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(Review Article)

Stalled high-pressure weather systems

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Abstract

Stalled High Pressure Weather Systems (SHPWS) are associated with abnormally high temperatures, low wind velocities (except at their peripheries, where they can be quite high), cloudless skies, and a consequent lack of precipitation.

Analysis shows that the high temperatures and clear skies associated with their formation are caused by the settling out of reflective (dimming) atmospheric Sulfur Dioxide (SO2) aerosols within the area of a "High".

This cleansing of the atmosphere allows sunshine to strike the Earth's surface with greater intensity, resulting in substantially increased warming.

Keywords: Stalled Weather Systems; Climate Change; Atmospheric Sulfur Dioxide; Great Depression Warming

1. Introduction

High Pressure weather systems come and go with no exceptional climatic effects, unless they happen to become stalled for periods of about a week, or more. Then, with no additional increase in atmospheric pressure, temperatures within the stalled area begin to rise, often reaching record-setting levels.

The offered explanation for the higher temperatures within a SHPWS is adiabatic, or compressive heating, caused by the descent of a cooler air mass to the Earth's surface [1].

This is obviously incorrect, since there is no downward motion once it reaches the Earth's surface, and therefore, no additional heat is being generated. It would thus be expected that this initial compression heating would be quickly dissipated into the cooler surface which it contacts, but instead, temperatures within the stalled area always increase, reaching as much 45 deg. C (113 Deg. F), or more, in extreme instances.

2. Procedure

Plinian VEI4-VEI7 eruptions inject Sulfurous compounds into the stratosphere, where they quickly convert to SO2 aerosols, which temporarily cool the planet. When these aerosols eventually settle out, warming to pre-eruption levels occurs, because of the cleaner, less polluted air.

The working hypothesis, then, would be that the higher temperatures within SHPWS are also due to decreased levels of atmospheric SO2 aerosols within their areas.

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Five relatively well-known SHPWS were examined to see whether there were any that were inconsistent with the hypothesis.

3. Discussion

Earth's Troposphere is suffused with millions of tons of industrial SO2 aerosol emissions, which reflect sunshine and cools its surface [2].

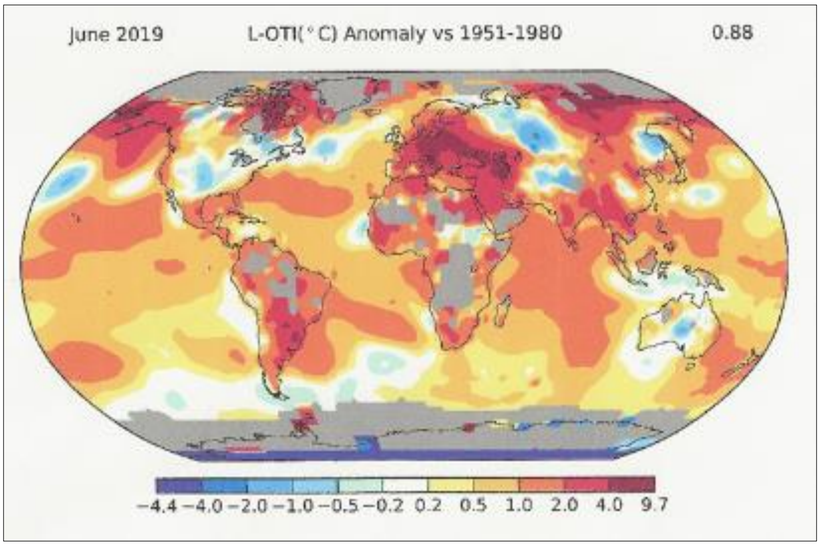
If the industrial emissions are from intermittent sources, they will wash out of the atmosphere within a week, or so. However, most emissions are from essentially continuous sources, such as Power Plants, Factories, Smelters, Home heating units, Internal combustion engines, etc., etc., so those that settle out of the atmosphere are quickly replaced, ensuring that SO2 aerosols are always present. Since the air is stagnant within a SHPWS, existing SO2 aerosols within its area quickly settle out, and, if not replaced from within the system, temperatures will naturally rise because of the cleaner, less polluted air.

This was the cause of the high temperatures that occurred in Europe (largely over France) in August of 2003. Then, because of the routine French shutdown of factories in August for vacations, there were essentially no replacement aerosols, and temperatures soared, reaching 42 deg. C. (107.6 deg. F. This resulted in a reported 14, 802 excess deaths, in France, alone (about 30,000 overall) [3].

A similar episode occurred in the spring and summer of 2018, when an abnormal SHPWS settled over Europe, and temperatures reached 45.9 deg. C (114.6 deg. F). Wikipedia attributed it to "a large heat wave affecting the northern hemisphere, caused in part by the jet stream being weaker than normal, allowing hot high-pressure air to linger in the same place" [4] (No cause was given for the hot air).

This was followed by another European heat wave, which began in late June of 2019. According to Wikipedia, it had "an all-time high temperature of 46.0 deg. C. (118 deg. F.), which occurred on June 28.

(In this instance, its cause was wrongly attributed [5] to high temperatures from Northern Africa moving into Europe. However, temperatures in Europe were higher than those in North Africa at that time, as is clearly shown in the following 250 km GISS Surface Temperature Analysis Map for June 2019) [6].



(The ONLY way that discrete areas can reach temperatures higher than those surrounding them is to reduce the amount of atmospheric SO2 pollution within those areas. Anomalous temperatures above 4.0 Deg. C. on GISS temperature maps are always indicative of a SHPWS. In this instance, temperatures ranged from 4.0 to 9.7 deg. C. Note that there are at least 3 other such areas on the above map).

Figure 1 Gridded Global Surface Temperatures for June 2019

Another example of elevated temperatures due to a SHPWS (nicknamed "The Blob") occurred between 2013 and 2016, when a "persistent and intense" ridge of high pressure developed over the Bering Sea, the Gulf of Alaska, and downward along the coast to Southern California". This warmed the seawaters within its area, resulting in the death or departure of much marine life, and killed upwards of a million seabirds that fed upon it [7]. The hot dry air also resulted in increased wildfires in California [again," The Blob" encompassed an area with very little industrial activity to replace the SO2 aerosols that settled out).

More recently, Australia experienced a Heat Wave which began on 25 Dec 2018 and extended into 2019, with temperatures reaching 46.8 deg. C (115.9 deg. F) on Jan 24, according to Wikipedia. Although not characterized as being due to a SHPWS, the GISS temperature map for Jan 2019 clearly shows the typical pattern of a SHPWS.

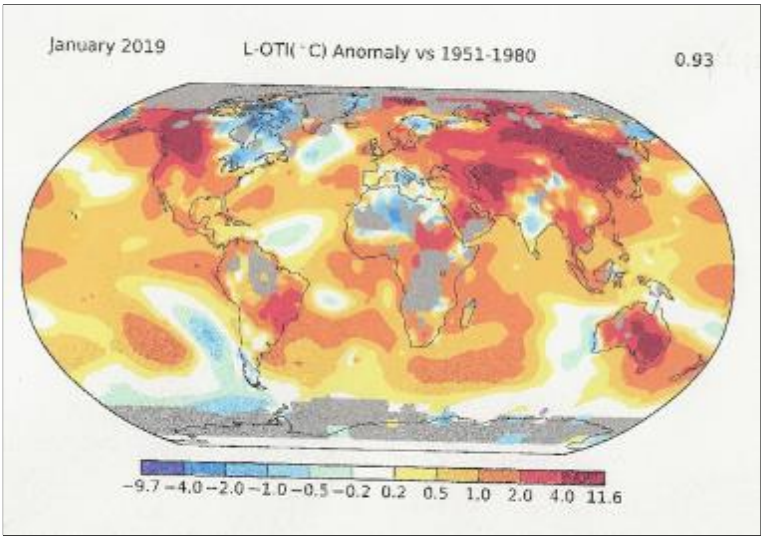


Figure 2 Gridded Global Surface Temperatures for January 2019

The abnormally high temperatures of the 1930s' American "Dust Bowl" years can also be explained in terms of decreased SO2 aerosol emissions into the atmosphere. Industrial activity during the depression years was greatly reduced, resulting in fewer industrial SO2 aerosol emissions into the Troposphere, which caused temperatures to rise. Between 1929 and 1932, global Industrial SO2 aerosol emissions fell by an unprecedented 13 Megatons [2].

In addition to the overall warming within the United States of the 1930's. Periods of exceptionally high temperatures and high winds also occurred, such as during the Heat Wave of June -Sept. 1936 (which peaked in July). As mentioned earlier, localized higher temperatures within an area can occur only if SO2 aerosols within the area are reduced. Thus, the devastating occurrence had to have been due to a SHPWS and its peripheral winds. This is clearly shown in the GISS temperature map for July 1936.

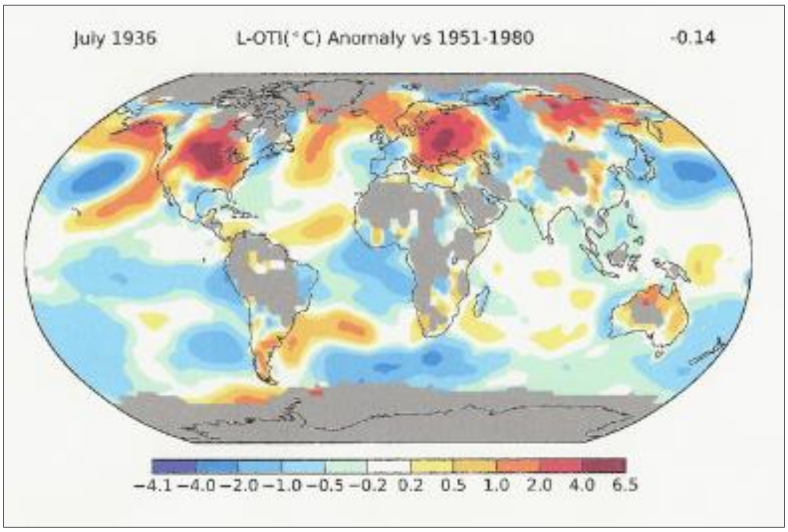


Figure 3 Gridded Global Surface Temperatures for July 1936

In addition to the SHPWS in the central United States, another one is located over Eastern Europe.

(The cool average anomalous global temperatures for Jul 1935, as compared to the previous ones shown, were due to VEI4 (3), VEI5, and VEI6 volcanic eruptions in 1932-33, whose cooling SO2 aerosols had not yet settled out of the atmosphere).

The following map (from Wikipedia) shows the actual extent of the July 1935 SHPWS Heat Wave.

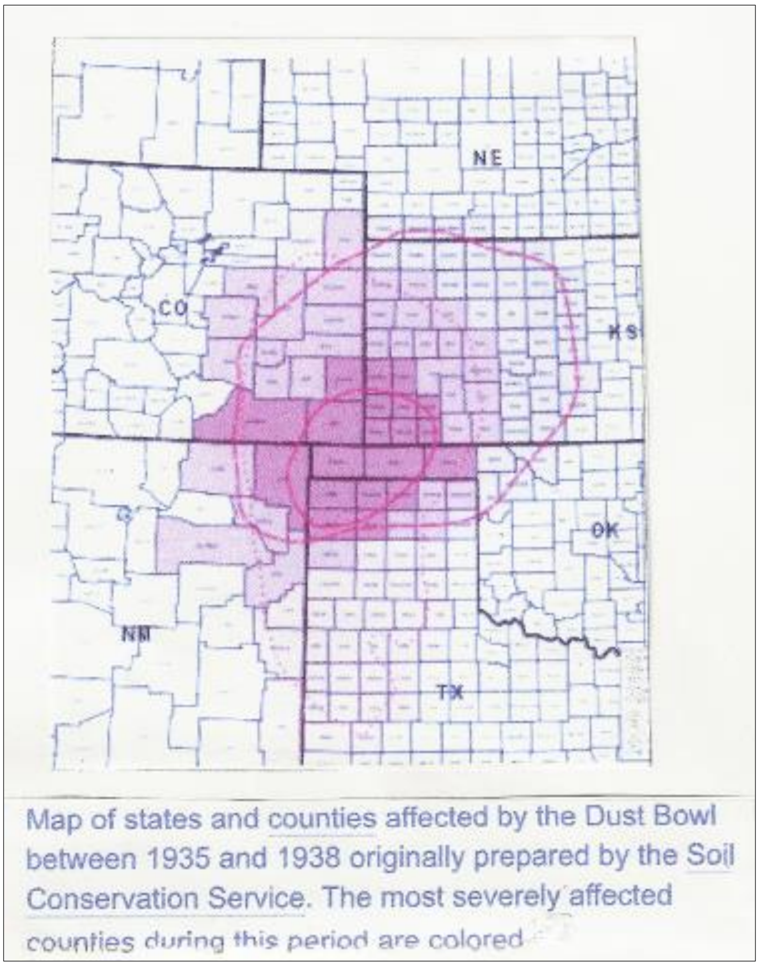


Figure 4 Location of the July 1935 “Dust Bowl” Stalled High Pressure Weather System

Some concern has been expressed that SHPWS may become more prevalent as our climate warms up. This could be determined by examination of the GISS temperature maps, for, say. 1940-1950 versus 2010-2020, taking care to exclude the Antarctic stations, which were not always there.

High temperatures within SHPWS provide a worrisome preview of what will happen to Earth’s climate if the burning of fossil fuels is eliminated, and their SO2 emissions are no longer available for cooling, as is now being attempted.

(Because of the dangerously high temperatures within SHPWS, it might be advisable to establish international rapid-response teams to seed them with some dimming substance, to replace their lost aerosols).

4. Conclusion

SHPWS are clearly the result of atmospheric SO2 aerosols settling of the areas within such systems.

At this time, no explanation is offered as to why they become stalled, although some appear to be trapped between surrounding areas of colder air.

References

[1] High Pressure Areas defined (Wikipedia).

[2] https://github.com/JGCRI/CEDS. (Scroll down to CEDS, click on Emissions by country are archived here, scroll down to SO2_emissions_by_country, a 49 kilo-byte file.

[3] 2003 European Heat Wave: https://www.climatesignals.org/events/european-heat-wave-2003.

[4] 2018 European Heat Wave (Wikipedia).

[5] 2019 European Heat Wave (Wikipedia)

[6] Gridded Global Temperature Maps: data.giss.nasa.gov/gistemp

[7] The Blob (Pacific ocean) Wikipedia