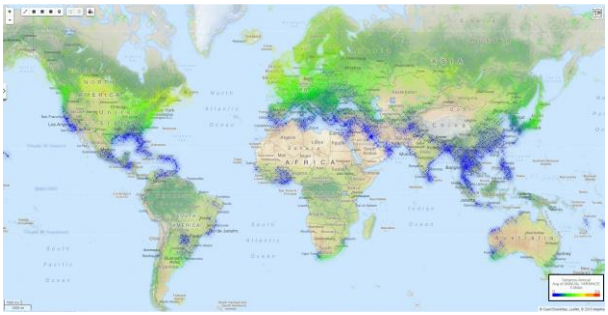
# Global Barometric Variation – Annual Maps and Monthly Raw Data

Originally Posted on March 18, 2016 (January 25, 2022) by JT Taylor



*(The Usual Disclaimer: I'm not a doctor, and am in no way qualified to give medical advice. I organized this data for myself and for the benefit of those who believe that living in a place with less barometric variation could be good for their health, so that they could see which cities have more or less barometric variation.)*

### Where I Got My Data

The global dataset used originated at the FTP site in the National Climactic Data Center (NCDC) public area of the National Oceanic and Atmospheric Administration (NOAA), which contains barometric pressure readings for more than **11,700 weather stations** around the world.

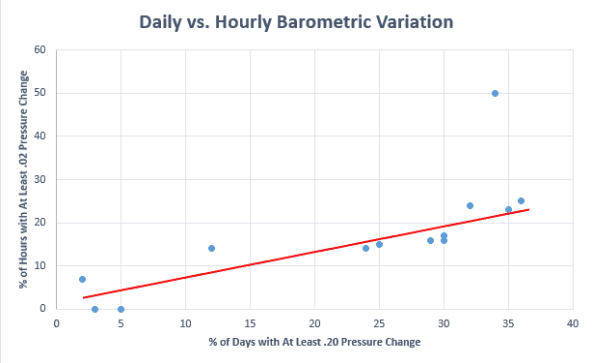
### Hourly Variation vs Daily

The percentage of days per year that experienced a standard migraine-inducing daily variation threshold (a **.20 or greater** change between **24 hour** measurements) was compared with an hourly variation threshold: (a **.02 or greater** change between any **two hourly measurements**). These threshold limits were chosen because the .02 hourly threshold, like the .20 pressure change over a 24 hour period, occur at approximately a 20% rate throughout the data set.

Here are the data on hourly variation:

| Station Name | Country | % Days with .20 change | % Hours with .02 change |
|---|---|---|---|
| CHICAGO O'HARE INTERNATIONAL | UNITED STATES | 30 | 16 |
| DENVER INTERNATIONAL AIRPORT | UNITED STATES | 34 | 50 |
| EDMONTON/NAMAO(MIL) | CANADA | 35 | 23 |
| FAIRFORD | UNITED KINGDOM | 30 | 17 |
| KUNSAN AB | KOREA, SOUTH | 12 | 14 |
| LOS ANGELES INTERNATIONAL AIR | UNITED STATES | 3 | 0 |
| MILDENHALL RAF | UNITED KINGDOM | 29 | 16 |
| MONTREAL/TRUDEAU INT | CANADA | 36 | 25 |
| RAMSTEIN AB | GERMANY | 24 | 14 |
| SALT LAKE CITY INTERNATIONAL | UNITED STATES | 25 | 15 |
| SAN DIEGO INTERNATIONAL AIRPO | UNITED STATES | 2 | 7 |
| SAN FRANCISCO INTERNATIONAL A | UNITED STATES | 5 | 0 |
| TORONTO CITY CENTRE | CANADA | 32 | 24 |

The data plotted for correlation:

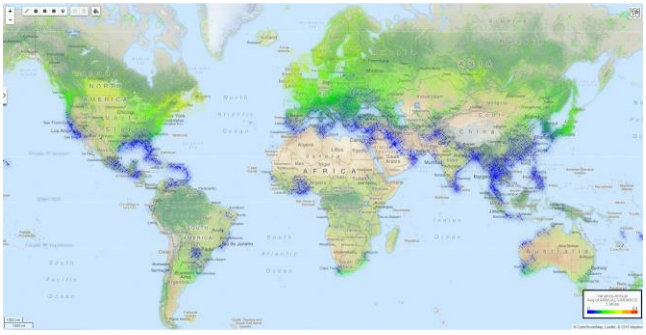



Other than the outlier–Denver (which as a high altitude city can expect to have greater measurement error, greater true variation, or both)–it seems reasonable to conclude that **daily barometric variation is an excellent proxy for understanding hourly barometric variation**.

**ANNUAL Global Variation Data**

Using daily changes, a master list and several color coded maps showing the **annual** barometric pressure variation of the world cities were compiled.

*The World*



Thankfully, there's not much red (more than 50% of days reaching the .20 threshold variation). Blue means very few days of elevated pressure variation, green suggests a modest number of days of elevated variation, and the yellowish colors suggest a significant number of days with elevated barometric pressure variation.

These variations seem significantly related to latitude, with minimal variation in the tropics.

Some interesting observations:

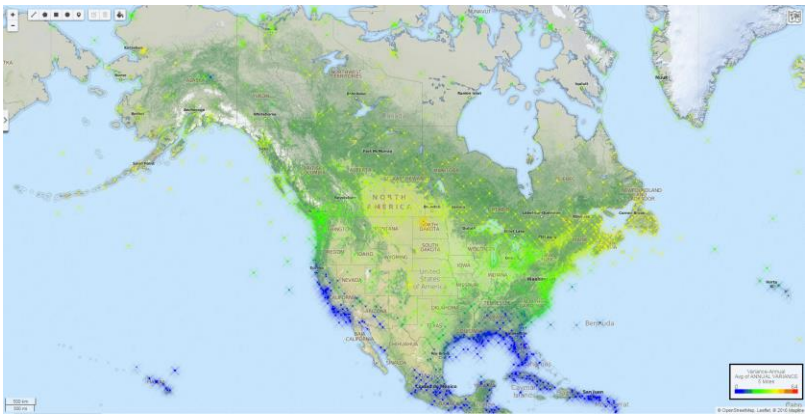
Coastal California, Portugal, Italy, and the Balkans seem to have considerably smaller pressure variation than would be expected from their latitudes.

The United States East Coast has high variation relative to its latitude.

The United States Mountain Time Zone has very high variation relative to its latitude.

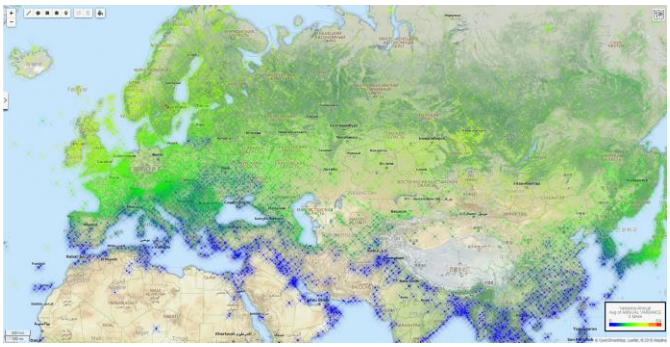
*North America*

The further south, the better, except for California, which is all blue, although it is interesting to note the significant difference between Crescent City, in extreme Northern California (12% of days annually meeting or exceeding the .20 threshold) and San Diego (1% of days). Note, some of the highest barometric variation in the world occurs in North Dakota for some reason.



*Eurasia and North Africa*

Europe and North Africa follow latitudes quite closely, with the biggest surprises in the United Kingdom and Japan. Ireland has much higher barometric variation than expected for its latitude. The East Coast of Central Japan has shockingly high variation given that it's on the same latitude as places with almost no barometric variation like Tel Aviv, Lisbon, and Islamabad. Norway also seems to be a bit more elevated than comparable latitudes in Sweden or Finland.

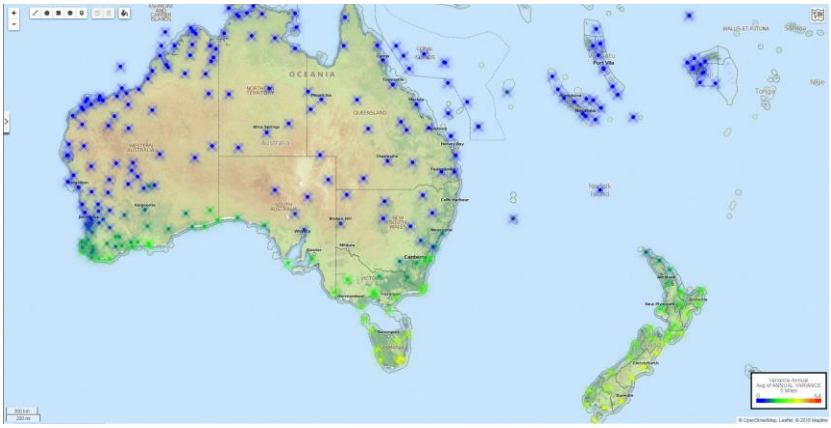


*Africa and South Asia*

Except for the unexpected swath of pressure variation in Coastal South Africa, living anywhere on this map would have you pretty safe from significant swings in atmospheric pressure, as defined here. However, smaller intraday pressure changes might have to be considered, and, of course, the lack of available data could be a modifier.

*Oceania*

Oceania generally follows latitude predictions as expected. Sydney has low variation, Melbourne is moderate, and New Zealand can get extreme on its wild southern end. I have no idea why Sydney and Melbourne don't show up on this mapping software, where instead we see Newcastle and Traralgon.




*South America*

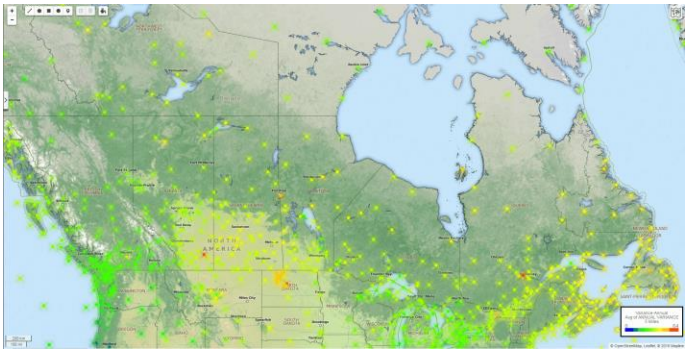
Very high and narrow mountain ranges such as the Sierras and Andes seem to throw off latitude correlation. In South America, there is a line of exceptionally high variation on the Eastern edge of the Andes. This is similar to the line of exceptionally low variation on the Western edge of the Sierras in North America.

*Western Europe*

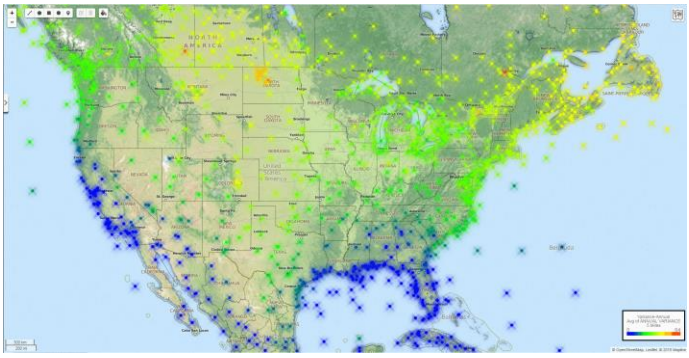
In Western Europe, there are very few measurements available in Germany for some reason. Ireland and Scotland have shockingly high pressure variation, presumably related to the legendary wind and rainfall in those areas.

*Canada*

Based upon this data base, Canada can be difficult for migraine sufferers who are triggered by changes in barometric pressure. Vancouver, Toronto, and Montreal seem least impacted by elevated pressure change compared to the remainder of the country.



*United States*



•

## Avoiding Migraines Resulting from Changes in Barometric Pressure

A .20 change in the barometric pressure (e.g., from 30.05 to 29.85, or vice versa) triggers a migraine. Looking at the number of days per year a city reported a .20 pressure swing in either direction from May, 2007 through May, 2013, from 966 USGS weather stations, the following lists suggests:

**20 Major U.S. Cities with the Least Barometric Variation** (days per year of >= .20 changes)

1. Honolulu (0 days per year)
2. Miami (4)
3. San Diego (7)
4. Los Angeles (7)
5. Tampa (11)
6. San Jose (14)
7. Sacramento (18)
8. San Francisco (18)
9. Phoenix (22)
10. New Orleans (22)
11. Jacksonville (22)
12. Birmingham (29)
13. Houston (29)
14. Atlanta (37)
15. San Antonio (37)
16. Austin (37)
17. Memphis (44)
18. Las Vegas (47)
19. Little Rock (48)
20. Charleston, SC (48)

Not surprisingly, it is the southern cities which have the fewest days of variation.

**20 U.S. Cities with the Most Barometric Variation** (days per year of >= .20 changes)

1. Augusta, Maine (128 days per year)
2. Rapid City, SD (127)
3. Montpelier, VT (117)
4. Bismarck, ND (117)
5. Boston (116)
6. Colorado Springs (113)
7. Denver (110)
8. Billings, MT (109)
9. Providence (109)
10. New Haven (105)

11. Cheyenne (105)
12. Anchorage (104)
13. Detroit (102)
14. New York City (99)
15. Buffalo (98)
16. Minneapolis (98)
17. Omaha (94)
18. Chicago (91)
19. Philadelphia (90)
20. Baltimore (87)

At the U.S. State Level, here is the complete list:

1. Hawaii (0)
2. Florida (14)
3. California (18)
4. Alabama (27)
5. Louisiana (27)
6. Mississippi (28)
7. Arizona (33)
8. Georgia (35)
9. Texas (45)
10. Tennessee (46)
11. Arkansas (46)
12. South Carolina (48)
13. Nevada (59)
14. North Carolina (60)
15. Oregon (61)
16. Kentucky (62)
17. Missouri (68)
18. New Mexico (72)
19. West Virginia (73)
20. Oklahoma (73)
21. Washington (75)
22. Illinois (78)
23. Virginia (78)
24. Indiana (80)
25. Utah (81)
26. Ohio (82)
27. Kansas (84)
28. Maryland (85)
29. Iowa (85)
30. Idaho (86)
31. Pennsylvania (89)
32. Delaware (89)
33. Wisconsin (92)

34. New Jersey (96)
35. Colorado (99)
36. Michigan (101)
37. Minnesota (101)
38. Alaska (101)
39. New York (102)
40. Nebraska (103)
41. Connecticut (106)
42. Rhode Island (107)
43. Wyoming (107)
44. Montana (108)
45. Massachusetts (111)
46. Vermont (112)
47. New Hampshire (115)
48. South Dakota (119)
49. North Dakota (120)
50. Maine (127)

Looking more deeply, we also see major differences by season. From April 1 to September 30, the national average is only 18 days of high barometric variation. From October 1 to March 31, the average is 50 days. This data is consistent with much higher reported incidence of migraines in the winter months.

Here's a sample distribution of barometric pressure variation for Austin, Texas. The number of days is the average number of high variation days for that month of the year, from 2007 to 2013.

- January – 6 days
- February – 8 days
- March – 5 days
- April – 4 days
- May – 2 days
- June, July, August, September – 0 days
- October – 3 days
- November – 4 days
- December – 7 days

So, if you live in Austin, more than half of your bad migraine days will be in the three winter months December to February. This seasonal pattern seems to hold true for most of the country.

The final cut of the data I looked at was to answer the question, "is this getting worse?" The answer is no, the data appear from year to year within the bounds of normal random variation.