-0,05		
2015	15	23	19	20	-2,8	3,8	1,2	2,6	1,20		
2016	16	20	19	16	-1,8	0,8	1,2	-1,4	-0,30		
2017	17	22	19	15	-0,8	2,8	1,2	-2,4	0,20		
2018	16	21	20	14	-1,8	1,8	2,2	-3,4	-0,30		
2019	18	19	16	15	0,2	-0,2	-1,8	-2,4	-1,05		1,75
2020	18	17	16	15	0,2	-2,2	-1,8	-2,4	-1,55		1,25
2021											
moy T /5 ans	17,8	19,2	17,8	17,4							
2019											
moy P /mois	1009	1011	1010	1014							
moy H /mois	0,34	0,75	0,73	0,66							
2020											
moy P /mois	1009	1009	1013	1017							
moy H /mois	0,79	0,78	0,87	0,79							



JULY

Relevé de température moyenne de l'anticyclone sibérien de 2009 à 2020

moyenne/an					ecart	à la	moy	mois	écart moy		
JUIN	**Iakoutsk**	**Irkoutsk**	Novosibi	**Ekaterinl**	Iako	Irko	Novo	Ekat	t°anticyclone		
1961-1990		**13,3**	16	**16,7**		-5,9	-1,8	-0,7	-2,80	moy mens	
2009	20	16	15	15	2,2	-3,2	-2,8	-2,4	-1,55	réchauf	
2010	16	17	17	18	-1,8	-2,2	-0,8	0,6	-1,05	climat	
2011	16	23	20	16	-1,8	3,8	2,2	-1,4	0,70	depuis	
2012	19	21	22	20	1,2	1,8	4,2	2,6	2,45	1961/1990	
2013	18	19	15	18	0,2	-0,2	-2,8	0,6	-0,55		
2014	17	22	17	16	-0,8	2,8	-0,8	-1,4	-0,05		
2015	15	23	19	20	-2,8	3,8	1,2	2,6	1,20		
2016	16	20	19	16	-1,8	0,8	1,2	-1,4	-0,30		
2017	17	22	19	15	-0,8	2,8	1,2	-2,4	0,20		
2018	16	21	20	14	-1,8	1,8	2,2	-3,4	-0,30		
2019	18	19	16	15	0,2	-0,2	-1,8	-2,4	-1,05		1,75
2020	18	17	16	15	0,2	-2,2	-1,8	-2,4	-1,55		1,25
2021											
moy T /5 ans	17,8	19,2	17,8	17,4							
2019											
moy P /mois	1009	1011	1010	1014							
moy H /mois	0,34	0,75	0,73	0,66							
2020											
moy P /mois	1009	1009	1013	1017							
moy H /mois	0,79	0,78	0,87	0,79							



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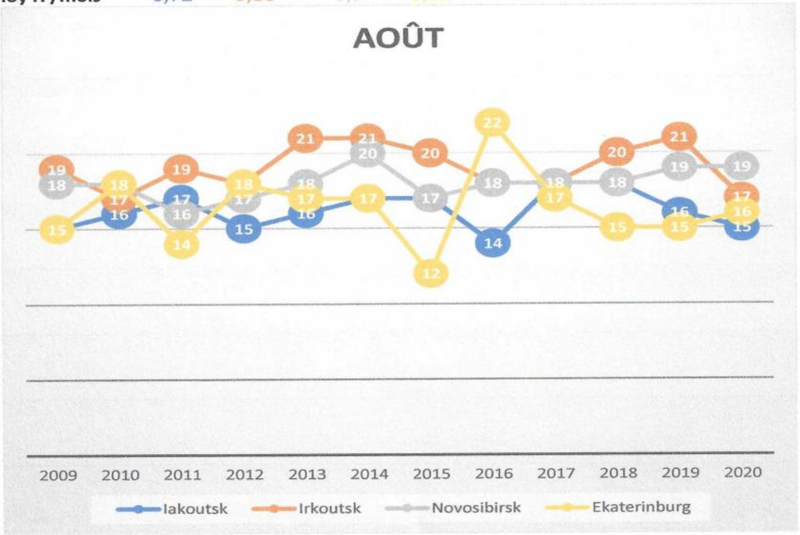
AUGUST

Relevé de température moyenne de l'anticyclone sibérien de 2009 à 2020

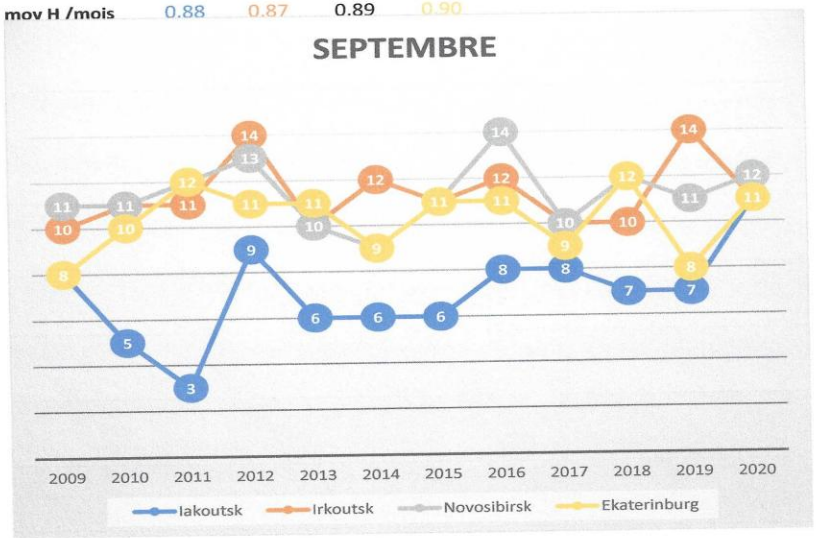
AOUT	Iakoutsk	Irkoutsk	Novosibi	Ekaterini	écart Iako	à la Irko	moy Novo	mois Ekat	écart moy t°anticyclone	
1961-1990		14,6	16,2	15,3		-4,2	-1,2	-1,1	-2,17	moy mens
2009	15	19	18	15	-0,8	0,2	0,6	-1,4	-0,35	réchauf
2010	16	17	18	18	0,2	-1,8	0,6	1,6	0,15	climat
2011	17	19	16	14	1,2	0,2	-1,4	-2,4	-0,60	depuis
2012	15	18	17	18	-0,8	-0,8	-0,4	1,6	-0,10	1961/1990
2013	16	21	18	17	0,2	2,2	0,6	0,6	0,90	
2014	17	21	20	17	1,2	2,2	2,6	0,6	1,65	
2015	17	20	17	12	1,2	1,2	-0,4	-4,4	-0,60	
2016	14	18	18	22	-1,8	-0,8	0,6	5,6	0,90	
2017	18	18	18	17	2,2	-0,8	0,6	0,6	0,65	
2018	18	20	18	15	2,2	1,2	0,6	-1,4	0,65	
2019	16	21	19	15	0,2	2,2	1,6	-1,4	0,65	2,82
2020	15	17	19	16	-0,8	-1,8	1,6	-0,4	-0,35	1,82
2021										
moy T /5 ans	15,8	18,8	17,4	16,4						
2019										
moy P /mois	1012	1015	1013	1011						
moy H /mois	0,57	0,70	0,69	0,86						
2020										
moy P /mois	1013	1010	1010	1010						
moy H /mois	0,72	0,86	0,9	0,92						



SEPTEMBER

Relevé de température moyenne de l'anticyclone sibérien de 2009 à 2020

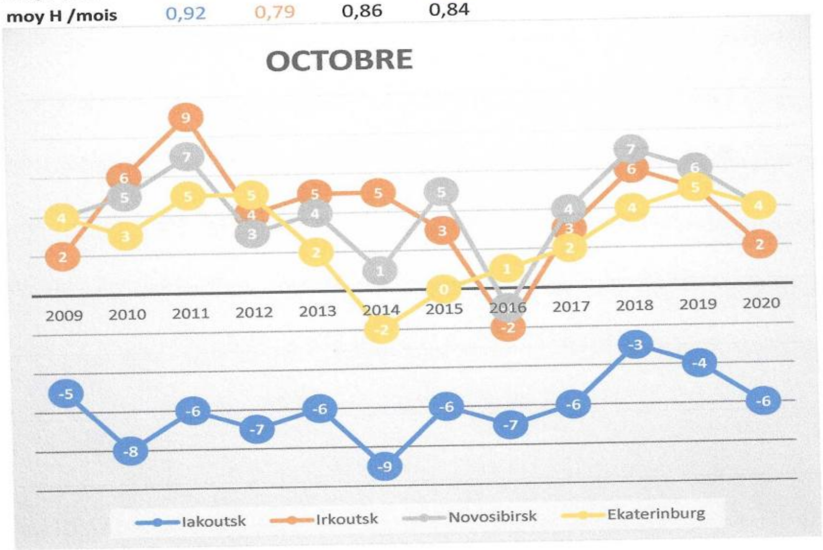
SEPTEMBRE	Iakoutsk	Irkoutsk	Novosibi	Ekaterinl	écart Iako	à la Irko	moy Novo	mois Ekat	écart moy t°anticyclone		
1961-1990		8	10,1	9,1		-3,2	-1,3	-1,3	-1,93	moy mens	
2009	8	10	11	8	1,8	-1,2	-0,4	-2,4	-0,55	réchauf	
2010	5	11	11	10	-1,2	-0,2	-0,4	-0,4	-0,55	climat	
2011	3	11	12	12	-3,2	-0,2	0,6	1,6	-0,30	depuis	
2012	9	14	13	11	2,8	2,8	1,6	0,6	1,95	1961/1990	
2013	6	10	10	11	-0,2	-1,2	-1,4	0,6	-0,55		
2014	6	12	9	9	-0,2	0,8	-2,4	-1,4	-0,80		
2015	6	11	11	11	-0,2	-0,2	-0,4	0,6	-0,05		
2016	8	12	14	11	1,8	0,8	2,6	0,6	1,45		
2017	8	10	10	9	1,8	-1,2	-1,4	-1,4	-0,55		
2018	7	10	12	12	0,8	-1,2	0,6	1,6	0,45		
2019	7	14	11	8	0,8	2,8	-0,3	-2,4	0,23		2,16
2020	11	11	12	11	4,8	-0,2	0,7	0,6	1,48		3,41
2021											
moy T /5 ans	6,2	11,2	11,4	10,4							
2019											
moy P /mois	1017	1020	1018	1016							
moy H /mois	0,79	0,75	0,76	0,87							
2020											
moy P /mois	1019	1020	1019	1020							
moy H /mois	0.88	0.87	0.89	0.90							



OCTOBER

Relevé de température moyenne de l'anticyclone sibérien de 2009 à 2020

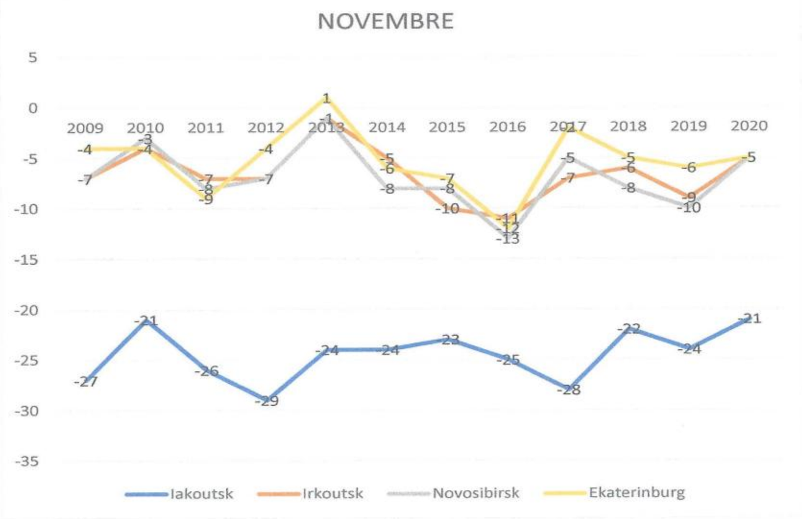
OCTOBRE	Iakoutsk	Irkoutsk	Novosibi	Ekaterinl	écart Iako	à la Irko	moy Novo	mois Ekat	écart moy t°anticyclone		
1961-1990		-0,1	1,9	2,1		-5,3	-2,7	-1,7	-3,23	moy mens	
2009	-5	2	4	4	1,4	-3,2	-0,6	0,2	-0,55	réchauf	
2010	-8	6	5	3	-1,6	0,8	0,4	-0,8	-0,30	climat	
2011	-6	9	7	5	0,4	3,8	2,4	1,2	1,95	depuis	
2012	-7	4	3	5	-0,6	-1,2	-1,6	1,2	-0,55	1961/1990	
2013	-6	5	4	2	0,4	-0,2	-0,6	-1,8	-0,55		
2014	-9	5	1	-2	-2,6	-0,2	-3,6	-5,8	-3,05		
2015	-6	3	5	0	0,4	-2,2	0,4	-3,8	-1,30		
2016	-7	-2	-1	1	-0,6	-7,2	-5,6	-2,8	-4,05		
2017	-6	3	4	2	0,4	-2,2	-0,6	-1,8	-1,05		
2018	-3	6	7	4	3,4	0,8	2,4	0,2	1,70		
2019	-4	5	6	5	2,4	-0,2	1,4	1,2	1,20		4,43
2020	-6	2	4	4	0,4	-3,2	-0,6	0,2	-0,80		2,43
2021											
moy T /5 ans	-6,4	5,2	4,6	3,8							
2019											
moy P /mois	1017	1028	1024	1019							
moy H /mois	0,79	0,63	0,78	0,83							
2020											
moy P /mois	1020	1027	1025	1026							
moy H /mois	0,92	0,79	0,86	0,84							



NOVEMBER

Relevé de température moyenne de l'anticycone sibérien de 2009 à 2020

NOVEMBRE	Iakoutsk	Irkoutsk	Novosibi	Ekaterinl	écart Iako	à la Irko	moy Novo	mois Ekat	écart moy t°anticyclone	
1961-1990		-9,8	-8,2	-7,1		-4,6	-3,0	-3,1	-3,57	moy mens
2009	-27	-7	-7	-4	-1,6	-1,8	-1,8	0,0	-1,30	réchauf
2010	-21	-4	-3	-4	4,4	1,2	2,2	0,0	1,95	climat
2011	-26	-7	-8	-9	-0,6	-1,8	-2,8	-5,0	-2,55	depuis
2012	-29	-7	-7	-4	-3,6	-1,8	-1,8	0,0	-1,80	1961/1990
2013	-24	-1	-1	1	1,4	4,2	4,2	5,0	3,70	
2014	-24	-5	-8	-6	1,4	0,2	-2,8	-2,0	-0,80	
2015	-23	-10	-8	-7	2,4	-4,8	-2,8	-3,0	-2,05	
2016	-25	-11	-13	-12	0,4	-5,8	-7,8	-8,0	-5,30	
2017	-28	-7	-5	-2	-2,6	-1,8	0,2	2,0	-0,55	
2018	-22	-6	-8	-5	3,4	-0,8	-2,8	-1,0	-0,30	
2019	-24	-9	-10	-6	1,4	-3,8	-4,8	-2,0	-2,30	1,27
2020	-21	-5	-5	-5	4,4	0,2	0,2	-1,0	0,95	4,52
2021										
moy T /5 ans	-25,4	-5,2	-5,2	-4,0						
2019										
moy P /mois	1025	1034	1033	1031						
moy H /mois	0,92	0,78	0,88	0,86						
2020										
moy P /mois	1022	1034	1031	1029						
moy H /mois	0,97	0,88	0,9	0,84						



DECEMBER

Relevé de température moyenne de l'anticyclone sibérien de 2009 à 2020

					écart	à la	moy	mois	écart moy	
DECEMBRE	Iakoutsk	Irkoutsk	Novosibirsk	Ekaterinburg	Iako	Irko	Novo	Ekat	t°anticyclone	
1961-1990		-16,4	-13,7	-11,5		-1,2	2,7	1,5	1,00	moy mens
2009	-34	-14	-18	-15	0,6	1,2	-1,6	-2,0	-0,45	réchauf
2010	-37	-18	-20	-16	-2,4	-2,8	-3,6	-3,0	-2,95	climat
2011	-36	-14	-13	-9	-1,4	1,2	3,4	4,0	1,80	depuis
2012	-35	-21	-23	-16	-0,4	-5,8	-6,6	-3,0	-3,95	1961/1990
2013	-31	-9	-8	-9	3,6	6,2	8,4	4,0	5,55	
2014	-40	-12	-11	-10	-5,4	3,2	5,4	3,0	1,55	
2015	-32	-11	-7	-8	2,6	4,2	9,4	5,0	5,30	
2016	-35	-13	-13	-17	-0,4	2,2	3,4	-4,0	0,30	
2017	-36	-12	-11	-7	-1,4	3,2	5,4	6,0	3,30	
2018	-32	-16	-18	-11	2,6	-0,8	-1,6	2,0	0,55	
2019	-36	-13	-11	-9	-1,4	2,2	5,4	4,0	2,55	1,55
2020	-35	-15	-17	-10	-0,4	0,2	-0,6	3,0	0,55	-0,45
2021										
moy T /5 an	-34,6	-15,2	-16,4	-13,0						
2019										
moy P /mois	1029	1032	1028	1021,0						
moy H /mois	0,97	0,90	0,95	0,89						
2020										
moy P /mois	1025	1038	1037	1036,0						
moy H /mois	0,99	0,89	0,94	0,85