IN 2020, THE GLOBAL TRANSPORT SHUTDOWN SLOWS THE THAWING OF THE PERMAFROST

AN UPDATED POSITIVE TIPPING POINT, TO COOL AND COOL OUR PLANET

THE ARCTIC HIGH

- Forms during a significant portion of the year over the Arctic Ocean and three very large continental areas, Siberia, Alaska added to Canada's Far North, and Greenland. It is predominant from November to March, weakens from April and during the summer, and gradually swells again in September and October.
- The Siberian High is the largest in size as well as pressure above 1030 millibars in January and February. It is made up of a vast area of high atmospheric pressure centered on Lake Baikal, the main city of this region is Irkutsk. Its area of influence on the climate extends to the south towards Mongolia and its capital Ulaanbaatar and to the north of China, to the northeast it includes the Verkhoyansk Mountains and the plain of the Lena River 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 to the West Siberian Plain with the city of Novosibirsk and the city of Novosibirsk to the south. to the west, the city of Ekaterinburg at the foot of the Urals.
- The Canadian and Greenland anticyclones are smaller and have a lower pressure of around 1020 millibars than the huge Siberian anticyclone on which we will pay particular attention.

AVERAGE TEMPERATURES IN SIBERIA

- Going off the beaten track and after consulting the historical-meteorological website of Russia, the average temperatures of the four Siberian cities Yakutsk, Irkutsk, Novosibirsk and Ekaterinburg were recorded month by month to establish an average temperature over a long period of time 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 has been calculated: the average (average 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, first of all 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 of 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 vapour 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, John Tyndall, an Irish physicist, identified that water vapour and carbon dioxide in the atmosphere were at the origin 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 the 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, Svante August Arrhenius, a Swedish chemist, 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 had warmed by 1.5° Celsius for more than a century and a half and that the carbon dioxide content had risen 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).

THE THAWING OF THE PERMAFROST

The global warming linked to CO_2 of 1° per century is therefore on the slope of the prediction of the end of the nineteenth century.
The thawing of permafrost that has been observed over the past ten years is 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.
Knowing that methane is a greenhouse gas 23 times more powerful than CO_2 and that it is estimated that the amount of CO_2 trapped in the permafrost is equivalent to four times that emitted by human activities since the industrial revolution of the mid-nineteenth century, we can deduce that humanity is facing an imminent and almost irreversible risk of a runaway greenhouse effect.
In addition, it has been observed that Arctic sea ice and continental ice are melting faster than those in Antarctica.
The IPCC has identified the approximate greenhouse gas contributions of key gases.

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

60% for water vapour, 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 vapour, which, as it rises, turns into water droplets suspended in the clouds. Its potential for Accelerating Global Warming (PARCEL) or CO2 equivalent, which measures the harmfulness of each greenhouse gas, is 8 times greater than that of carbon dioxide. Another unit used is the carbon equivalent obtained by multiplying the GWP by the ratio between the mass of a carbon atom (C=12 g.mol-1) and that of a molecule of carbon dioxide (CO2= 44g.mol-1) over a given period of time, which is generally 100 years. (We find: carbon equivalent of CO2=0.273 PRG=1, carbon equivalent of H2O=2.02 average PARCEL=8, carbon equivalent of CH4=6.27 PRG=23, carbon equivalent of N2O=81 PRG=296)

Average global warming accentuates the evaporation of surface ocean waters, which are overheated at the level of volcanic islands located between the two tropics. And the warmer the atmosphere gets, 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 out of whack, the powerful cold thermal anticyclones of Antarctica and the Arctic managed, through this atmospheric circulation, to air condition the planet

KEROSENE COMBUSTION WHILE CRUISING 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 (boundary between the troposphere and the stratosphere) and in the lower stratosphere between 10,000 and 13,000 meters. cruising levels normally used in air transport.

To burn one kilogram of kerosene you need three kilograms of oxygen, 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 steam causes condensation trails if the humidity exceeds 68%, for a temperature of minus 40 degrees Celsius.

These contrails give rise to cirrus homogenetus clouds acting as a heat trap with a powerful warming effect for the planet, greater than that of concomitant CO_2 emissions, especially at night by retaining in the atmosphere the infrared 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. So 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 about 4000 meters below the tropopause, would lead to an overconsumption of fuel of 25%. Or by developing, 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 homogeneous cirrus, so there is 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 high-altitude cruising, which is very good for the planet.
The additional expense of fuel can be offset by increased aircrew productivity, as operating aircraft at this reduced cruising altitude generates less fatigue, which is good for aircrew and passengers carried.
Some statistics from 2006 that are still relevant to set an order of ideas,
- 93% of aviation kerosene was burned in the northern hemisphere,
- and 69% between 30° and 60° north latitude.

Three regions of the world accounted for 50% of global emissions, the USA 26%, Europe 15% and the Far East 11%.
This distribution of kerosene consumption alone can explain the greater warming of the Arctic +4.2°C compared to Antarctica +1°C. (see photo NASA/GISS Anomaly of the period 2015/2019 compared to the reference 1951-1980 table 21)

MARCH 2020: COVID 19 HALTS GLOBAL AIR TRAVEL

The second observation in December 2019 appeared, in Wuhan in southern China, (on a market selling wild animals or by uncontrolled genetic manipulation, unverifiable information) a new virus called Covid 19. In an attempt to limit the spread of this new virus of unknown origin, the Chinese authorities have completely confined the populations of the city and its province and all the other countries subsequently confronted with this pandemic have followed the Chinese example of total lockdown. At the beginning of April 2020, more than half of the world's population was in total lockdown.

Since January 31, 2020, by these drastic measures, the most polluting factories have been shut down in China and global air transport has been gradually stopped. NASA satellite photos showed that there was no more pollution over Beijing and in the Po Valley in the two countries that suffered the first severe contaminations.

Through the study that has been conducted, we can therefore 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 flights from North America to the Far East, Irkutsk, Novosibirsk and Ekaterinburg are on the trajectory of the Europe-Far East flights (data taken from the historique-meteo.net website, tables and figures attached as well as the Google Earth photo of the Siberian flyover tables 22 to 37)).

The months of December 2013 and 2015 reported abnormally high temperatures in the four cities compared to the historical average. As well as during the months of January 2015 and 2017, then in 2019 and especially 2020, the differences climb to more than 6° compared to the average. The same trend has been observed for the months of February since 2015 and especially in 2020, which is 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, there has been a warming since 2014 and an observation of primary importance, the month of March 2019 was the least cold of the decade in these four cities after that of 2017. The Siberian high warms up inexorably during the four winter months of the polar

THE IMPACT OF GLOBAL AIR TRANSPORT ON THE SIBERIAN HIGH

It should also be noted that the average temperature differences of the Siberian anticyclone in spring and summer are very small, of the order of more than 1°. The significant thaw of the permafrost observed during the summer of 2019 is therefore the result of much less cold winters for six to seven years, i.e. since 2013, climate runaway is therefore a reality in the Arctic Ocean.

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

Without any contrails from planes in Siberia for a year and therefore without homogeneous clouds created by man, infrared rays are no longer blocked, they are released back into space. The ground temperature drops on a rolling average from March 2020 to February 2021 by 1.36° per month. In December 2020, the average temperature dropped by 2° compared to December 2019, in January 2021 the average temperature dropped by 8.75° compared to January 2020, and in February 2021 the average temperature dropped by 6.75° compared to February 2020. After three winters at this regime, the Siberian anticyclone, whose CO_2 content remains unchanged, would have become cold and dry again as before 1990, just by removing the supply of water vapor from air transport.

FLYOVER OF THE ARCTIC IS RESPONSIBLE FOR RUNAWAY CLIMATE CHANGE

It has just been shown 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 Canadian Far North.

- 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 of Air Transport by 5% per year, and a doubling every 14 years of passengers transported around the world.

ARCTIC NON-SPILLOVER TREATY: A 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 no longer block the infrared radiation reflected by the earth's surface, the UN must be referred as soon as possible by EUROPE, RUSSIA, CANADA and the USA to decide on the following precautionary measures, enshrined in an Arctic Treaty on the model of the 1959 Antarctic Treaty signed in the middle 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 at the altitude of the tropopause reduced by four thousand meters.

2-Sanctuarize the Arctic zone bounded 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 must no longer transit through polar routes to connect continents.

3-Define the new air routes for the avoidance of the Arctic Sanctuary. (see attached examples of AMN-EXO Table 23, EUROPE-EXO Table 24, 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° by 2100.

DECISION 1

Decision No.1 alone reduces the carbon footprint of air transport by 65% and its effect is immediate. It is a very simplified contribution to stay within the limit of a 1500-word text that I sent at the beginning of January 2021 to the Citizens' Convention for the Climate. 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 No. 2, as a partial and very slow recovery of global air transport had been planned after the pandemic, we could have taken advantage of these few months or years of respite without too many planes in the airspace of Siberia, Alaska and the Canadian far north 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 World Air Transport has been phenomenal and the huge Siberian anticyclone has resumed its previous warming.
Russian scientists at the Permafrost Institute in Yakutsk are monitoring this process day after day because the thawing of the permafrost at depth causes enormous damage to Siberian infrastructure (cities, bridges, rail and road infrastructure, factories are built on permanently frozen ground) and the costs for the Russian economy are considerable.
It should be noted that Russian air transport is the only one to continue to fly in the Arctic sanctuary to serve Siberian cities, as well as the Canadian air transport to serve Inuit territories and the American air transport to serve Alaska, and also to the European far north Norway, Sweden, Finland. But these sanctuarized territories must not see the development of mass tourism. This is what we are starting to see in South Antarctica with the development of Antarctic cruises from Ushaya, which must be stopped urgently. This is reflected on the global warming map Table 20 by an orange zone, i.e. +2°C, while the dominant colours on this continent are yellow, white or even blue.
The huge anticyclones that form in winter in Antarctica and the Arctic are the two heat engines that naturally regulate the planet's temperature. Human presence and activities must be reduced to the strictly necessary, that is to say, reserved only for the field 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 in the world must be closely supervised by international bodies. The new air routes to avoid the Arctic Sanctuary are longer, especially between Asia and North America, with a turning point 40°N 180°W in the middle of the Pacific. They must be shared according to predefined market shares at the global level because they are strategic in order to avoid any trade war.
The flights without intermediate stops, New York-Beijing 16:20, New York-Tokyo 14:10, New York-Shanghai 16:15, New York-Hong Kong 17:30 are going to be difficult to bear in tourist class without the comfort of a reclining seat and a little more space, which Premium Class offers. The Chinese and Japanese airlines and all those that still have an Airbus 380 fleet will be at an advantage. The post-covid 19 period may revive the concept of the very large aircraft that gave birth to the A380, an aircraft acclaimed by all passengers for its noise absence and comfort, and which moreover did not kill anyone. Denigrated by European airlines who have not been able to make it profitable, there is a fleet of about 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 to retire. And these planes and crews, taken over by non-European companies, should not come back to compete with the national airlines restructured at great expense by European states with planes that consume less kerosene to respect the low-carbon energy transition.

DECISION 4

Regarding Decision No. 4, the sizing of European and global air traffic, there must be coordination between all countries, because the planet cannot hope for better days without limiting air travel. We see more and more that "The house is burning" since 2002 "and we are looking elsewhere", President Chirac's shock formula is still relevant. In July 2019, a worrying historical record should have alerted us, the thermometer exceeded 32°C in Anchorage, Alaska, which has never been seen before, so the air route via Anchorage is not a fallback solution. In September 2019 and for four months, gigantic forest fires in Australia destroyed biodiversity over 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 the 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' Climate Convention 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 radical to say the least against Air Transport.

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

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

8 YEARS OF EXUBERANT AND IRRATIONAL GROWTH

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

In Antarctica, the water vapor is due to the explosion of the Hunga Tonga submarine volcano on January 15, 2022, which sent 140 million tons of water vapor into the southern hemisphere stratosphere. This water vapor is evacuated in winter by the polar vortex and it will take 1500 days, a little more than 4 years, around February 2026, to see a reduction in the runaway climate and the resumption of the extent of the Antarctic sea ice that the NSIDC will publish in early February.

In the Arctic, water vapor is due to the overflight of the area in the lower stratosphere by World Air Transport until 2019. As soon as this overflight was stopped from March 2020 following the covid 19 pandemic and then the war in Ukraine, the climate runaway was considerably reduced. But the amount of water vapor in the Arctic is equivalent to two annual explosions of an underwater volcano of the Hunga Tonga type, which explains the difference between the Arctic runaway (7.8°), and only 4.7° in Antarctica.

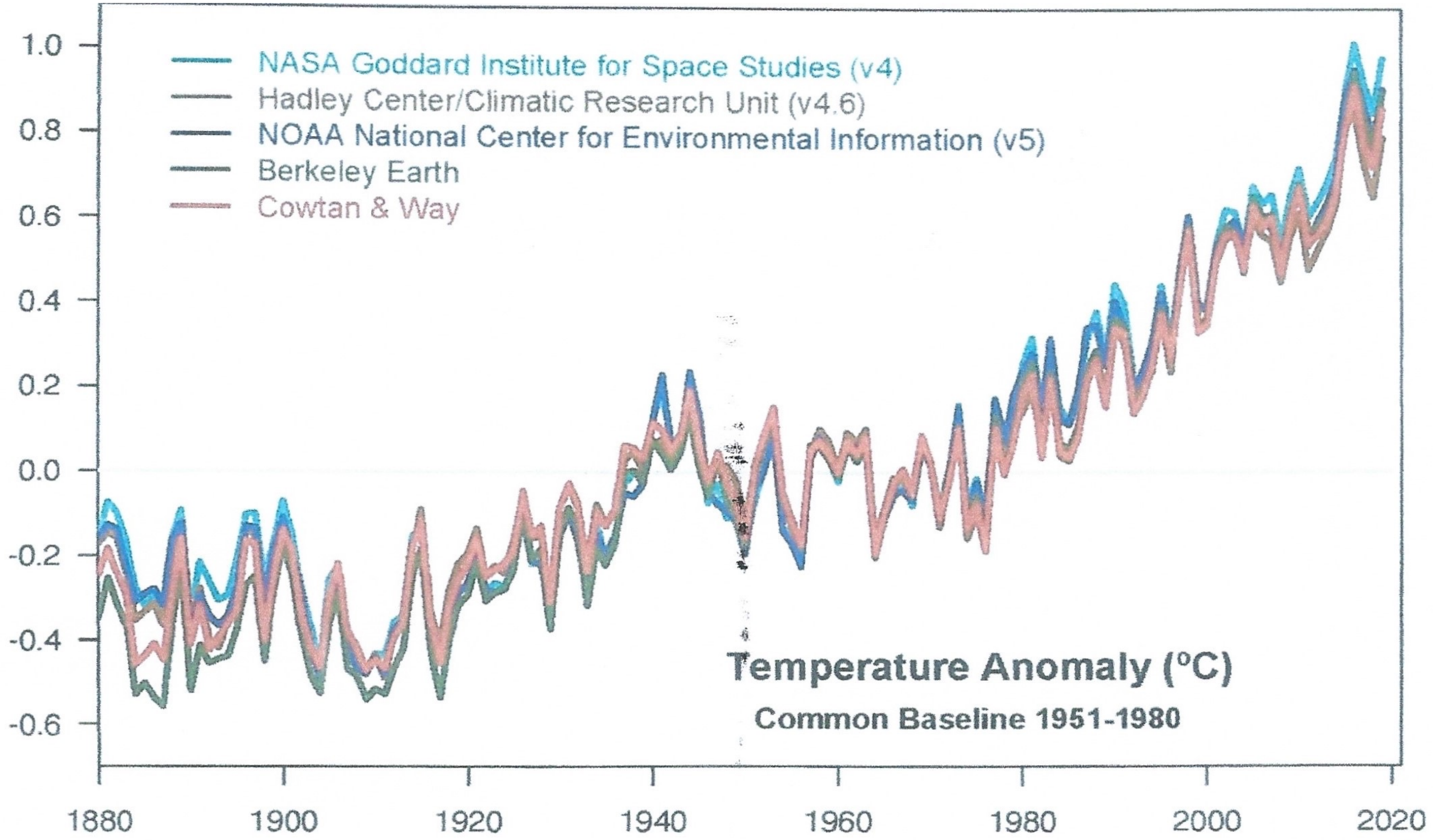
To put out the fire on our one and only habitable planet, we must return to an average air traffic limited to that reached in 2025 at the beginning of the 2027 season. This means cancelling out the exuberant and irrational future growth of the next 25 YEARS and not seeing global air travel double to 9 billion passengers by 2050.

In Europe and in the world with this limitation of the growth of air transport for the survival of the planet, the tourism industry, aeronautical manufacturers and subcontractors, airlines, cruise lines with their floating palaces of 8000 passengers will be seriously impacted. But we cannot revive the growth of these activities without taking care of their impact on the climate.

CONCLUSION

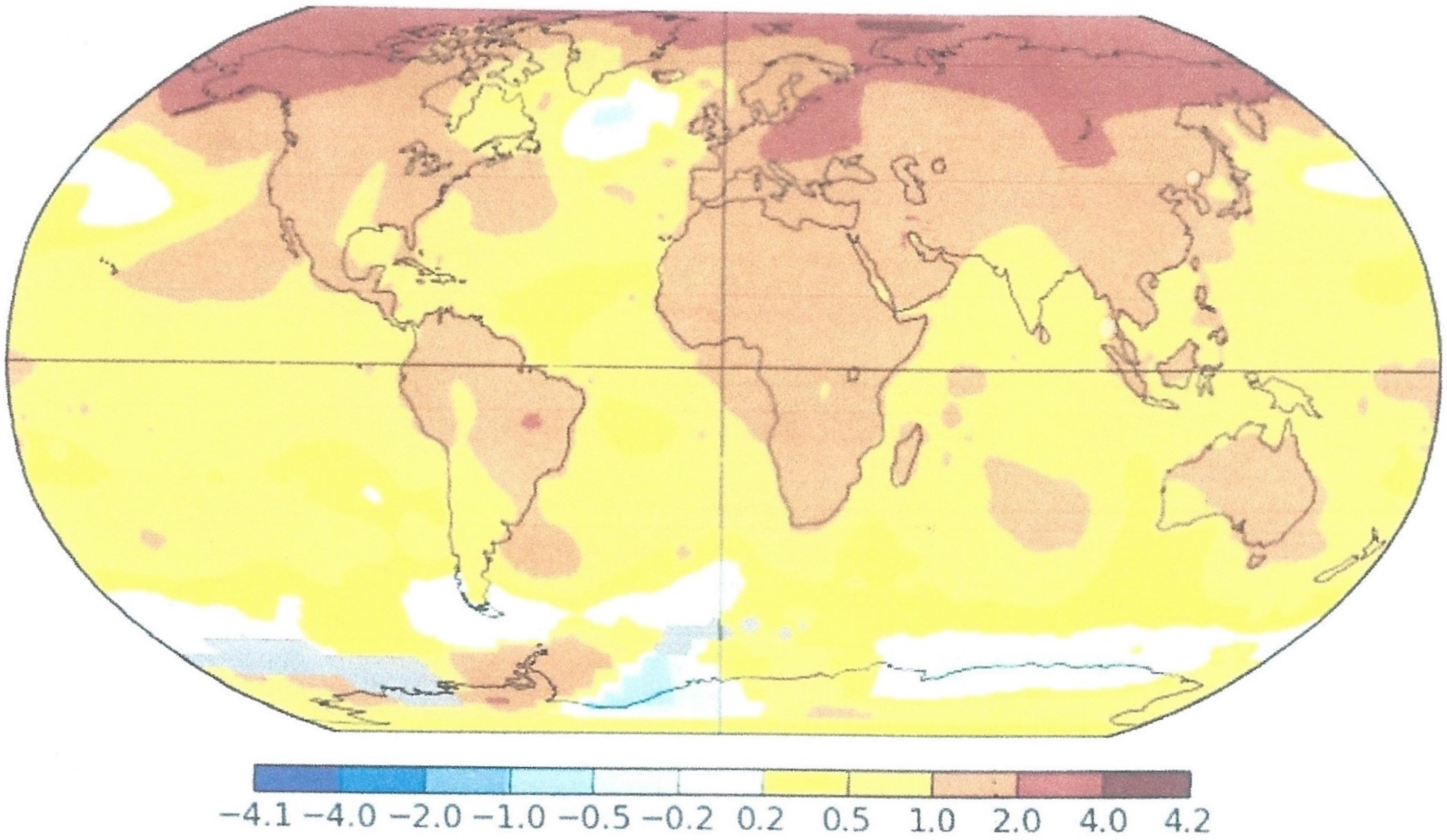
A formidable battle against an invisible enemy has been waged in hospitals by the public and private health services of each country. As front-line infantrymen and with limited means, they ended up admirably overcoming the first wave (the loss of human life is significant but must be put into perspective compared to the 50 million deaths in three successive waves of the Spanish flu of 1918/1919. The constraints are not well received by the population, but as these populations are not immune, it was necessary to wait for the vaccine to claim victory and resume air transport activity without border closures. To get the economic machine going again, the States have committed astronomical sums, we are talking about 5000 billion dollars, but we must not forget that what is ahead of us is the total war against runaway climate change that will cause millions of deaths (natural disasters, cyclones, tornadoes, rising waters, floods, climate refugees, etc.). shortages, pandemics, famines...) if humanity does not manage to limit global warming to less than 2 degrees by 2100. And it is this war that we will have to win, it may take about ten years until 2035. This requires a general mobilization of companies, political decision-makers, banks, researchers, engineers, technicians, workers, builders and farmers. Rich countries and their global oil companies, whose activities are largely responsible for global warming, currently have all the technical, financial and know-how to cool and cool 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 WARMING PERIOD 2015-2019/REF 1951-1980

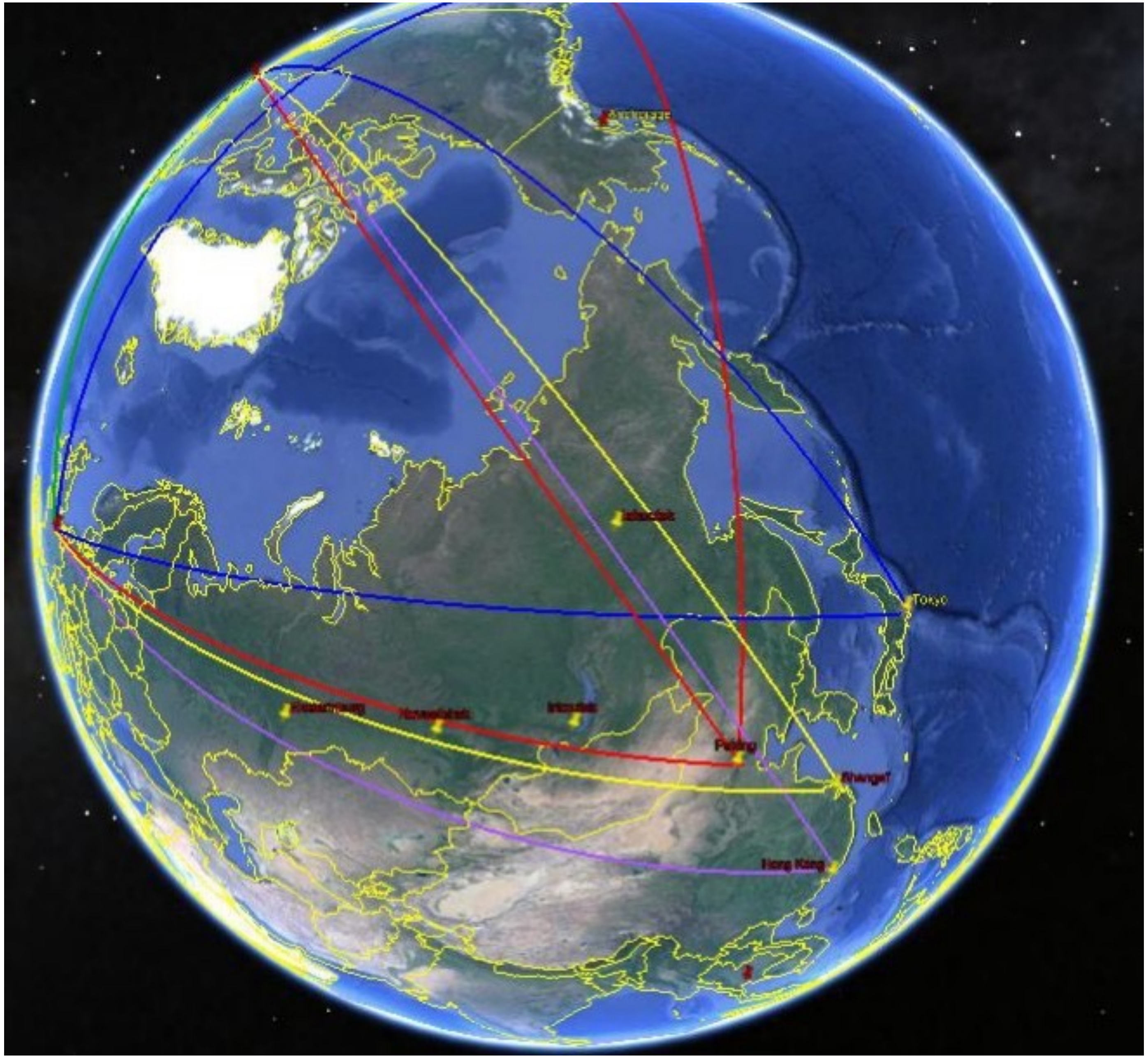


Anomalie de la période 2015-2019 par rapport à la référence 1951-1980.
En outre, notez la petite plage froide dans le nord-atlantique. Une signature éventuelle du ralentissement de la circulation océanique dans ce secteur.
Crédits : NASA/GISS.

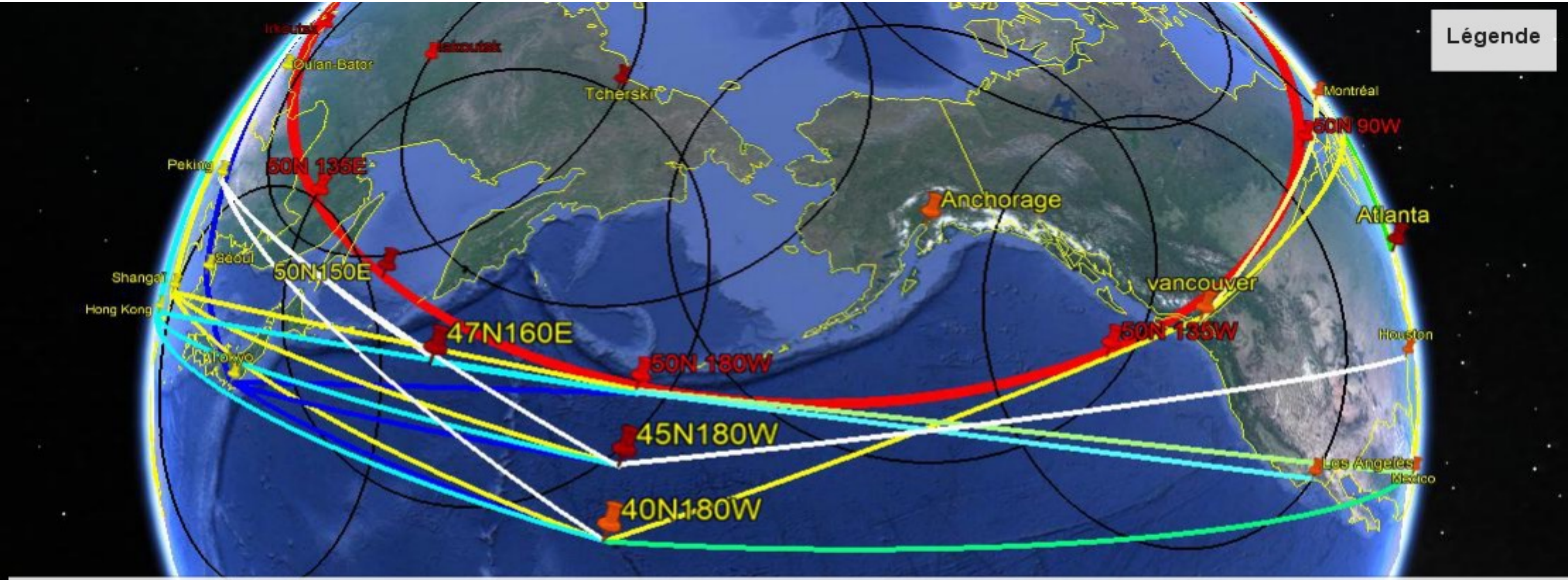
ARCTIC CLIMATE RUNAWAY in decline AND ANTARCTICA stopped

Année	Saison	Etendue	Températures		Etendue	empératures		Température	Remarques/Origine/Causes
		Banquise Arc	Banquise	Arctique	Banquise Anta	Banquise	Antarctiqu	moyenne annuelle	
		Mkm2	Mini	Maxi	Mkm2	Mini	Maxi	globe Terrestre	
2015	An Nov Oct	10,566	0,5°	4°	12,414	_1°	2°	0,79°	
	HN hiver Nov Avr		2°	4,6°		_1°	1°	0,78°	
	HN été. Mai Oct		0,5°	4°		_1°	2°	0,79°	
2016	An Nov Oct	10,163	2°	4,6°	11,202	_0,5°	1°	0,94°	
	HN hiver Nov Avr		2°	6,2°		0	1°	1,02°	1er Hiver avec Emballement clim
	HN été. Mai Oct		2°	4°		_1°	1°	0,87°	Arctique à +6,2°
2017	An Nov Oct	10,393	2°	5,1°	10,749	0,2°	1°	0,99°	
	HN hiver Nov Avr		2°	7,8°		0,5°	2°	1,11°	Hiver le plus chaud en Arctique à +7,8°
	HN été. Mai Oct		0,5°	4°		0	2°	0,86°	
2018	An Nov Oct	10,355	2°	4,5°	11	0,5°	2°	0,89°	
	HN hiver Nov Avr		2°	6,8°		1°	2°	0,95°	hiver très chaud en Arctique à +6,8°
	HN été. Mai Oct		1°	4°		0,5°	2°	0,83°	
2019	An Nov Oct	10,201	2°	4°	10,876	1°	2°	0,90°	
	HN hiver Nov Avr		2°	6,9°		1°	2°	0,93°	Hiver encore très chaud Arctique à 6,9°
	HN été. Mai Oct		2°	4°		0,5°	4°	0,88°	
2020	An Nov Oct	10,15	2°	4,7°	11,602	0,5°	4°	0,99°	Pandémie Covid 19 (16/11/2019)
	HN hiver Nov Avr		2°	5,4°		1°	2°	1,06°	Arrêt survol de l'Arctique Mars 2020
	HN été. Mai Oct		2°	4°		0,2	2°	0,92	Dès l'été 2020 baisse emballement
2021	An Nov Oct	10,552	2°	4,7°	11,579	_05°	2°	0,94°	climatique de l'Arctique car baisse de
	HN hiver Nov Avr		2°	5,7°		0	1°	0,99°	la vapeur d'eau dans la stratosphère
	HN été. Mai Oct		1°	4°		_0,5°	2°	0,90°	
2022	An Nov Oct	10,661	1°	4°	10,726	0°	2°	0,89°	15/01/2022 Explo volcan sous marin
	HN hiver Nov Avr		2°	5°		0°	1°	088°	HungaTonga 140 Millions T vapeur
	HN été. Mai Oct		1°	4°		0°	2°	0,91	d'eau expédiées dans la stratosphère
2023	An Nov Oct	10,469	1°	4°	9,931	0,2°	4,1°	1°	En année pleine 2ème Ralentissement
	HN hiver Nov Avr		1°	4,5°		_0,5°	2°	0,93°	emballement Arctique après 2022
	HN été. Mai Oct		1°	4°		0,5°	4,7°	1,07°	Hiver HS Emballement climatique
2024	An Nov Oct	10,391	1°	4°	10,461	0°	4°	1,19°	Antarctique +4,7° mais élévation de
	HN hiver Nov Avr		2°	5°		_1°	2°	1,15°	température moins importante
	HN été. Mai Oct		2°	4°		1°	4°	1,22°	2024 année la plus chaude sur Terre
2025	An Nov Oct								

CURRENT FLIGHT OVER SIBERIA FLIGHTS EUROPE FAR EAST NORTH AMERICA



NEW AMN-EXO AIR ROUTES (alt cruise max 7500 meters)



Nouvelles Routes Aériennes Amérique Nord/Extrême Orient (alt croisière max 7500 mètres)

Evitement du Santuaire Arctique, zone circulaire en rouge de 2400 Nm de rayon,
centré sur le Pôle Nord, englobant Le Canada, la Sibérie, le Groënland, l'Alaska et l'Europe du Nord, Russie comprise.

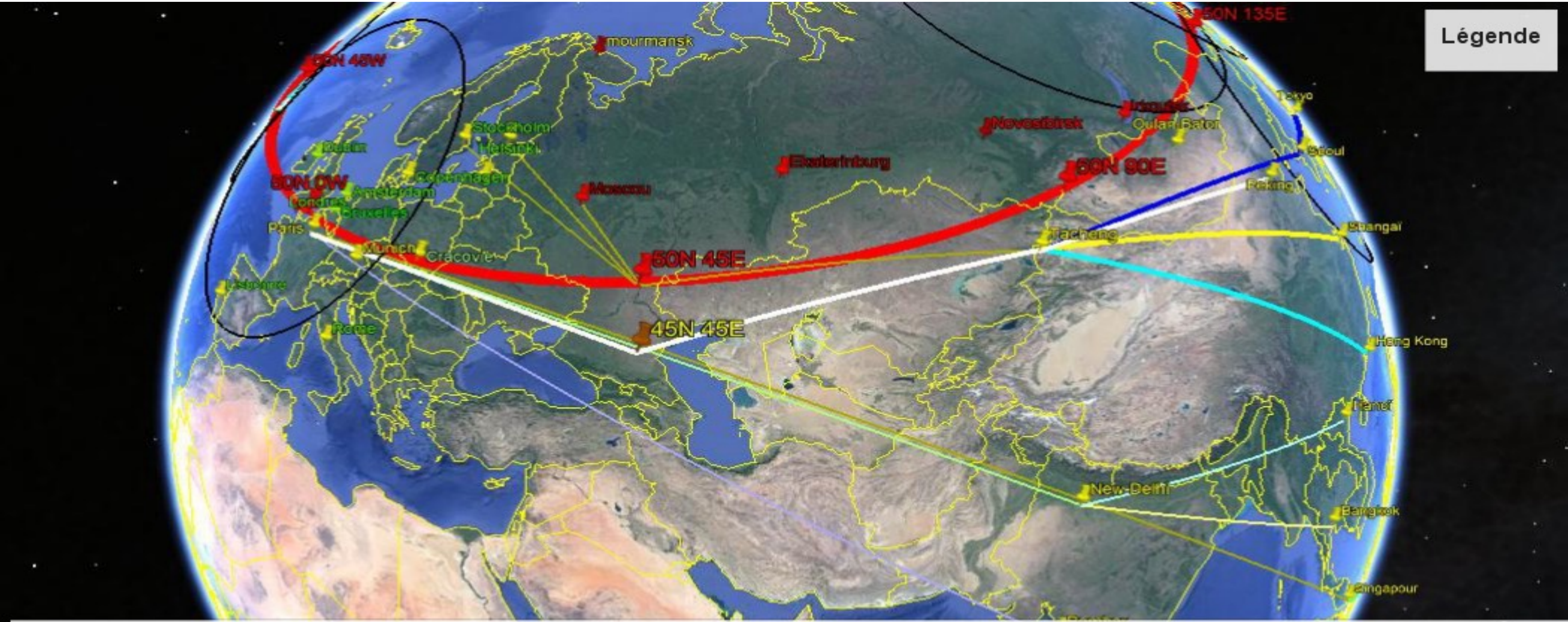
Objectif: Supprimer les traînées blanches de condensation de la vapeur d'eau des avions à réaction qui génèrent des cirrus homogénitus afin de diviser par 4 l'anomalie d

Nota Bene: Avant 1986 le survol de la Sibérie était interdit par l'ex-URSS et les routes polaires directes n'étaient pas ouvertes mais passaient par Anchorage.

Honolulu

Vue depuis l'espace (altitude : 8691 km)

NEW AIR ROUTES EUROPE –EXO (alt cruise max 7500 meters)

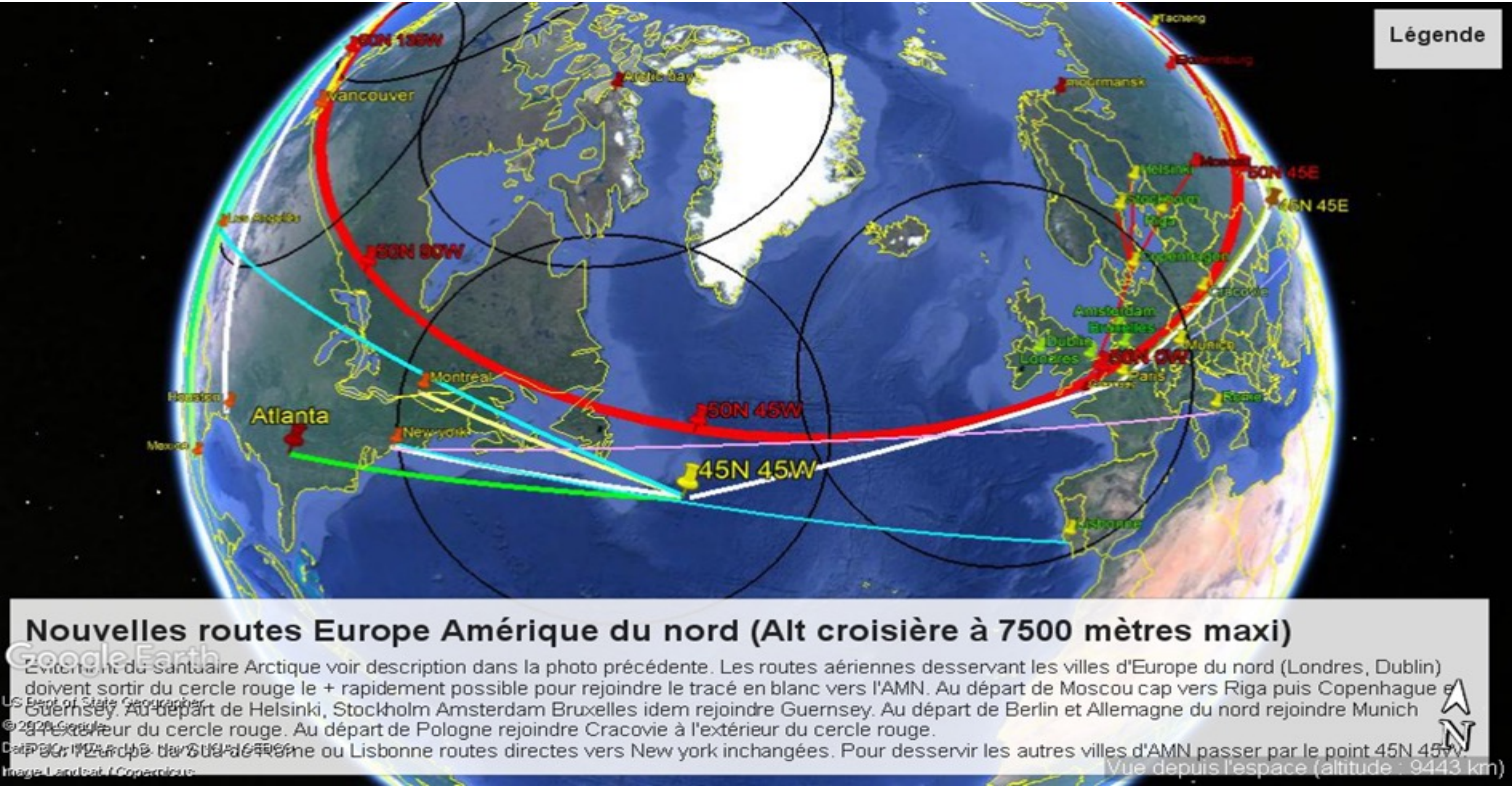


Nouvelles routes aériennes (alt croisière à 7500 mètres max) Europe / Extrême Orient

Evitement du santuaire de l'Arctique et contournement de la chaîne de l'Himalaya avec le toit du monde, l'Everest qui culmine à 8848 mètres.
Comme précédemment sortir du cercle rouge le + rapidemment possible. De Stockholm, Helsinki, Riga, Moscou cap sur le point tournant 50N45E et puis vers T
De Copenhague et Varsovie rejoindre Cracovie,puis la route en blanc vers le point tournant 45N45E et ensuite Tacheng...
De Berlin, Amsterdam, Dublin, Londres et Bruxelles rejoindre Munich sur la route en blanc, puis vers le point 45N45E et Tacheng...
De l'Europe du Sud, Lisbonne, Madrid, Rome, Zurich, Athènes rejoindre le point tournant 45N45E et Tachent...

Vue depuis l'espace (altitude : 9126 km)

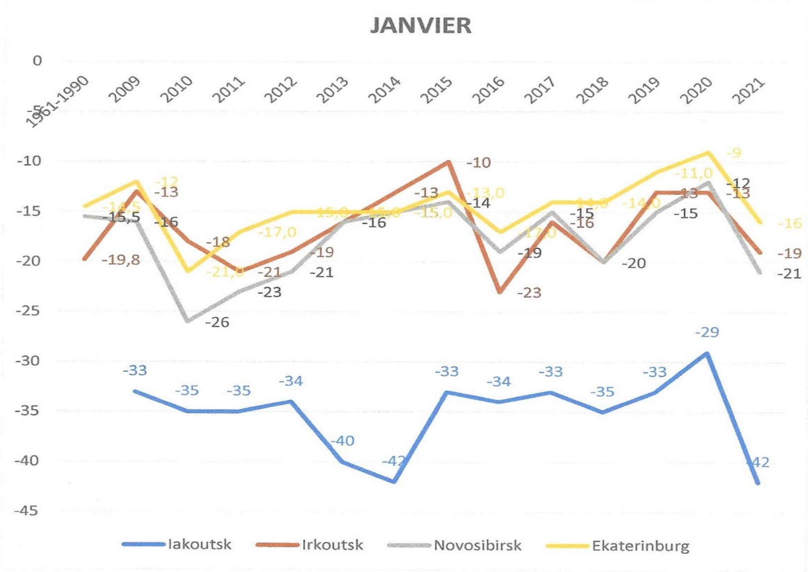
NEW AIR ROUTES EUROPE AMN(alt cruise max 7500 meters)



JANUARY

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

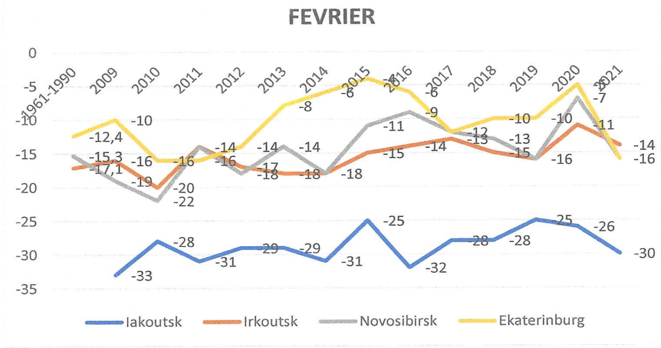
					écart	à la	moy	mois	écart moy	
JANVIER	Iakoutsk	Irkoutsk	Novosibi	Ekaterinl	Iako	Irko	Novo	Ekat	t°anticyclone	
1961-1990		**-19,8**	-15,5	-14,5		-2,4	**4,9**	**1,5**	1,33	moy mens
2009	-33	-13	-16	-12	2,4	4,4	4,4	4,0	3,80	réchauf
2010	-35	-18	-26	-21,0	0,4	-0,6	-5,6	-5,0	-2,70	climat
2011	-35	-21	-23	-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**						



FEBRUARY

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

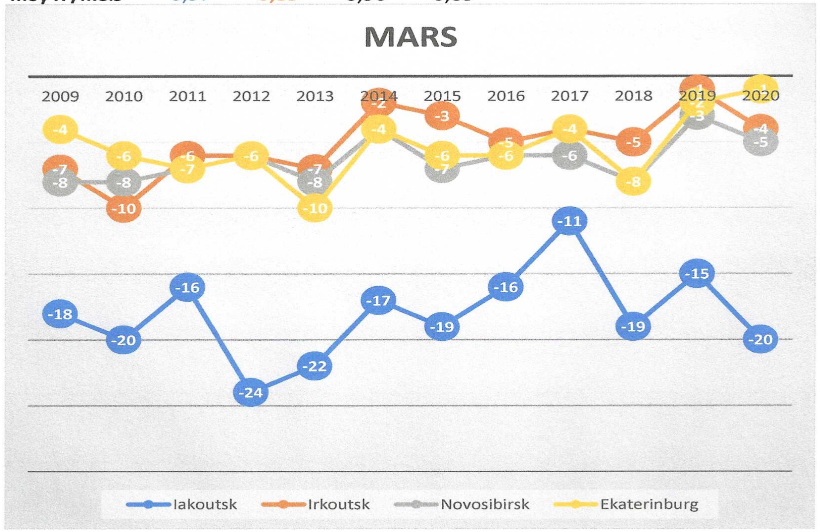
FEVRIER	Iakoutsk	Irkoutsk	Novosibi	Ekaterinl	écart Iako	à la Irko	moy Novo	mois Ekat	écart moy t°anticyclone	
1961-1990		-17,1	-15,3	-12,4		**-0,1**	**2,1**	**0,4**	0,80	moy mens
2009	-33	-16	-19	-10	-3,0	1,0	-1,6	2,8	-0,20	réchauf
2010	-28	-20	-22	-16	2,0	-3,0	-4,6	-3,2	-2,20	climat
2011	-31	-14	-14	-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

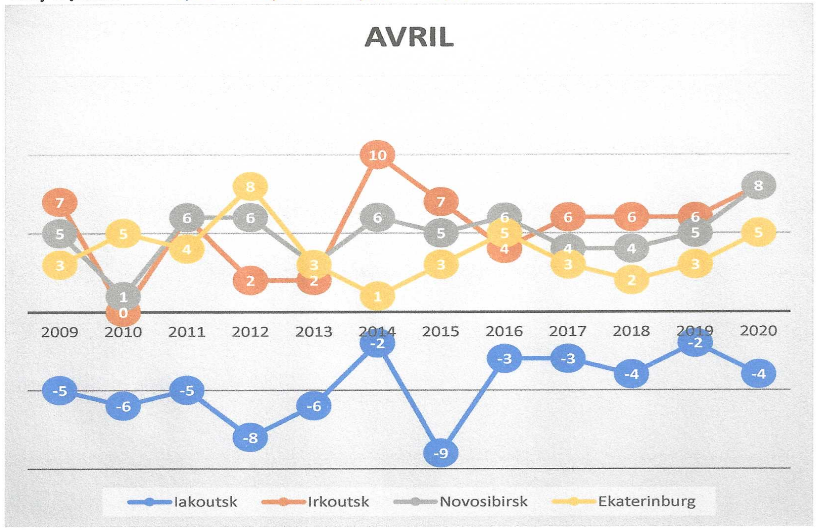
MARS	Iakoutsk	Irkoutsk	Novosibi	Ekaterinl	écart Iako	à la Irko	moy Novo	mois Ekat	écart moy t°anticyclone	
1961-1990		-9,1	-7,4	-5,4		-1,9	0,0	1,2	-0,23	moy mens
2009	-18	-7	-8	-4	2	0,2	-0,6	2,6	1,05	réchauf
2010	-20	-10	-8	-6	0	-2,8	-0,6	0,6	-0,70	climat
2011	-16	-6	-7	-7	4	1,2	0,4	-0,4	1,30	depuis
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

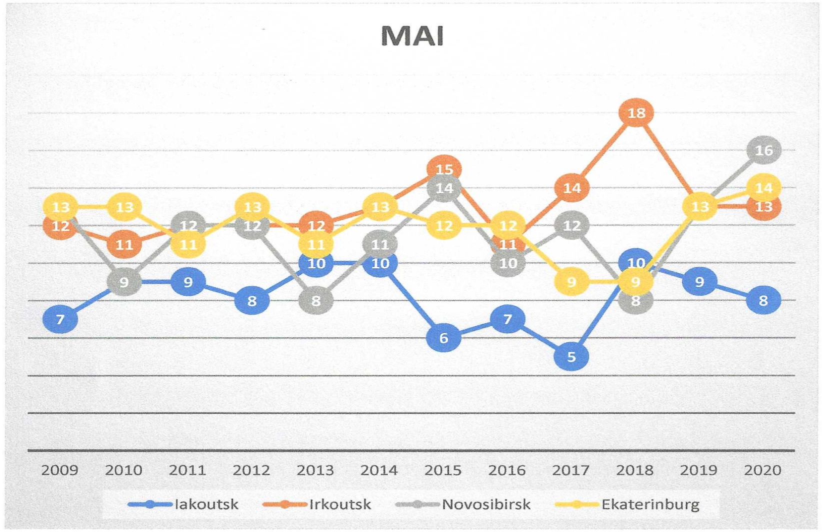
					écart	à la	moy	mois	écart moy	
AVRIL	Iakoutsk	Irkoutsk	Novosibi	Ekaterin	Iako	Irko	Novo	Ekat	t°anticyclone	
1961-1990		0,3	1,2	3,4		-3,1	-3,0	-1,2	-2,43	moy mens
2009	-5	7	5	3	1	3,6	0,8	-1,6	0,95	réchauf
2010	-6	0	1	5	0	-3,4	-3,2	0,4	-1,55	climat
2011	-5	6	6	4	1	2,6	1,8	-0,6	1,20	depuis
2012	-8	2	6	8	-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

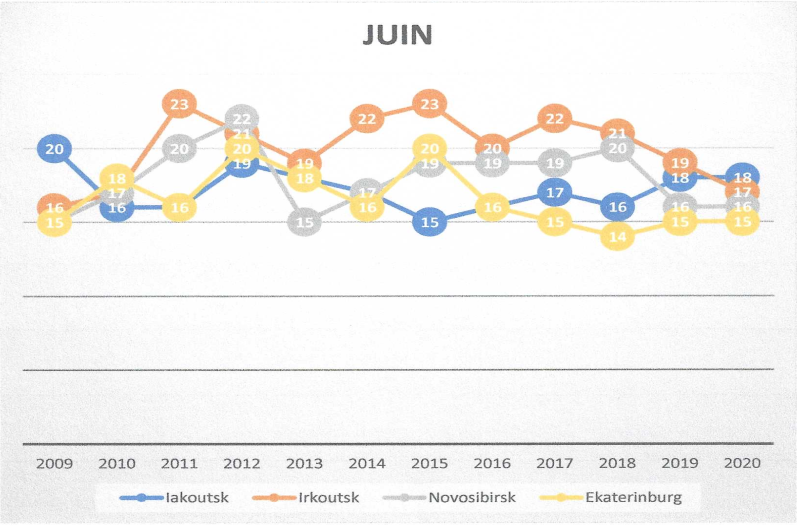
					écart	à la	moy	mois	écart moy		
MAI	**Iakoutsk**	**Irkoutsk**	**Novosibi**	**Ekaterinl**	Iako	Irko	Novo	Ekat	**t°anticyclone**		
1961-1990		**8,3**	**10,1**	**9,7**		-3,5	-0,7	-2,5	-2,23	moy mens	
2009	7	12	13	13	-1,6	0,2	2,2	0,8	0,40	réchauf	
2010	9	11	9	13	0,4	-0,8	-1,8	0,8	-0,35	climat	
2011	9	12	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							



JUNE

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

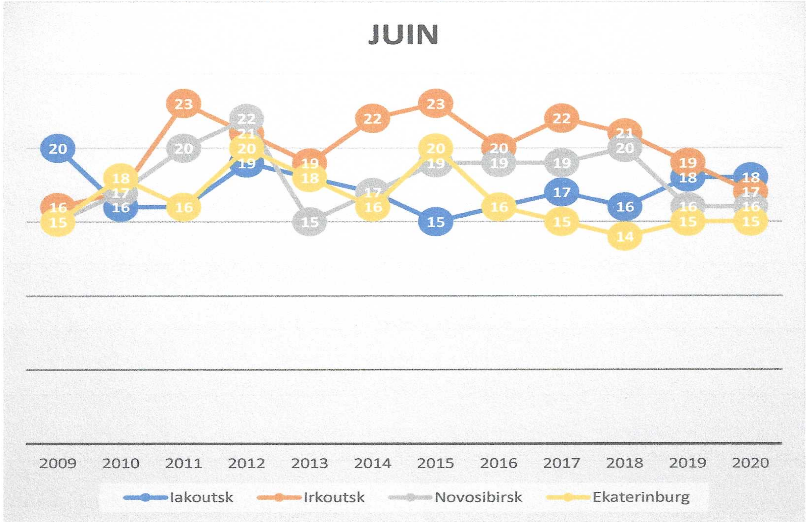
moyenne/an JUIN	Iakoutsk	Irkoutsk	Novosibi	Ekaterin	ecart Iako	à la Irko	moy Novo	mois Ekat	écart moy t°anticyclone	
1961-1990		13,3	16	16,7		-5,9	-1,8	-0,7	-2,80	moy mens
2009	20	16	15	15	2,2	-3,2	-2,8	-2,4	-1,55	réchauf
2010	16	17	17	18	-1,8	-2,2	-0,8	0,6	-1,05	climat
2011	16	23	20	16	-1,8	3,8	2,2	-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

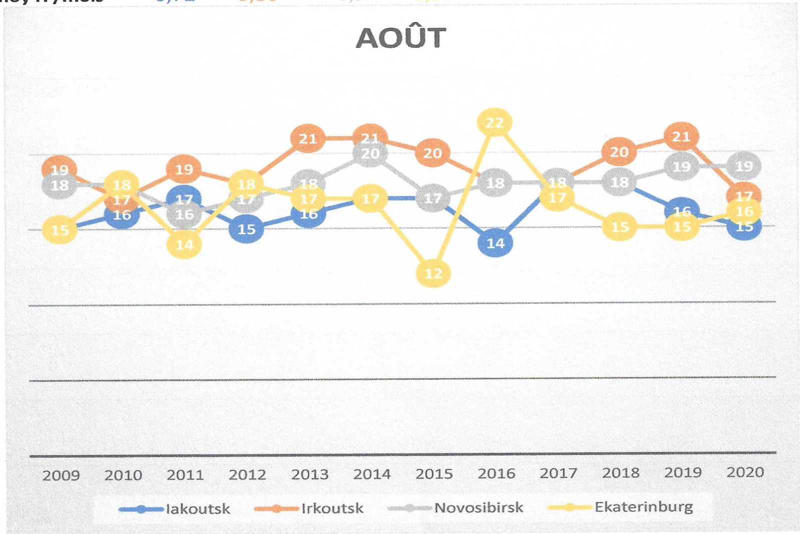
moyenne/an					ecart	à la	moy	mois	écart moy		
JUIN	**Iakoutsk**	**Irkoutsk**	**Novosibi**	**Ekaterin**	Iako	Irko	Novo	Ekat	**t°anticyclone**		
1961-1990		**13,3**	**16**	**16,7**		-5,9	-1,8	-0,7	-2,80	moy mens	
2009	20	16	15	15	2,2	-3,2	-2,8	-2,4	-1,55	réchauf	
2010	16	17	17	18	-1,8	-2,2	-0,8	0,6	-1,05	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							



AUGUST

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

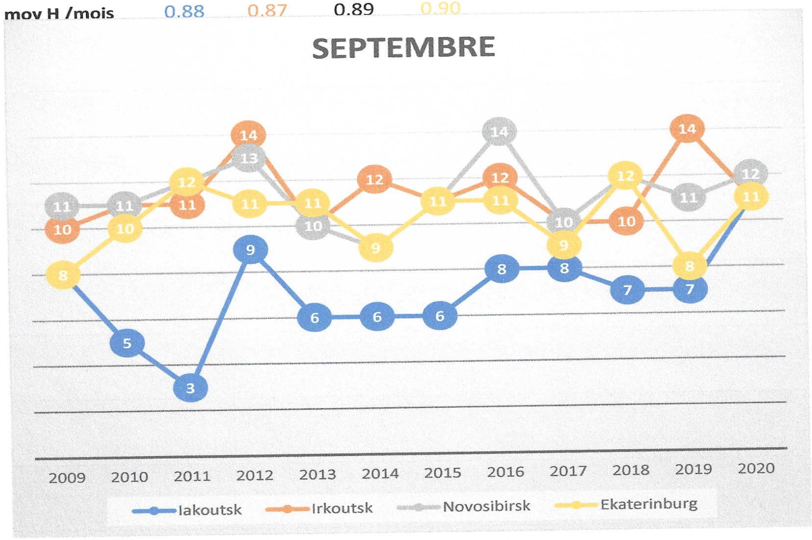
AOUT	Iakoutsk	Irkoutsk	Novosibi	Ekaterinl	écart lako	à la Irko	moy Novo	mois Ekat	écart moy t°anticyclone	
1961-1990		14,6	16,2	15,3		-4,2	-1,2	-1,1	-2,17	moy mens
2009	15	19	18	15	-0,8	0,2	0,6	-1,4	-0,35	réchauf
2010	16	17	18	18	0,2	-1,8	0,6	1,6	0,15	climat
2011	17	19	16	14	1,2	0,2	-1,4	-2,4	-0,60	depuis
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

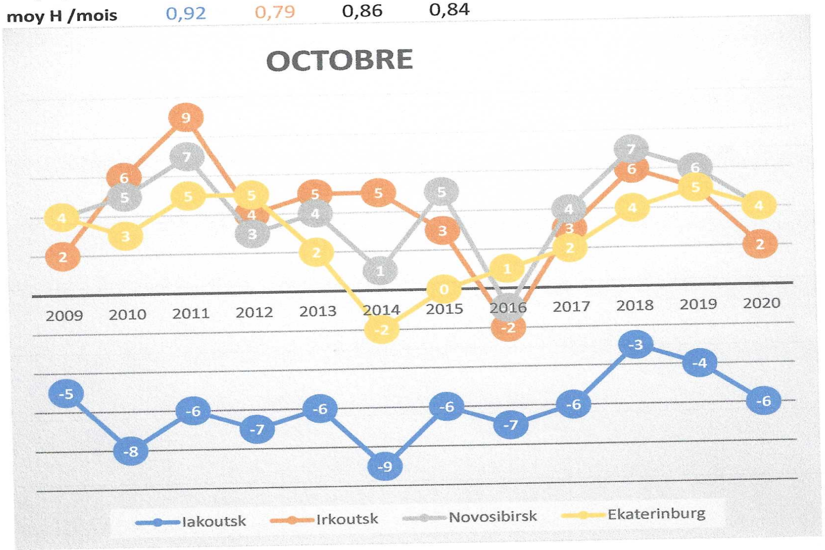
SEPTEMBRE	Iakoutsk	Irkoutsk	Novosibi	Ekaterinl	écart Iako	à la Irko	moy Novo	mois Ekat	écart moy t°anticyclone		
1961-1990		8	10,1	9,1		-3,2	-1,3	-1,3	-1,93	moy mens	
2009	8	10	11	8	1,8	-1,2	-0,4	-2,4	-0,55	réchauf	
2010	5	11	11	10	-1,2	-0,2	-0,4	-0,4	-0,55	climat	
2011	3	11	12	12	-3,2	-0,2	0,6	1,6	-0,30	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

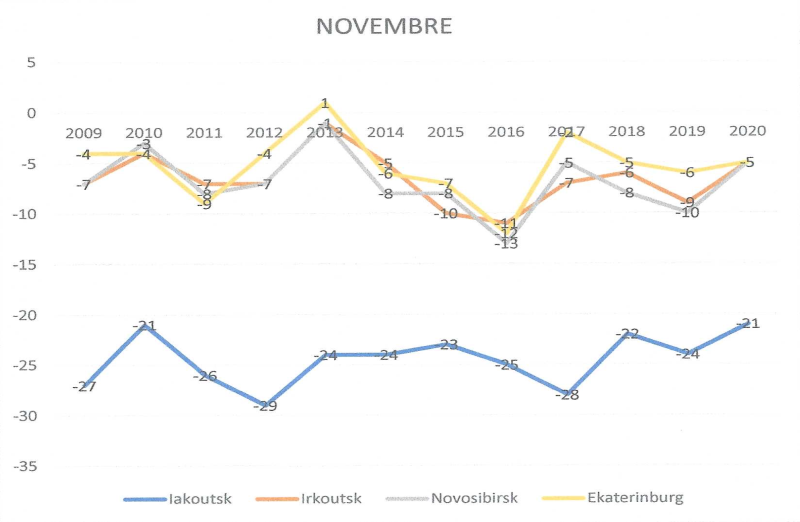
					écart	à la	moy	mois	écart moy		
OCTOBRE	Iakoutsk	Irkoutsk	Novosibi	Ekaterinl	Iako	Irko	Novo	Ekat	t°anticyclone		
1961-1990		-0,1	1,9	2,1		-5,3	-2,7	-1,7	-3,23	moy mens	
2009	-5	2	4	4	1,4	-3,2	-0,6	0,2	-0,55	réchauf	
2010	-8	6	5	3	-1,6	0,8	0,4	-0,8	-0,30	climat	
2011	-6	9	7	5	0,4	3,8	2,4	1,2	1,95	depuis	
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'anticyclone sibérien de 2009 à 2020

NOVEMBRE	Iakoutsk	Irkoutsk	Novosibi	Ekaterin	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

DECEMBRE	Iakoutsk	Irkoutsk	Novosibirsk	Ekaterinburg	écart à la moy mois Iako	Irko	Novo	Ekat	écart moy 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 /moi	1029	1032	1028	1021,0							
moy H /moi	0,97	0,90	0,95	0,89							
2020											
moy P /moi	1025	1038	1037	1036,0							
moy H /moi	0,99	0,89	0,94	0,85