Incremental Factor Catalyzing Climate Change

Mikolaj Kuca*

Department of Biological Chemistry, Collegium Humanum–Warsaw Management University, Warsaw, Poland

Research Article

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***For Correspondence:** Mikolaj Kuca, Department of Biological Chemistry, Collegium Humanum–Warsaw Management University, Warsaw, Poland

E-mail: M.Kuca@protonmail.com

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ABSTRACT

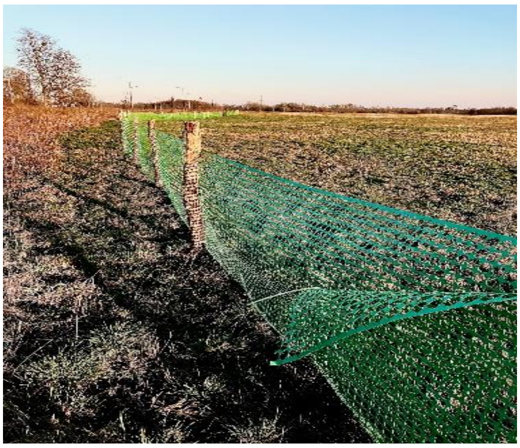
The change of climate across Europe is noticeable for its residents. It is widely accepted that the primary causal factor is the increase in atmospheric CO_2 concentration. However, many of the observable changes are related to a disturbed humidity. This is particularly evident in the effects on vegetation and progressive desertification. Lack of access to fresh water is a growing problem that often results in humanitarian crises on a massive scale. The primary supply that replenishes freshwater reserves is the inflow of sea moisture over the continents. This is the natural equivalent of the distillation process with this water feeding into rivers, lakes and underground deposits. Critical here is the barrier at the land/water frontier. The obstructions in this zone define the climate of the continent. The most spectacular natural barrier are the Andean ranges accountable for the formation of the desert areas of Chile. Until recently, the only man-made structures were coastal resort buildings. Over the past two decades, however, there has been an explosion of offshore wind farms. The scale of the development is so enormous that the number of European skyscrapers has long since been surpassed by even taller wind turbines. Detecting changes in atmospheric humidity resulting from wind farms is not easy. The impact is still not immense. Here we encounter a problem analogous to CO_2, when a negligible change in physical parameters, in the long term with permanent affect has the potential for climate alteration. In my research, I have demonstrated the first evidence confirming the theory. Offshore wind farms are a new factor responsible for the desertification of Europe.

Keywords: Environment; Ecology; Wind farms; Desertification; Precipitation; Rain; Wind power; Climate

INTRODUCTION

In my earlier publications, I have paid a lot of attention to identifying the physical mechanisms underlying dehumidification properties of the costal wind farms [1]. The change of air characteristics occurs at three fundamental levels: Thrust, altitude, humidity (Figure 1).

Figure 1. Permeable netting has been used for decades in Europe to prevent water and snow ingress in winter towards industrialized areas. Here the mesh is so sparse to be almost transparent, yet protects the road in winter conditions.



The basic principle of the laws of physics states that energy conservation determines the wind speed attenuation when propelling turbines. This is the most intuitive process, but in my opinion with the least dramatic impact, more serious impact arises from the creation of a basin resulting in a shift of air circulation to the upper layers of the atmosphere. Coastal mountain ranges were always identified as responsible for reducing the humidity of continental air. Constituting a natural barrier, these cause the much dryer air above to drift. The uneven distribution of atmospheric humidity should be emphasized here. When right above water's surface, the air is fully saturated, the humidity rapidly decreases with altitude. The magnitude of this phenomenon is enormous. It is understood that water is almost exclusively present in the troposphere. However, it should be clarified further by indicating that almost 3/4 of the water residue is below the height of 2 km. As we recall that every year, the erected wind turbines being constructed are taller and taller, the climate relevance of this development becomes understandable. Elevation correlated atmospheric humidity–the author's compilation based on radiosonde data according to Massaro [2]. The impact of erected constructions on the vertical air circulation has been studied numerous times indicating that the circulation shifts to the upper zones. Below the extremity of the building, pockets of stuck air are formed, thereby producing a basin effect in Figure 2 [3].

Figure 2. Basin simulation with residual moisture. Tall constructions surrounding water pool prevents the moist air from drifting away.

It is important to remember that there are plans for building turbines which will be nearly 500 meters tall in the near future [4]. Such large structures eclipse Europe's tallest buildings in terms of their height [5]. One of the largest structures currently in operation, which reaches 260 m (tip of the blade) with the hub height of 150 m, is the Haliade-X that is intended to produce 12 MW at full capacity. For comparison, the Sintra mountain range (Figure 3) in Portugal reaches a comparable 500 m altitude with a clear impact on the climate and the flow of Atlantic moisture.

Figure 3. A common view from Lisbon, the Sintra Range (c. 500 m tall) is regularly veiled in clouds in contrast to the crystal-clear skies in other coastal areas.

In addition, investors themselves pointed to the phenomenon of wind stealing, previously considered in the context of sailing boat competitions. Studies were undertaken on the optimal distribution of structures across the farms [6]. For investors, the layout of wind turbines on a farm is of economic importance, while the model prepared by the author to simulate the impact is a method of validating the proposed theory. Here, you can see a picture from a special technique movie for visualization of fog rolling in towards land in Figure 4.

Figure 4. Visualization of fog rolling in towards land.

Finally, the most critical influence, I indicate to be, is the direct dehumidification process by rotating airfoil. So far, it has been studied on a limited scale for engineering purposes for aircraft design and by constructors of wind turbines for cold weather locations. “In order to optimize the large wind turbines operation in ice prone cold regions, it is important to better understand the ice accretion physics and its effects on aerodynamic performance and power production losses [7].” Under certain conditions, these experiments have shown that up to 100% of the captured droplets freeze on the turbine. This problem has a direct impact on the profit of commercial wind farms as well as their economic viability. On a broader scale it indicates the existence of a physical phenomenon of blades being capable of capturing moisture. The exact mechanism is related to the pressure drop due to the shape of the airfoil as well as turbulent flow behind the turbine. It is important to remember, as the rainfall that is in the direct proximity of the costal line may be increased due to this process. Nevertheless, the air that penetrates further inland is of significantly lower humidity as my research indicates it (Figure 5).

Figure 5. Still from a special-technique-movie for laboratory turbulent air flow observation of air passing through a model of wind turbine.

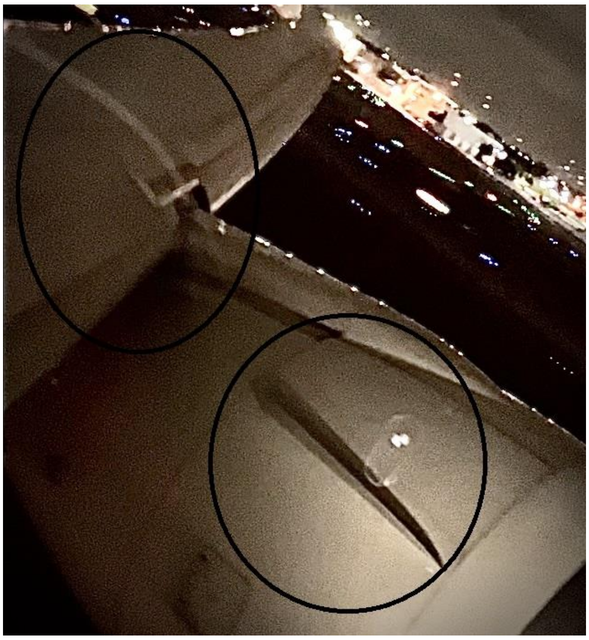
Reduced humidity over Europe results in short, cold winters with heavy freeze and low snowfall. In the summer, on the other hand, it manifests itself in heat waves and record-breaking temperature readings. It also has an impact on changing continent's flora [8]. Disturbances of the moisture circulation in Europe cannot be exclusively associated with CO_2 concentration. Indeed, it would be evenly distributed across the continent, alternatively producing the opposite effect, i.e., an increased precipitation at water vicinity in response to elevated temperatures and evaporation. These are areas where the actual meteorological data records show the conflicting trend of decline.

To conclude, the global humidity circulation is a carefully balanced system. It is calculated that 8% of global mass of water continually crosses the costal line in both directions [9]. In Europe, the dense urbanization has limited natural reserves of fresh water. Muddy areas are being drained and get built up. This is an ongoing process. Thus, we highly rely on the supply of fresh provisioning delivered by wind. Whilst, not much is done to slow down the 8% from draining the continent of water, for example by reintroduction of floodplains of rivers. The opposite side of the equation is also unbalanced by the erection of windfarms on the coasts. As human activity in Europe speeds up the rivers flow towards seas, the inflow of moist air towards the land is correspondingly lowered, both leading towards observable desertification [10].

MATERIALS AND METHODS

My research is based on experimental and data analyzing approach. For the experimental faze I conducted various laboratory simulations utilizing models on scale: 1:1000 to establish air dehumidification rate of a reference wind turbine. The results are not statistically significant and besides images, are not included in this manuscript. The underlying cause is the difference in speed. While the real life turbine may reach 300 km/h for the rotating airfoil, it is only 3 km/h for the model. Thus, the pressure drop is inadequate for condensation which is observed in Figure 6.

Figure 6. In commercial aircraft, the condensation trail only develops at speeds above c. 100 km/h on the airfoil. Here, at usual humidity, the condensation visible caused by nacelle strakes on the engine.



The dehumidification effect observed in the laboratory was evident in the accumulation of moisture on the wind turbine structure at the temperature difference, the dew effect (Figure 7). Detecting slight changes and buildup trends in the atmospheric humidity circulation is not trivial either. In the context of global warming, evaporation is accelerated, what makes the observation more complex.

Figure 7. The construction tested in laboratory is covered with water droplets that drip downwards. The exact rate of air drying could not be determined.

My innovative approach is to compare areas that first should experience the effects of a coastal fence against regions where this effect is not yet to be seen due to natural geographical barriers. Thus, the areas on either side of the English Channel directly live off the moist currents. Hence, in summer lower humidity should be noticeable in the form of reduced rainfall records. As I mentioned in the introduction, this phenomenon will not occur directly on the coast, where turbulence from wind turbines knocks out water. I selected five towns within a few dozen miles of the coast: Abbeville (Somme, France), Ashford (Kent, UK), Bergues (Nord, France), Bruges (Flemish, Belgium), Dokkum (Friesland, The Netherlands). In contrast, I designated the Alpine valleys for the control group. In these areas, the summer precipitation is driven by the accumulated water of the lakes and the inflow from the higher layers of the atmosphere, where the effect of wind turbines has not yet reached. This area should experience increased precipitation due to the climate warming effect. This is a transitional phase that will continue to occur for as long as the water reserves accumulated in the lakes and glaciers of the Alps remain. I expect that at a later stage, the desertification will also affect this region. At present, however, it is the ideal reference zone to demonstrate a trend that's new to Europe. The following 5 towns are as follow: Gunzburg (Germany), Jenbach (Austria), Mondsee (Austria), Oberstdorf (Germany), Schaan (Lichtenstein).

I studied the years 2009-2023, the time of rapid development of wind farms in Europe. I chose a fortnight summer time. The first two weeks of July are the most active at dragging sea moisture towards the center of the continent. I had to exclude the 1st of July due to technical issues. To avoid yearly and local variations that are irrelevant to the trend, I calculated cumulative precipitation for each year that can be represented in the form of a graph (Figures 8 and 9).

Figure 8. Cumulative rainfall 2-15 July of each year and the trendline for Bergues, France.

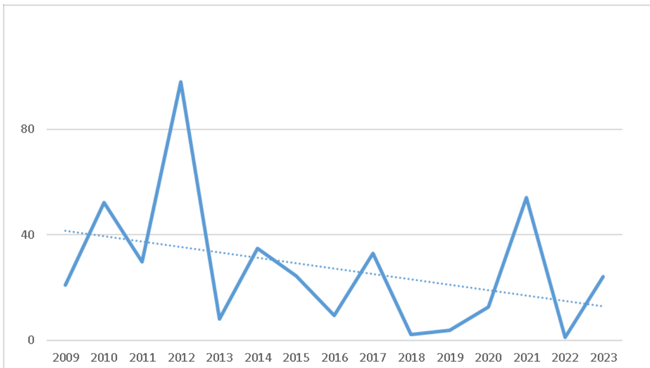


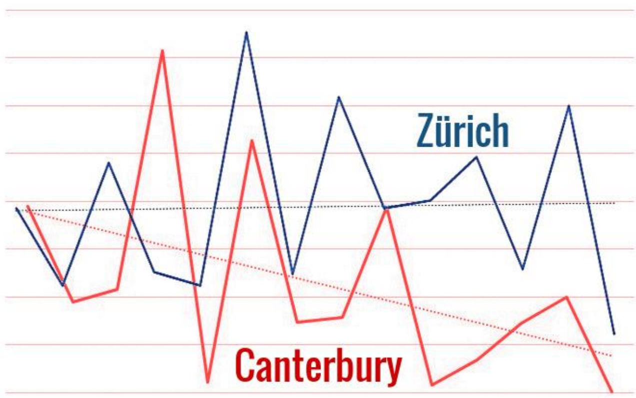
Figure 9. In terms of the weather variability, no patterns are visible until we run detailed statistical analysis. For Bergues, sunny days or heavy downpour occur in an almost chaotic pattern, although the cumulative amount of precipitation already reveals the trend.

Bergues, FR	2009	10	11	12	13	14	15	16	17	18	19	20	21	22	2023
	0,7	16	0,1	0	1,6	0	4,7	0,3	0,2	0	0	0,1	0	0	0
	0,8	5,6	0	0,9	2,6	0	0,7	0,2	0	0,1	0	0	1,3	0	0,3
	0	0	0	13	0	0,8	5,9	0	0	1,4	0	0,8	15	0	6
	0,2	0,2	1,2	12	0,1	5,2	5,6	1	0	0	0,4	0	8,2	0	10,8
observed	2,3	0	1	21	0	9,6	0	0	1,7	0	0,1	0,2	2,7	0	0
precipitation	2,9	0,4	0,6	8,7	0	0	0	0,3	0	0	1,4	0	0,2	0,2	0
daily:	4,5	0	5,2	7	0	0,2	3,2	0,2	0	0	0	6	0,5	0	0
<0,3mm	0,9	0	2,5	1	0	1,9	0,5	0	0	0,1	0	0,7	0	0	3
>10mm	0,1	0	0	0,3	0	8,1	0	0	0,7	0	0,5	1,4	15	0	0,3
	1	0	0	2,9	0	5,2	0	0	6,9	0,6	0	0	0,4	0	0,1
∑ for 14 days	4,6	1,3	12	6,4	0	0,6	1,3	0,3	22	0	0,9	0	7,3	0	1,8
<10mm	0,7	2,2	1,1	1,9	0	3,2	2,1	6,5	0	0	0,1	0,2	3,2	0,7	0
>50mm	2,2	27	5,7	23	0	0,1	0,3	0,6	1	0	0,4	3,2	0,5	0,2	1,8
	0,1	0	0	8	0	0,1	0,2	0	0,3	0	0	3,1	0	0,2	2,3
∑ (cumulative):	21	52	30	106	4,3	35	25	9,4	33	2,2	3,8	16	54	1,3	26,4

To ascertain the repeatability of the identified trend, I have run statistical analysis. Although I list five towns in this publication, I have carried out an analysis on a much broader scale and always with identical results. Statistical calculations form the basis of the verdict identifying the difference in alteration of precipitation in both regions of Europe.

When I first noticed the difference in 2022, the parameters were much more pronounced. At the time I compared two cities, coastal Canterbury and Alpine Zürich (Figure 10). In line with the predictions of climatologists, the enhanced evaporation accompanying the greenhouse effect was reflected in an increase in precipitation in the interior of the continent. While gathering material for a presentation for the planned Autumn 2024 3rd World Conference on Climate Change, I carried out a meticulous analysis of key microclimate areas. To my surprise, desertification had passed its peak in some of these areas. The resources of the surface water in Europe are already insufficient to compensate for the limited influx of marine air flows and a decrease in precipitation has begun to be recorded in the center of the continent as well.

Figure 10. In my first reports, there was a qualitative difference of increase *vs.* decrease in rainfall. It is now common to encounter a decline regardless of location, with the only difference being in the rate of drop.



In my earlier observations, the accelerated evaporation of surface water compensated for the impact of windfarms. But, this has changed over the last two years. For the mountainous Schwyz, the P-factor calculated two years ago still had a positive value of +0.4. Now it is already down to -2.9. The shrinking glaciers of the surrounding Alps and snowless winters have caused this small valley to dry out. Surface water resources are nowadays no longer sufficient to sustain precipitation on the European continent. Still, the reported trend also continues: Precipitation falls much more sharply in the coastal zone in the vicinity of extensive wind farms. To get broader perspective, I include P-factor also for remote areas of Europe: Thurso (Hihgland, UK) -0.11, Ballina (IR) -0.65, Grandola (PT) +0.05, Chabeuil (FR) +0.39, Briancon (Alps, FR) -1.37, Meggen (Alps, CH) -2.43. In coastal locations where wind farms have not been built, the change in precipitation fluctuates around neutral values. The closer we get to the heart of the alps, the more significant the decline becomes (Figure 11).

Figure 11. The Alps are subject to intensive development, which overlaps with CO_2-induced climate change leading to drought. The drainage of slopes and the built up valleys eradicate natural buffers for water and snow triggering summer droughts and driving temperatures to high record. Here, the French glacier under redevelopment, July 2023.

Due to the latest advances in change of trends, I have included a couple of supplementary areas to demonstrate that desertification is becoming the most serious concern for Europe in the coming decade.

RESULTS AND DISCUSSION

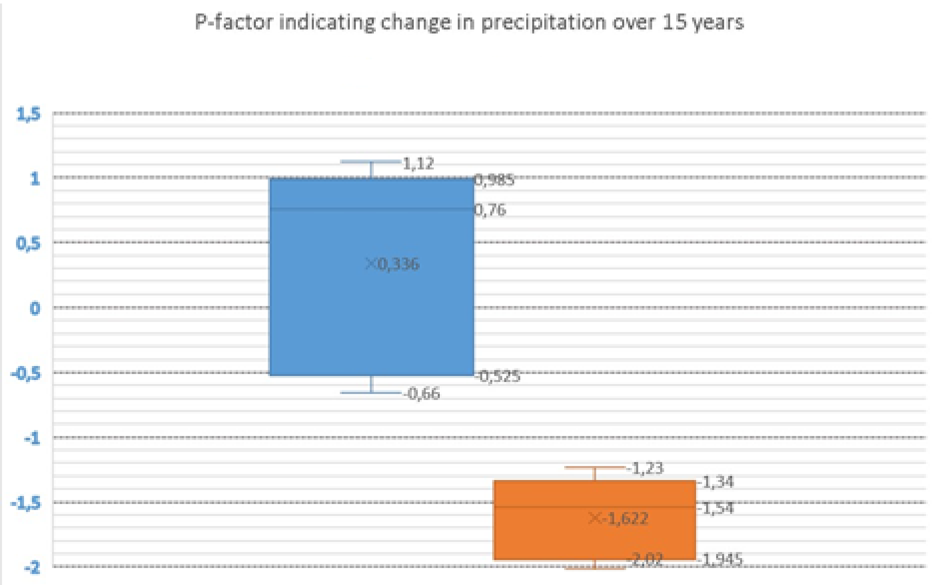
For the selected locations, I calculated the cumulative precipitation over the studied period, i.e. from 2009, when construction of the wind installations began in earnest, until summer 2023 (Figure 12). It is based on publicly available historical data [11]. The compiling fortnight precipitation eliminates daily variations without influencing the tendency. When manually calculating, it was noted that after 10 days the trend line stabilizes its course which is sufficient to ensure results repeatability. Based on these data, I determined the Precipitation trend line and its coefficient by denoting it with the letter P. It allows areas of different moisture content to be compared, while monitoring changes over the successive years. The P-value coefficient for Precipitation change is summarized in the Table 1.

Table 1. List of calculated P-factor representing the change in precipitation over time for the studied locations with the statistical conclusion.

Control	P-factor	Tested area	P-factor
Gunzburg, DE	-0.38	Abbeville, Fr	-1.23
Jenbach, AT	0.76	Ashford, UK	-1.45
Mondsee, AT	-0.66	Bergues, FR	-2.02
Oberstdorf, DE	1.12	Bruges, BE	-1.54

Schaan, LI	-0.85	Dokkum, NL	-1.87
Additional areas (not included)			
Bialowieza, PL	1.24	Schwyz, CH	-2.89
Tested group mean value of P: -1.622; SD 0.3201			
Control group mean value of P: +0.336; SD 0.8028			
The calculated value is significant at the p <0.05 (0.0019)			

Figure 12. The disparities are substantial and statistically significant. In the areas affected by the English Channel wind farms, there is a noticeable reduction of rainfall relative to the control group. **Note:** ■ control group; ■ tested group.



Although CO_2 is only four molecules in 10,000 others, it represents a pivotal greenhouse gas. But on Earth, water is by far the most decisive greenhouse gas for conditioning the habitability of the climate. Unfortunately, surface water stocks in Europe have been reduced over decades. To illustrate the buffering effect of floodplains on climate, I included rainfall computations for one of the largest wild wetlands of all, the Eastern European Bialowieza, with its P-factor of +1.24. This area has been studied in depth since 2000 due to the hazard imposed by the hydrological constructions in close vicinity to the reserve [12]. It was demonstrated that wildlife is influenced not only by the overall amount of rainfall but also by the distribution over the months. Unfortunately, both warming and wind turbines have a negative impact on rainfall patterns. Thanks to floodplains and vast wetlands, this primal forest area still receives intense rainfall.

An increasingly rare sight in Europe: The spring floodplain of a river observed in Figure 13. For centuries, the vast floodplains of lowland Europe have provided a reservoir of moisture for the summer months. Thus, stabilizing the climate into a moderate one. Here, you can see the floodplain of the Narew River, one of the largest areas left unchanged and surrounded by the massive Bialowieza National Forest.

Figure 13. Floodplain of the Narew river.

CONCLUSION

The extensive development of coastal wind farms is a new factor influencing Europe's climate. Climate warming through CO_2 emissions has disturbed the delicate weather balance and is impacting water evaporation. This is noticeable in the meteorological data and the above analysis. Besides, I have been able to demonstrate the existence of an additional factor that is now noticeable in the English Channel shoreline towns, where the windfarms are most abundant in Europe. The calculations backed up by coherent theory based on recognizable physical principles provides a comprehensive weather model. The upcoming summer of 2024 and subsequent years will provide validation of the presented theory. If proven correct, should determine strategy regarding climate protection. Such as including French Gulf of Lion for protection against wind farms as vital for Central Europe climate.

In this paper, I demonstrate for the first time that water reserves on the continent are no longer sufficient to balance the lower inflow, and the desertification has begun on a steep incline. The last two years have been dry and are the start of a new period in the history of the European climate. More dry years are ahead of us in this very decade. Desertification has long been a global problem. Until now, the human factor has been responsible for the accelerated drainage of land water into the ocean. For some years now, through the construction of huge coastal farms in Europe, we have in addition began to reduce the inflow and return of water over the continent. In the coming decade, these action will lead to unprecedented environmental catastrophe unless the wind turbines are rebuilt to actively pump moist air into Europe.

REFERENCES

1. Kuca M. The Climate Dilemma for Wind Farms. 2022.
2. Massaro G, et al, Accuracy of retrieving temperature and humidity profiles by ground-based microwave radiometry in truly complex terrain. Atmos Meas Tech. 2015;8:3355–3367.
3. Dimitrova R, et al. CFD investigation of airflow around a simple obstacle with single heating wall. CFD. 2005.
4. Sneed A. World’s largest wind turbine would be taller than the empire state building. Sci Am. 2017.
5. Winters J, et al. The largest wind turbine ever. Mech Eng. 2018;140:31.

6. Yu-Ting Wu et al. Power output efficiency in large wind farms with different hub heights and configurations. RES. 2019;132:941-949.
7. Yi Jin J, et al. Study of ice accretion and icing effects on aerodynamic characteristics of DU96 wind turbine blade profile. Cold Reg Sci Technol. 2019;160:119-127.
8. Smith T. Empirical evidence for recent global shifts in vegetation resilience. Nat Clim Change. 2022;12:477–484.
9. Gimeno L. et al. Oceanic and terrestrial sources of continental precipitation. Rev Geophys. 2012;50. December 2012.
10. Marino G. Desertification: Is Europe on the brink of a soil crisis? Renewable Matters. 2020.
11. World weather api and weather forecast. 2024.
12. Boczon A, et al. Ground waters in the Bialowieza forest in the dry year 2000. 2002.