The Effects of Artificial Clouds on Climate

An Examination of Jet Aircraft and Cloud-Aerosol Interaction

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ABSTRACT

Since the 1960s, high-altitude weather modification programs have increased worldwide. The effects of A) commercial aircraft injecting trillions of cubic feet of water vapor into the sky annually and B) the precipitation enhancement activities of weather modification aircraft combine to produce significant cloud cover over the Earth, affecting temperatures and weather conditions more than CO2 or other greenhouse gases. We are continually modifying the weather via aircraft; therefore, we are also modifying the climate via aircraft.

1. INDICATIONS THAT EARTH'S CLIMATE IS CHANGING

We believe Earth's climate is changing because we can observe the *weather* changing. Higher temperatures, melting glaciers, worsening storms... all the signs of climate change, including rising sea levels from melting ice, have to do with weather pattern observations, in particular warming trends. [1]

(End notes page 10)

PREMISE 1:

WE KNOW THE CLIMATE IS CHANGING BECAUSE OF OBSERVED CHANGES IN WEATHER PATTERNS.

2. "CLIMATE" VERSUS "WEATHER"

"Weather" is what we are experiencing today; "climate" is what we experience year after year. In other words, *climate* = *weather over time*. If we modify the *weather* continuously, we would modify the *climate*.

PREMISE 2:

CHANGING THE CLIMATE MEANS CHANGING THE WEATHER; CHANGING THE WEATHER *OFTEN* = CHANGING THE CLIMATE.

3. EVIDENCE THAT CO2 CAUSES CLIMATE/WEATHER CHANGES

Strong evidence suggests that CO2 emissions are contributing to a global warming trend. Correlative data indicates a connection; however, it does not equal causation. Other "rising correlations" exist which do not affect the climate, and high CO2 levels in ancient ice corresponding with temperatures[2] does not constitute proof that CO2 is currently causing warming. Experimental data is from small-scale testing on micro-models which are only loosely analogous to the entire Earth; in fact, we are far from being able to accurately model the whole planet and all its processes to predict weather and climate events. But we know that each gallon of fuel we burn results in nearly 20 pounds of carbon dioxide added to the air, and as far we can tell, CO2 stays trapped in the upper atmosphere indefinitely.[4] However, connecting all this evidence to specific weather patterns or predicting weather events is complex and involves many variables.

PREMISE 3:
WE DO NOT KNOW PRECISELY HOW MUCH CO2 AFFECTS TEMPERATURES AND WEATHER EVENTS COMPARED TO OTHER FACTORS.

4. NASA: THE EFFECT OF CLOUDS ON CLIMATE

According to NASA, *"Even small changes in the abundance or location of clouds could change the climate more than the anticipated changes caused by greenhouse gases, human-produced aerosols, or other factors associated with global change."*[5] Let's assume NASA is correct; in fact, we can directly observe that clouds block the sun in the daytime, resulting in shade and lower ground temperatures; at night, clouds provide insulation that prevents heat from radiating away from the Earth. Therefore, "even small changes" in the amount of cloud cover could significantly change the Earth's climate and weather patterns.

PREMISE 4:
CHANGES IN CLOUD COVER AFFECT EARTH'S WEATHER AND CLIMATE.

5. WHY CLOUDS AFFECT WEATHER PATTERNS

Clouds provide a cooling effect in the daytime because, of course, *clouds block sunlight*. Adding more clouds would increase the Earth's albedo (brightness) and reduce insolation (the amount of solar energy reaching the ground) by deflecting the solar radiation back into space and diffusing, filtering or scattering the radiation spectrum that penetrates the clouds.[5] Clouds provide warming at

night, because they create an "igloo" or blanketing effect; heat is prevented from escaping into space, so the ground doesn't cool down as much prior to getting re-heated the next day. (Clear nights are generally much colder than cloudy nights, while sunny days are usually warmer than cloudy days.)[6] Clouds also create and accelerate wind. In the daytime, clouds create shade; the temperature drops in the shaded area, and the air contracts and descends. Warmer air from the surrounding area rushes in to take up the space left by the contracting air.[7]

Clouds may also *prevent* precipitation. At night, cloud cover can re-emit the heat absorbed during the daytime and prevent heat from escaping. This creates warmer nighttime temperatures, resulting in higher pressure that can deflect some storms away from that area.[8]

PREMISE 5:
CLOUDS AFFECT AIR TEMPERATURE, PRESSURE AND WIND.

6. ANTHROPOGENIC CLOUD PRODUCTION

Humans can and do produce clouds, far more than almost anyone realizes, including people within the scientific community. We make clouds around the Earth furiously.[9] We know that condensation trails from jet aircraft can form persistent cloud cover, and alarmed witnesses around the world have seen aircraft contrails thicken, merge together, and cover the entire sky. Humans are constantly creating clouds through aircraft.

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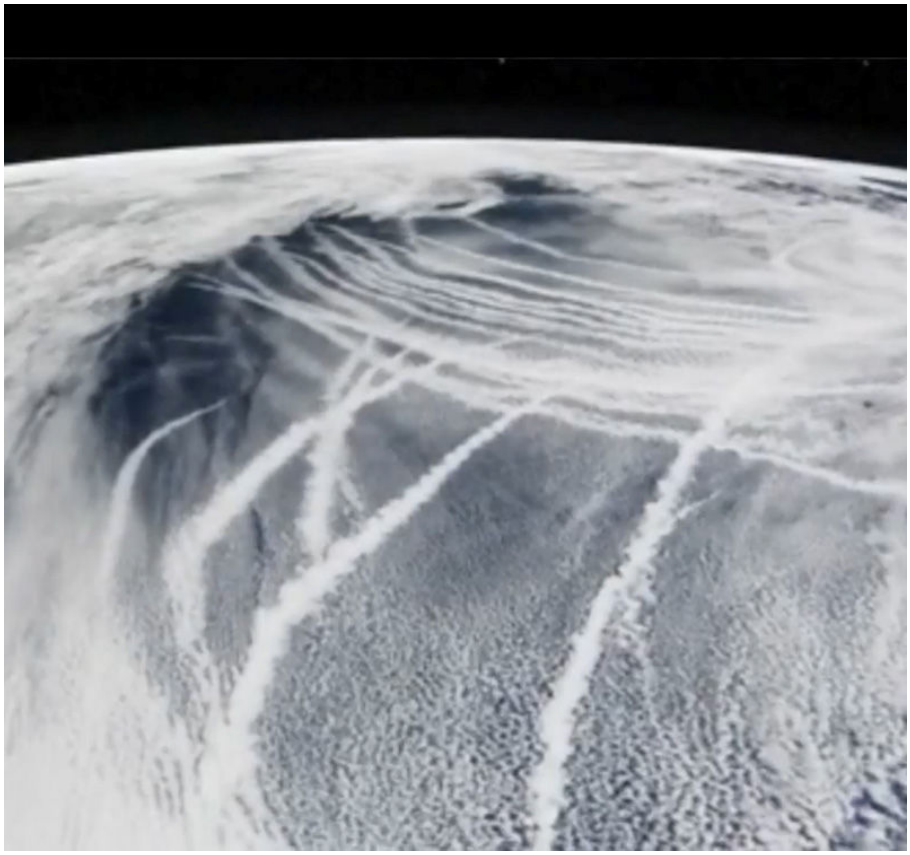
High-altitude artificial clouds created by aircraft condensation trails



NASA satellite image of jets forming contrail clouds

NASA satellite image showing jet contrails forming cloud cover

PREMISE 6:
JET AIRCRAFT DIRECTLY AFFECT THE ABUNDANCE AND LOCATION OF CLOUDS; HENCE, AIRCRAFT AFFECT WEATHER CONDITIONS.

Contrails forming clouds in California before storm clouds arrive

7. HOW MUCH DO AIRCRAFT ACTUALLY CONTRIBUTE TO CLOUDS?

Answer: Aircraft produce approximately 10 trillion cubic feet of water vapor per year. This rough calculation is based exclusively on global jet fuel consumption of about 60 billion gallons per year,[10] and does not include the steam produced from all the other carbon-based fuel combustion. Jet fuel combines with oxygen to burn and produce water and carbon dioxide (2 $C_{12}H_{26}$ + 37 0_2, producing 24 CO_2 + 26 H_2O).[11] If we consume 60 billion gallons of jet fuel annually, we are introducing 60 billion gallons (480 billion pounds) of WATER into the atmosphere each year. 60 billion gallons of H_2O = ~10 trillion cubic feet of water vapor (the frozen steam expands ~100x in the low-pressure upper atmosphere where contrail clouds form).

PREMISE 7:
JET AIRCRAFT INJECT CO2 AND H20 INTO THE UPPER ATMOSPHERE, CREATING TRILLIONS OF CUBIC FEET OF ADDITIONAL "CLOUD VAPOR" ANNUALLY.

8. CONDITIONS AFFECTING THE FORMATION OF ARTIFICIAL CLOUDS

On some days there are no visible contrail clouds. Other factors being equal, this is primarily because of relative humidity– insufficient ice crystals for contrails to bond with in order to accumulate and persist.[12] But we must remember that the "humidity" in the lower stratosphere is not actually "liquid" moisture anymore; nor is the water vapor a "gas." When they bond at sub-freezing temperatures, H2O molecules form solid crystalline structures, so after the super-heated exhaust vapor is blasted from the jet engine's manifold at over two thousand degrees, it instantly freezes and bonds into tiny ice crystals... micro-snowflakes. High relative humidity means greater density of these tiny ice crystals, which also act as cloud condensation nuclei (CCNs), facilitating persistent contrail clouds by providing the cloud-forming nuclei for exhaust moisture to bond with.

PREMISE 8:

JET EXHAUST + SUFFICIENT MOISTURE (RH) / SUFFICIENT CCN = CLOUDS.

9. WEATHER MODIFICATION ACTIVITY AND CLOUD FORMATION

"Weather modification" consists *primarily* of cloud seeding, *primarily* using aircraft, *primarily* to enhance precipitation. There are minor exceptions. Since the 1960s, high-altitude weather modification programs have increased worldwide.[13] We know that sufficient cloud condensation nuclei and "moisture" (ice crystal saturation/CCN concentration) are required for jets to form persistent clouds. Ongoing weather modification programs add massive amounts of cloud condensation nuclei to the upper atmosphere before every rain or snow storm (18,000 to 22,000 feet and higher[14]) in order to induce greater precipitation.

PREMISE 9:

WEATHER MODIFICATION ACTIVITIES ADD SIGNIFICANT CCNs TO THE ATMOSPHERE, FACILITATING CLOUD FORMATION.

10. INCREASES IN WEATHER MODIFICATION ACTIVITY

Weather modification via high-altitude cloud seeding is conducted regularly in almost every western state in the US. At least 68 counties engage in documented, ongoing "precipitation enhancement" programs[14] covering millions of square miles. Nations that need more water for growing populations and agriculture, which is most of them, use cloud seeding programs to try to increase water supplies.[14] China seeds clouds in over two thousand counties.[15] The result is increased atmospheric cloud condensation nuclei over every continent.

PREMISE 10:
THE WEATHER MODIFICATION INDUSTRY HAS EXPANDED SINCE THE 1960S TO BECOME GLOBAL AND PROLIFIC, ADDING MORE AND MORE CLOUD-FACILITATING CHEMICALS TO THE ATMOSPHERE.

11. EXTRAPOLATIONS
Based on the ten preceding premises, we can see that humans are continually modifying the *weather* via aircraft; therefore, we are also modifying the *climate* via aircraft.

A. Jet aircraft add billions of gallons of water to the upper atmosphere (which equals trillions of cubic feet of frozen water vapor) and produce clouds to varying degrees, including widespread white haze and often thick cloud cover.

B. The AgI-based (silver iodide) weather modification activities and industry that started in the 1960s have continued to grow and have spread globally, adding massive amounts of cloud-facilitating CCNs into the atmosphere around the world.

C. The combination of *jet plane transportation adding water vapor* plus *weather modification aircraft adding cloud condensation nuclei* equals added cloud cover. Aircraft are therefore directly affecting the weather by spawning clouds as they ascend to cruising altitude[16]. (Most weather modification events, air traffic and artificial cloud production take place in the northern hemisphere, where the greatest "climate change" is being observed.)

D. Clouds cool the Earth in the daytime but prevent heat from escaping at night. The net result of additional cloud cover is probably *higher average temperatures*, since the ground doesn't cool down as much at night before being re-heated by the daytime sun.

E. Increasing clouds = increasing wind = increasing storms. When all the western states conduct cloud-seeding events to increase water supplies, the additional cloud condensation nuclei continue to travel eastward with the winds. As the CCN aerosols gather more moisture and form clouds, the additional cloud cover from aircraft flying *in front of the storm* lowers the air pressure, accelerating winds.

F. Burning jet fuel produces twice as much CO2 as water vapor (almost 20lbs vs. 8lbs per gallon, respectively) and doesn't come back down to Earth as water does.

But water is extremely heat-conductive and traps far more heat energy than CO2... and water crystallizes and forms clouds that immediately affect temperatures, pressures and winds.

G. Water vapor introduced by jets into the lower stratosphere also destroys the ozone layer, which could affect the levels of solar radiation reaching the ground. [17]

H. Cloud-seeding flares use toxic chemicals, including silver iodide, aluminum, strontium and magnesium. These chemicals and have been accumulating in our soil, water and lungs for decades. [18]

I. Cloud seeding uses salt-based chemicals that may affect water surface salinity, temporarily inhibiting evaporation in some areas. [19]

12. CLOUD SEEDING AND THE LAW

Cloud seeding is not illegal in the United States (or any of the countries examined for this report). Court cases about cloud seeding have taken place in many states[13], including noteworthy cases in

- New York
- Oklahoma
- Washington
- Nebraska
- Pennsylvania
- Montana
- South Dakota
- North Dakota
- Texas
- California

13. COMMERCIAL WEATHER MODIFICATION COMPANIES

Weather modification programs in the United States are usually conducted at the county level through utility companies that hire weather modification fleets (typically Bombardiers and Hawker Jets and high-altitude propeller planes), which are paid for by consumers through the Public Purpose Programs surcharge on the utility bill. Weather modification companies in the US include:

- North American Weather Consultants [http://www.nawcinc.com/]
- Weather Modification, Inc [http://www.weathermodification.com/]
- Western Weather Consultants [http://westernweather.net/wordpress/]
- Meteo Systems [http://www.meteo-systems.com/]
- Atmospherics, Inc [https://www.facebook.com/AtmosphericsInc]
- WET International [http://www.wet-intl.com/]
- Ice Crystal Engineering [http://www.iceflares.com]

14. STATES CURRENTLY CONDUCTING CLOUD SEEDING

US States conducting extended weather modification activities or ongoing precipitation enhancement programs using aircraft with cloud seeding flares:

- North Dakota [http://www.startribune.com/local/175173981.html?refer=y]
- California [http://www.countyofsb.org/pwd/pwwater.aspx?id=3740]
- Colorado [http://www.nawcinc.com/NAWC%20Operational%20Programs.pdf]
- Georgia [http://www.nawcinc.com/NAWC%20Operational%20Programs.pdf]
- Idaho [http://earthfix.opb.org/water/article/idaho-power-looks-to-cloud-seeding-to-enhance-wint/]
- Illinois [http://www.weathermodification.com/projects.php]
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END NOTES & REFERENCES

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14. Precipitation Enhancement Primer
http://www.waterplan.water.ca.gov/docs/cwpu2009/0310final/v2c10_precipenhance_cwp2009.pdf

15. Cloud Seeding in China
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16. Aircraft contrails have a beginning and end. The plane usually has no visible contrail until it reaches the around 20,000 feet (common cloud-seeding altitude). Depending on the ice crystal/CCN saturation, this is the zone where contrails become visible, while the engines are at full throttle. Once the jet reaches cruising altitude, it uses less fuel compared to when it's climbing, and there is not enough moisture or CCNs to create the visible wake of ice crystals. On descent, jet usually do not use enough fuel to create visible contrails.

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Additional documentation, a video and more FAQs:
http://artificalclouds.com.

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