

Naturally, the weather: On complexity, philosophy, and world systems

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[T]he dynamics [of the weather system] can be modeled as a stable linear multivariate process driven by geographically coherent white noise.

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[Meteorological phenomena] admit of several different explanations for their coming to be and several different accounts of their existence.

Epicurus

... the notion of *Time*, is to be considered in the nature of Warre; as it is in the nature of Weather. For as the nature of Foule weather, lyeth not in a showre or two of rain, but in an inclination thereto of many days together: So the nature of War, consisteth not in actual fighting; but in the known disposition thereto, during all the time there is no asurance to the contrary. All other time is PEACE.

Thomas Hobbes

Il y va de la Terre, dans sa totalité, comme des hommes, dans leur ensemble. L'histoire globale entre dans la nature; la nature globale entre dans l'histoire: voilà de l'inédit en philosophie.

Michel Serres

What can we say, and what can we not say, about the weather? The answer matters, then and now, for the survival and health of human life and culture, and life in general. Extreme meteorological events—floods, droughts, tsunamis, hurricanes, and tornadoes—as well as greater climatological changes, such as global warming, form the critical margin of weather phenomena from this point of view. Modern, technological adaptation to nature, such as the production of closed dwelling places with artificial environments, has not diminished the danger of the weather. Technological production is not an independent controlling variable on natural systems, such as the world weather system, but a set of functional variables within the environment. We have failed, fortunately, in attempting to escape from our subservience to weather and we have irritated that from which we fled.

Naturally then, because we dwell precariously on the earth and are subservient to and in the control of weather, the weather matters for culture and life in general. What weather is and how it can be known are first questions of philosophy.

How do we think through what we do not know in order to cope with the vagaries of weather? Weather readings may be split into those that seek explanations of extreme phenomena in what is simpler and more familiar, and those that maintain the complexity of the immanent, of the phenomena themselves, as something thinkable. The former is the philosophy of transcendence or theology; the latter is the naturalist alternative.

Naturally the weather, then, to think the place of philosophy in nature and the value of nature, to think the difference between philosophies of transcendence and immanence, to show how a philosophy of immanence, that is to say, a naturalism, bestows or recognizes value in nature or nature's phenomena.

Naturally, because the weather occupies a place not like we do, as a living thing residing in a dwelling, protected from the outside, but as the outside, the liminal system that runs across the skin of the world, connecting the heavens with the subterranean, always moving even when as still as still, one thing only because its many manifestations or events cannot be split off from each other and considered to perish on their own.

Naturally, the weather from the perspective of philosophy and nature: the weather today poses a challenge for human practice, in the effects that we have on the global system and the counter-effects on us, and a challenge for thinking of the nature of thinking, given the complexity and global status of this strange brew that passes for a thing.

Naturally the weather for a textual reason as well: several key works in the philosophy of nature use weather as their paradigmatic example or emblem: Epicurus' letter to Pythocles, Thomas Hobbes' *Leviathan*, and Michel Serres' *Le contrat naturel*. Each addresses the issue of how we perceive the weather and relates this question to the broader subject of the value of nature from an immanent or naturalist point of view. Each of the texts sees philosophy as a practice mediating a relatively fixed human nature and the changeable weather.¹ Epicurus' tale of nature emphasizes the individual ethic that should be developed from a correct appreciation of nature; Hobbes' tale is explicitly social and political, arguing for justice as a withdrawal from nature; finally, Serres brings together the antagonism between society and nature in a reading of their conjunction in time and the weather (*du temps*).²

I. The Nature of Weather Today

My central claim concerning the weather may appear contradictory: we have and have not progressed in our understanding of weather phenomena since ancient Greek times. Much depends on the meaning of 'phenomena' and 'understanding.' Today we are more aware of the variables relevant to the phenomena or patterns of behaviour of the weather, and we are more able, in a systematic and quantifiable way, to predict and to control such behaviours. Yet we are fundamentally in the same position as the Greeks since such understanding of weather phenomena has not eliminated our ignorance of the overall nature of weather and we are still under

its behest, notwithstanding fantastic increases in our ability to withdraw from or ward off the forces of the outside. We have thus made great advances in understanding, which I wish to outline below as they show the complexity of such knowledge, while remaining at the level of the phenomena, phenomena to which we are still subservient. The meaning of understanding and the nature of the appropriate response or attitude to limitations of understanding are still problems today, as they were in the more fideistic culture of the Greeks within which Epicurus developed his naturalist philosophy. Our situation is like that of more knowledgeable and powerful Greeks, who find that after all their scientific and technological progress they are still under the sway of powers they do not understand.

I describe contemporary meteorology and climatology this way, first, since the fact that the global human population is subservient to, dependent upon, and threatened by the weather is hardly contestable (putting aside those who believe abandonment of the earth is an answer to natural limitations to human life). While technological and engineering advances allow a significant proportion of us to live in warm, dry, and comfortable circumstances, this is not true generally of people across the world. Disparities between high-energy consumption living, necessary for the creation of stable internal environments, and the mass of more traditional and pre-technological conditions of life, especially in the Third World, contribute to our collective frailty in the face of nature. Global warming is the central and frightening example of such a case. I shall focus on a distinct problem, the apparent increase in more traditional types of natural disasters, such as thunderstorms, which impact more severely on those less encased in hermetic environments, though not exclusively so. While such disasters are more familiar and traditional, their causes are as difficult to pin down as the novel and unfamiliar event of global warming. Indeed the two are related: global atmospheric heat is a key determinant of storm activity. I choose to focus on storm activity for several reasons: increases in storm activity promise to be a major threat on life; storms have been attended to, philosophically, in the past; and, finally, the irreducible multiplicity of factors and striking temporality of extreme weather events pose the epistemological and ontological problems of thought of nature acutely.

The Center for Diagnostic Climatology, part of the U.S. Government's National Oceanographic institutes, affiliated with the University of Colorado, has a mandate to mediate meteorology and climatology, that is to say, knowledge of short and long term weather patterns, moving in the order of seasons to decades. The CDC mission is to "to advance understanding and predictions of weather and climate variations on time scales ranging from a week to centuries."³ The satisfaction of this mission includes as central components the "elucidat[ion of] fundamental processes governing climate phenomena such as droughts, floods, and the El Nino Southern Oscillation (ENSO), and to identify the causes of longer-term (decadal to centennial) climate variations."⁴ The types of fundamental processes and causes at stake are complex.

How does the CDC, a leading scientific institution in the field, go about the study of fundamental processes and causes in climate change and extreme weather? Why it does so is clear: the human dimensions of extreme meteorological and climate phenomena are numerous, and go far beyond the deaths and damage wreaked by storms. The immediate harm of extreme weather events, including storm systems, be they too much water (floods), wind (hurricanes, tornadoes), or heat (forest-fires, drought), is born by humans, animals, and the environment in general, including the developed environment. The aftermath of such events is often worse in terms of human and animal death and suffering, largely due to the spread of disease: the corpses and waste spread by extreme weather are a clear danger in their own right; the breakdown of waterworks, heating and cooling systems, food distribution, etc., pose larger-scale human catastrophes.

The implication of extreme weather events in natural resource-based engineering and technological enterprises is multifaceted and forms one of the complex problems for longer-term, synthetic weather research. The human dimensions include “population and other demographic changes, technological change, economic structures and market forces, political-social institutions and their interaction and societal values.”⁵ Most importantly for weather formation are human land and water usage. Human use of water forms one small part of the overall system relevant to weather formation, that is to say, the hydrologic cycle, which, as CDC puts it, “cuts across all of the... themes [of US oceanographic and climatological research] and provides the link between these themes and human dimensions.”⁶

The all-encompassing character of a consideration of the hydrologic cycle, while daunting as any theory of the whole is likely to be, cannot be evaded in approaching narrower problems, such as hurricane forecasting. In attempting to solve the narrower problem one need not, of course, come to a definitive and precise comprehension of the whole. Yet middle and long-term weather predictions cannot ignore the whole, and doing so may also impact on short-term predictions.

Examining the various modelling techniques used by CDC and others in weather prediction shows how a theory of the whole is useful. Predictions in climatology use observational evidence, modelling techniques, or a combination of both. The standard form of modelling technique in climatology is a linear one, with computer simulations of weather forces played against stipulated parameters. As CDC explains, “[i]n the forward problem, sample geophysical variables are run through a forward radiative transfer model, along with specific information about the satellite instrument such as the instrumental error characteristics and spectral response functions, and the outputs are simulated radiances.”⁷ The assumption of the technique is that instrumental parameters plus randomly generated geophysical variables are sufficient to provide useful information concerning potential weather patterns. Such a technique is in line with traditional assumptions concerning cause-effect relations and cognitive mapping.

The originality of CDC's approach lies in the fusion of past observational data, modelling techniques, and information theory, in a way that challenges the traditional model of cognitive mapping and suggests a new model for weather. In place of the linear or forward model, CDC develops an inverse-linear technique: "The inverse problem begins with the actual satellite observations. These observations are then used in an inverse radiative transfer model to produce retrievals of geophysical variables."⁸ That is, we should start from actual observations—an obvious truth of empiricism—and our modelling techniques should be coupled to them. The full implications of this approach go much farther, however, and show something of the difficulty in coupling observation with cognitive mapping and the complexity of empiricism. Briefly, the coupling of observations and models requires a shift from a more piecemeal, instrument-based technique to a full information theory; from "an idea of what performance we might anticipate from a given instrument"⁹ to a complete idea of what is likely to happen given our best guess of how all the variables involved may interact. Some detailed explication is required to give fuller specification of the meaning and importance of this shift in thinking the weather, and its potential significance for science and philosophy.

A restatement of our problem may help to clarify the issue at stake between the two approaches to modelling. Weather, including extreme weather, is affected by a highly complex set of variables. One may attempt to understand and predict the weather by trying to think together all the relevant variables, but this is impossible given that one has to think about everything to figure out the meaning of a particular within that global system, a particular that itself may affect the whole. One may also proceed by identifying significant variables and relating them to their potential predecessors and consequents.¹⁰ A significant or informative signal is something that correlates with but is distinct from the weather patterns one is trying to approximate. In the case of extreme weather events, sea surface temperature (SST) is the central variable. At the interface of all three phases of the hydrologic cycle, mirroring the involvement of all water phases in hurricanes and other extreme weather events, sea surface temperature is a meeting-ground upon which the various variables pertinent to weather are played out.

Even in such a simplified account, one may see the difficulty of thinking weather. Combining observation with modelling requires, to begin with, some notion of what is and is not a sign, that is to say, what counts as data. Such issues are accounted for by the piecemeal, linear modelling method: some agreement on what the instrument measures and when it is in error, when a purported signal is in fact noise, needs settling. The account of the relation of signal to noise is different in the inverse linear modelling method. From a linear approach which deals with noise primarily as an epistemological issue of the error of a measuring apparatus, we move to a theory that includes noise within the parameters of what is being modelled, and necessarily so if the coupling of observation and modelling is to work. Let us look at the technical explanation of this procedure.

CDC explains that *Linear Inverse Modelling* is a “method for extracting the dynamical parameters of a system from data.”¹¹ What this means is that model parameters are not confined to instrumental configurations, either in the sense of measuring devices or computer models; rather, parameters themselves are somehow ‘read off’ or ‘from’ past events. The point of such a ‘realist’ approximation of parameters is to have a more probable estimate of the likely event, taking everything into account, that is to say, all variables as they have played out in the past (given our data) and as they are expressed in significant variables (for example, SSTs). The opposing, linear technique is based in simplification: assuming such and such parameters, this is a likely outcome. The generalist tack of the inverse approach attempts to think the relation between past events, current parameters, and future outcomes, and in doing so, everything needs to be considered, though it cannot, of course, all be thought at the same time. Considering everything means a different relation between noise and signal; from an approach wherein signal is everything that is not instrumental noise, we have an approach that recognizes, as a real or ontological feature of the event, noise (as a concatenation of unsorted or *folded* relevant variables) and its relation to signal.

CDC’s central hypothesis concerning inverse modelling is that “the dynamics [of the weather system] can be modelled as a stable linear multivariate process driven by geographically coherent white noise.”¹² How does the difference in modelling technique bear upon the variables that are accounted for in making climatological predictions? The theoretical advantages of the inverse over the linear model are fairly clear, even though they may not be born out in superior predictive power. The inverse model is multivariate, with the implication of several variables expressed in the noise function. That is, the linear, univariate models use instrument functions to model the behaviour of a system given one variation. Such techniques are, according to CDC, “unable to predict either the growth or the changes of sign” in a complex system across periods; they “merely have the initial condition decay to climatology, possibly with different decay rates at different points, over the domain.”¹³ The synthetic capacity of the linear inverse model is due to the function of the white noise variable. Geographic white noise expresses seasonally dependent stochastic forcing: “the observed phase locking to the annual cycle is transmitted to the SST anomalies through a seasonally dependent variance of the stochastic forcing.”¹⁴

To reiterate: the linear inverse model is theoretically superior in that it (a) accounts for many variables, not just one, (b) synthesizes the activity of variables upon each other through the function of noise, and (c) plots together periods or phases of the system through variation in the noise function (“seasonally dependent variance of the stochastic forcing”). Stochastic forcing is the only seasonally dependent variable in the model, thus serving as the single fulcrum or nodal point for the concatenation of past variables and their non-linear effect on a current phase.¹⁵ CDC “emphasize” the singularity of the seasonal nature of the stochastic forcing

and “that it is neither the deterministic dynamics alone nor the stochastic forcing alone but the interplay of the two which accounts for the observed growth of El Nino events and their phase locking to the annual cycle.”¹⁶ The white noise, it should be noted, “represents the broadband non-linear dynamics affecting the more slowly varying ‘deterministic’ (and predictable) part of a measured signal”¹⁷ and “drives” the stable linear features of the Indo-Pacific ocean-atmosphere system.

The claims of such a modelling technique with respect to extreme weather events are major, but the limitations should not be understated. First, the actual predictive power is equal to but not better than the linear model and, in many cases, no better than “the simplest possible linear forecast.”¹⁸ Second, when dealing with noise, or properly, geographically stable white noise, as a variable expressive of the implication of many past variables, we run into the problem of treating the background as a signal, of noise as information. How do we distinguish meaningful from unmeaningful noise? Carrying our doubt further, what limits does noise, as a function in understanding and prediction, place upon the very ability to understand and predict? Specifically CDC is concerned with distinguishing seasonally dependent white noise from “unpredictable noise,” itself “strongly affected by the behaviour of synoptic weather systems as they approach and decay in these regions of diffluent flow. Much of its unpredictability therefore ultimately arises from the unpredictability of synoptic weather systems.”¹⁹ The unpredictability here is in part due to our ignorance concerning “eddy-mean flow interactions in these regions (as well as of the eddies themselves).”²⁰

There is much that we still do not know, especially as concerns the implication of many variables in the past and the structure of their influence, as noise, upon the future. To this end, “taking into account the detailed spatial and temporal structure of the [stochastic] forcing” is needed. From the other side, synoptic weather systems are “strongly affected by the slow variations of the background flow in space and time. The variations of the storm tracks,²¹ in turn, affect the variations of the background flow, again in both space and time.” To make clear the complexity and difficulty of this problem, CDC admits that “a proper understanding and modelling of this interaction remains an outstanding problem in meteorology.”²² Much attention needs to be paid to the skill and error of forecasting procedures and calculations—forecasting forecasting skills of weather systems—and a significant part of what such attention seeks to distinguish is the difference between seasonally dependent stochastic forcing and the “inherent noise” of the atmosphere-ocean system.²³

I have gone into some detail concerning one key aspect of CDC’s modelling procedure and it should be apparent that much is elided. In considering fundamental issues such as the geographic and temporal variables of noise, the reciprocal effects of storm tracks and space-time flow upon each other, and the character of the ocean-atmosphere interaction, we meet questions of great magnitude and complexity. For example, on the behaviour of clouds, the CDC writes that “[c]urrent

computer power permits explicit simulation of multiple clouds for multiple cloud lifetimes” and yet we lack “a model strategy under which the modelled cloud ensemble is not controlled by lateral boundary conditions (‘forcing’) or initial conditions.”²⁴ We are back at the full hydrologic cycle and the human effects on climate change, themselves a complex, multivariate dimension of the ocean-atmosphere system. As CDC puts it, “[t]he exchange of chemically and radiatively active trace gases, such as ozone and water vapour, between the stratosphere and troposphere alters the chemical and radiative balances in both regions, which would, in turn, influence the radiative forcing of the global climate system. A better understanding of the physics and dynamics of stratosphere-troposphere exchange. . . is thus critical to understanding and predicting global climate change and assessing the climate impacts of human activities.”²⁵ Much is known, but the complexity of the complete system maintains large pools of ignorance, or undifferentiated noise.²⁶

II. Epicurus, Naturalism, and the Interpretation of Storms

We have seen something of what our highly advanced, complex sciences tell us today of weather systems. I wish to emphasize two points. First, that meteorology and climatology are necessarily transdisciplinary and their object, if we wish to continue speaking so, is a *world object* or global event-system.²⁷ Second, while our predictive, calculative, and comprehensive powers have improved dramatically over time, and especially in the last century, in some respects we are still primitive in our relations with the heavens. The choice between transcendent or immanent explanations remains. Some still seek theological reductions of complexity and others replay what I shall argue is an Epicurean attitude toward the complex or unknown in nature, that is, a detachment from reduction and an affirmation of multiplicity. I shall explore Epicurus’ letter to Pythocles to better understand naturalism and its relation to the heavens, and, further, to make precise the character of detachment or freedom from disturbance which is the main practical upshot of such a thought.

Epicurus begins the letter to Pythocles, one of three outstanding letters and a major source of our documentation concerning Epicurus’ teachings, with a coupling of the aim of philosophy and a study of meteorology. Meteorology is a part of ‘true physics’ and the study of the latter is crucial, according to Epicurus, to the end of proper practical philosophy, namely, a blessed life. As the term indicates, ‘blessedness’ requires something out of the agent’s control. For Aristotle, similarly, happiness was properly attributed only after the death of an agent, since a crisis at the end of one’s life or after (for one’s family or friends) cancels or diminishes it. One must, accordingly, be fortunate to be happy. Epicurus’ philosophy, while promising perhaps more than Aristotle concerning the consequences of the right practice of philosophy, should be thought within this relation to fortune.

Epicurus urges us to think physics, and specifically meteorology in the case of the letter to Pythocles, in order to “contribute to a blessed life,” a goal which he glosses as “freedom from disturbance and a secure conviction.”²⁸ Let the gods

smile upon you: receive a good spell of weather; avoid the wrath of the heavens: steer clear of turbulent air or water. The notion that the heavens, as the abode of the gods, are the source of change in the weather is not Epicurus' doctrine. Rather, abstention from explanation in terms of gods contributes to our blessedness. Meteorology is worthy of study because it shows us how to resist bad forms of theological explanation (which eventually lead to disturbance, while appearing to cancel it) and how to produce good forms of naturalist explanation. Differences in types of explanation are linked to different attitudes to the world and thus the better attitude, that is to say, one which is in closer alignment with nature, is more likely (though not guaranteed) to bring us happiness. What then is naturalism and how is it distinct from philosophies of transcendence or theology?

Epicurus begins his letter with a purported fact concerning the phenomena of meteorology: according to our sense-perception (as distinct from judgement), meteorological phenomena "admit of several different explanations for their coming to be and several different accounts of their existence."²⁹ Epicurus holds this seemingly simple claim to be a striking fact. Why? Epicurus insists on beginning with observation, but this is not enough; one must hesitate in the plurality of observation before passing judgement. To begin with observation is easy, if not a truism; to begin with a phenomenon and give it its due is another matter. Such an attitude does 'justice' or is 'fair' to the phenomena; it is "the manner called for by the phenomena."³⁰ Any other attitude places us in "tumult" and is formed by "irrationality and groundless opinion."³¹

The question of what we are observing is not an easy one. Appearances are not events. The phenomena themselves are not apparent for we do not observe 'them' but only their various signs: "Some of the phenomena which are within our experience and are observed just as they really are do provide signs applicable to what comes to pass in meteorology, but we cannot observe meteorological phenomena; for they can occur in several different ways."³² The emphasis on possibility, the openness of what past events may explain a current state and what variety of futures may follow a complex present, is continued throughout the letter. Epicurus writes that it is important to maintain "a firm hold on what is possible."³³ He also names his view "the method of several different explanations."³⁴ This method is contrasted with "the method of unique explanations."³⁵ He associates the latter with theology and argues that "the nature of the divine not be brought to bear on this at all" as it leads us to simplify or seek the unique where there are many.³⁶

There are several examples of the ways in which a meteorological phenomenon may be caused and accounted for. The example of lightning is as good as any:

And lightning flashes similarly occur in several different ways; for the atomic configuration which produces fire is squeezed out by the friction and collision of clouds and so generates a lightning flash; it could also occur as a result of the wind making the sort of bodies which cause this luminescence flash forth from the clouds; and by the

squeezing of clouds when they are compressed, either by each other or by the winds; and by the inclusion in them of the light scattered from the heavenly bodies, which is then driven together by the motion of the clouds and winds and is expelled by the clouds; or as a result of the filtering of the finest form of light through the clouds and as a result of its movement; and by the conflagration of the wind which occurs because of the vigour of its movement and its extreme compression; and because the clouds are broken by the winds and the atoms which produce fire are then expelled and so produce the presentations of the lightning flash. And it will be easy to see that it could happen in a great many ways, for him who clings always to the phenomena and who is able to contemplate together what is similar to the phenomena.³⁷

There is no doubt that we know, in detailed ways, far more about the particular processes involved in lightning—the phenomenon—than does Epicurus. But this is not the main point. Climatologists today are challenged not primarily by the particularities of the processes involved in extreme weather events, which are largely known, but in how they come together, in the real events that are likely given the array of natural necessities and contingencies. Stated another way, our understanding of physically necessary laws and processes is now greatly advanced though our thinking of their concatenation is still rudimentary.

To insist that scientific explanation is (always) reduction to invariable law is a mode of the movement away from phenomena to the theological method of ‘unique explanations.’ One way of conceiving the value of nature is to practice what Epicurus calls “heeding the call of the phenomena,” what I referred to above as “doing justice to the appearances”. The reductive move is a move away from what appears, usually to some other *underlying* or *overarching* process or set of properties that is held to account for what has occurred or been witnessed. The reductive move, if it is not to succumb to some infinite regress (the simpler requires explanation in still simpler terms, etc.) relies upon a belief in some primary or fundamental reality, other than the phenomena.³⁸

Reduction is abstraction. The reductive method abstracts from the phenomena to the singular law, form, or essence that such phenomena are held to express or make manifest. Epicurus, on the contrary, ‘stays’ with the phenomena; he is pluralist rather than monist, positing many (not merely possible but) probable and real accounts of what is happening. Transfer from one ‘level’ of the real to another is, accordingly, conceived as a journey or transformation, a dislocation, and not as a transcendence in the sense of a movement to the ‘truly real,’ be it above (as in theology) or below (as in scientism). The real is held to be polyvalent, complex, and full of events, rather than a repetition or revelation of a singular structure. For both these reasons, it makes sense to maintain the integrity of the phenomena which have been witnessed when coming up with an account, if, that is, the particularity of what has been witnessed is the interesting thing, and not the elucidation of a pre-conceived theory.

A 'phenomenon,' as Epicurus writes above, need not be confined to what is directly given; indeed, the peculiarity of meteorological phenomena is that they are not immediately given but are only indicated by other phenomena and in such a way that *many meteorological phenomena are possible within the same indices*. A phenomenon is complex, but within the sensible; as something that appears, it may be the phenomenon of direct sense (the scene upon which it appears allows it to be seen, touched, tasted, smelt, or heard) but it may also require inference. We know already that the inference is not unique and necessary, in that there are many possible phenomena that may justly be inferred, but how may an inferred existent be conceived as a phenomenon? This is where the method of reduction and the method of multiple explanations show their central difference: the method of reduction moves, outside of time, from one level to a deeper or higher one, while the pluralist method connects occurrences across time. An event such as a lightning flash is not, accordingly, a singular object, but an expression or development of other events, which happened or will happen this way this time, but not again.³⁹

Epicurus promises, at the end of a proper understanding of meteorology and the rest of true physics, through the practice of his philosophy, a happiness or blessedness notorious for its appearance of quietude and removal from life. Does Epicurus advocate a transcendence from complication as the end of philosophy? No, and understanding why not will serve our further inquiry into the nature of weather phenomena (distinguishing between extreme and calm patterns), and, by comparison, the nature of human relations (distinguishing between war and peace).

Blessedness or calm, for Epicurus is the result of practical philosophy, though philosophy cannot guarantee its provision. The right attitude and thought may prepare one for a calm life; unless the view of calm as transcendence from, or rising above, life is correct, the right attitude and thought are insufficient nevertheless.

Epicurus explains blessedness and calm in terms of freedom from disturbance. Is such freedom an absence of motion and sense? Are motion and sense themselves equivalent to disturbance, leading eventually to a Platonic philosophy of death where the only peace is a rising above of the chaos of particulars and impressions? Epicurus' end of philosophy is rightly a hedonism and not an asceticism or religious transcendence. Calm and blessedness, accordingly, are forms of pleasure, the highest form of pleasure. Higher and lower here are not merely matters of intensity, for pleasure is not a brute physical sensation but itself a complex human response.⁴⁰

Epicurus identifies two types of pleasure: 'in motion' (*kinetic*) and 'static' or 'stable' (*katastematic*); and the latter has two sorts, *aponia* and *ataraxia*. The meaning of *aponia* and *ataraxia* as the higher types of pleasures and as 'static' needs careful interpretation. Gisela Striker argues that the text on these matters is "desperately difficult"⁴¹ and often "quoted out of context," yet she offers a paraphrase of Epicurus' key passage⁴² as follows: *aponia* and *ataraxia* "are *states* of pleasure, but the joy and delight that come with them manifest themselves in motion, that is, in particular episodes of pleasure and enjoyment."⁴³ Describing *aponia* and *ataraxia* as

“states” allows us to distinguish them from “static” somethings, which is important for conceiving calm as this-worldly or immanent. One may have states without believing in absolute stasis; a state may be relatively stable without being absolutely free of motion. Put simply, the choice is between a relative calm within life and an absolute freedom from disturbance in death.⁴⁴ Freedom from disturbance is, accordingly, consistent with motion and a certain kind of pleasure:

[I]f one grants Epicurus the claim that pleasure is constituted by undisturbed affection, one might find it plausible to say that a hedonist should aim at those states of body and mind that make life enjoyable regardless of what one takes pleasure in, except for the few disturbances that will arise from unavoidable pains. And if the connection between states of freedom and pleasurable experiences is as close as Epicurus’ theory would make it out to be, one might also be willing to accept the terminological move of calling these states pleasures as well, albeit objectless ones.⁴⁵

The calm or blessedness advocated by Epicurus is not a freedom from the vagaries of life but a freedom from unnecessary disturbance in life. It directs us to the absence of disturbance not as the negation of motion, but as the state of perception and thought which is affected by, or in touch with, nature as it need be—not unnecessarily complicated or turbulent. What is unnecessary is striking the wrong attitude about what is necessary or attempting to escape it; shunning such evasive manoeuvres maintains a place within life free for perception and thought. Taken to the extreme, as Striker contends in her last sentence, one may even see the sense of attributing blessedness to pain and suffering in that there is an objectless pleasure in not being disturbed by an incidence of harm. These are, however, dimensions of Epicurus’ thought that take us beyond the central issue, that is to say, the immanent character of calm and blessedness.⁴⁶

Epicurean calm is, thus, a motion and not the cancellation of motion; it is a special, selective, right kind of motion. Calm is a balanced or harmonious motion, where no extreme is bred, invited, or likely to seduce. The value of the weather and of the motion of bodies as matters for philosophical reflection, in the sense of practical human deliberation, is that we learn about the true pattern of things and (therefore) our own true pattern. Being able to understand and appreciate the coming to be and passing away of things allows the coming and passing of our desires to be better regulated; our goals become more realistic and more real.

Such purported benefits to a practical philosophy seem trite and obvious when stated concisely, without their details, and this is as it should be, since “[l]e réel est plein de détails.”⁴⁷ Epicurus’ message concerning the weather is one and the same: all is in the details; there is no one story of lightning, but there is this one and this one and this one, many possible events, many cases. The detail will tell, not the escape into a fantastic, simple, cloud. Naturalism in this sense is a patient and complex empiricism, a practical philosophy of the new and the many, aware of the

need for selection and setting the right course, but answering that need within nature, and not, impossibly, through its transcendence.

III. Thomas Hobbes on Natural Human Turbulence

From Epicurean “true physics,” wherein the individual’s ethical relation to the world is derived from a study of natural turbulence and calm, we move to a more modern use of nature for ethical and political ends, namely Thomas Hobbes’ *Leviathan*. Where Epicurus’ philosophy is most concerned with the well being of the individual, the value in contemplating and speculating about nature lies, for Hobbes, in its general social and political consequences. The Hobbesian theory of the social and stipulative character of ethics and justice, or, in other words, the creation of obligations by way of forming contracts, is modelled on a theory of the state of nature. Hobbes’ state of nature is a largely undesirable state, which is warded off by the almost magical creation of another world, namely, the political commonwealth.

Hobbes does not believe that the state of nature may ever be cancelled or fully repressed, since it is not an empirical or historical form to begin with. The state of nature is a hypothesis, more like a possible future state that would become probable if we abandoned our social and political artifice. The state of nature, for Hobbes, exists side by side with society, or, even more strongly, makes society possible in that the sovereign power must remain within the state of nature in order to enforce the contracts of civil and political life. The realms of ethics and positive law have purely magical status unless they are accompanied by the threat of war which the state of nature, in the body of the sovereign, represents. In the state of nature anything and everything is possible, including the stipulation of regulatory and restrictive laws and codes as well as the condition of violence which produces respect for what is stipulated. Hobbes’ inclusion of the state of nature within the social contract and the political commonwealth shows the interrelation and interconnectedness of the two spheres. Later forms of social contract theory, as well as other types of moral philosophy, tend to make the good, the valuable, and the just entirely social phenomena, but it is to Hobbes’ credit that he maintains the state of nature within the commonwealth as the condition of possibility for ethics and law. If ethics and law are not anchored, somehow, to nature then they are truly magical, creations from nothing. Hobbes’ ingenuity is to make the social and political realms only pseudo-magical, by grounding their imperatives in a sovereign force, which is both within the hypothetical state of nature and serves to bring about common social life.

Hobbes’ contract form and its double connection to nature and society will be taken up later by Michel Serres in his own thinking of the natural contract as the general form by which the spheres of nature and society, in their entirety, enter into an ethical or legal relation. Both Hobbes and Serres are inspired to think the relation of nature and society by the weather. Serres, as we shall see, conceives of

the weather as linked essentially to time (*du temps*) and weather and time both bring together society and nature. For Hobbes, war is our human nature and peace is the civilized, socially contracted removal of war.

What is, what could be, a removal of war, a removal of nature? Hobbes' solution to the problem of nature is no escape, properly speaking, no closure of natural process, but its containment, a segregation: war, nature, is limited to one, to the sovereign, and the maintenance of the natural condition in a limited place, the select highest place within the commonwealth, is necessary for law and sociality to be possible. Hobbes' sovereign must remain in the condition of war if the citizenry are to benefit from nature's removal. And war, for Hobbes, is a storm, and peace is thought as the calm between storms.

In the crucial and short thirteenth chapter of *Leviathan*, "The Naturall Condition of Mankind," Hobbes describes the condition of "Warre of every one against every one" by reference to the weather:

... the notion of *Time*, is to be considered in the nature of Warre; as it is in the nature of Weather. For as the nature of Foule weather, lyeth not in a showre or two of rain, but in an inclination thereto of many days together: So the nature of War, consisteth not in actuall fighting; but in the known disposition thereto, during all the time there is no asurance to the contrary. All other time is PEACE.⁴⁸

Hobbes' thought of war as the disposition or inclination toward disturbance, and, correlatively, of peace as the absence of disturbance, or calm, are similar to Epicurean views, though not Hobbes' attitude to turbulence nor his conception of calm.

We do not see, in this face or act, our natural condition. The natural condition is a hypothesis, not some matter of fact state or set of properties. For Hobbes, one must consider the character of time in thinking of the natural condition. The temporal and hypothetical dimensions of the natural condition rule out sensory or empirical confirmation of its character. The place of the state of nature as the ground of our contractual obligations makes it difficult to conceive of it as merely stipulative. The state of nature must be approached, accordingly, by a combination of observation and modelling. The scientist of human life should observe, according to Hobbes, the behaviour of others but judge according to his own knowledge of his self; such a study is a good one when one's own case is extended well or applies generally to others, that is, when one is able to hit upon what is essential rather than accidental.

One arrives, according to Hobbes, at knowledge concerning our warlike nature via a series of intuitions of differing complexity, at the far end intuitions concerning what we would do under certain circumstances. Such judgements are supported only by appeal to what we have seen others do in similar circumstances and what we see in ourselves as capacities for action. The similarities between the requirements of good political science and meteorology are readily apparent.

Hobbes' use of the term "inclination" indicates a series of events among humans and clouds connected in ways other than simple entailment or necessary connection. An inclination is a tendency rather than a universal and necessary law. The sciences of persons and of weather are, in other words, complex and taxing for they deal with tendencies rather than universal laws. Universal laws have bearing in these realms, but that they are insufficient as accounts of phenomena; they are too general and indiscriminate and need supplement, detail, context, particularity. An inclination or tendency, furthermore, is a probability, a likelihood, a proximity to a result in a certain neighbourhood; as Hobbes indicates, sometimes it turns into something worse and sometimes it does not. *The uncertain or variable character of inclination is absolutely necessary for Hobbes' account*: without it his story of the natural condition of mankind would be inconceivable; the threat of violence by the sovereign must be perpetually potential while only occasionally actualized. An inclination is like an essence but differs from such in being closer to the phenomenon it is meant to explain. An essence, from the perspective of a philosophy of transcendence or theology, is or may be disconnected from its expression. An inclination approximates an essence in its ideality as a probability or disposition; yet an inclination is only as an extension or inference from its expressions and would not exist without such. In other words, foul weather is not some essence separate from calm or storm, nor is the natural human condition entirely distinct from social occasions or violent brawls. Dispositions or inclinations are virtual states, ambiguous and probabilistic, yet real; they are *about to be* in general though they may not be in this time or that; sometimes they fail to manifest themselves at all but usually they do.

Hobbes begins his analogy between war and storms with the complication of time. Time is given extensive consideration throughout his epistemology.⁴⁹ Introducing the complication of time means that our consideration of the nature of something, be it weather or war, must define that thing not merely in terms of the inherence of one or more properties in a substance, but in a dispositional or tendential way, as what something is *probable to do*. An inclination, accordingly, is not an "actual" incident or two, or three, but a "known disposition," which is equated with "an inclination thereto of many days together". The incline within a plurality that is manifested in some kind of regular or significant pattern is the 'nature' Hobbes seeks. And in this realm, he finds weather and human character to be alike: each is distinguished between clearly positive and negative forms (calm, peace; storms, war) and each is often found in a mixed condition (about to clear, about to burst), thus making its character difficult to comprehend.

In *The Gift of Fear*, Gavin de Becker tells of the technologies of intuition for regaining perception of fear (contrary to civilized reason and judgement) in an attempt to fathom the beginning of the event of violence and so avoid or temper it. The seemingly abstract philosophical question, "What is an event, when does it begin?" is, in this light, a supremely practical affair, meaning, perhaps, the difference

between life and death. The answer to the question again hinges on the notion of inclination, when something starts to happen even though it need not but is likely to. Something violent happening is not the result of something special or missing, according to de Becker: “With the man who goes on a shooting spree at work, it is not that he has some mysterious extra component or that he necessarily has something missing. It is usually the balance and interaction of the same ingredients that influence us all.”⁵⁰ This fits with Hobbesian method concerning knowledge of human nature: the potential for violence is in us and may be known by observation and self-reflection. Similarly, de Becker argues that only upon a comparison between our motivations and those of our potential attacker may we well predict an encounter. The onset of violence is an inclination within an intensification of an ordinary process, a weighting, a quorum, a quantum, a threshold of what is common. This having been said, it is still difficult to predict the onset of such an event, because of the looping effect by which the beginning takes on a character only in relation with that which follows, for example, the act of violence. If the beginning led to something else, as it could have done, then it would not have been a beginning of this, violent, event. The difficulty of reading warning signs may thus be expressed as the difficulty of separating pre-incident indicators from the incident: “[p]rediction moves from a science to an art when you realize that pre-incident indicators are actually part of the incident.”⁵¹ A more general way of expressing this feature of the problem is in terms of the context of violence, the meeting of persons, which de Becker characterizes as necessarily interactional⁵²: something is not fully what it is until it has been met by something else.

IV. War and Peace; Storms, Interludes, and Harmonies

In his *Le contrat naturel*, Serres adopts much of Hobbes’ thought concerning the link between ethics and contracts, but argues with the Englishman concerning the field within which contracts may be formed, forcing an extension from the social to the natural. The turn to the natural has many reasons, from the soil upon which the pugilistic subjects of Hobbesian thought stand to the environmental catastrophes of mass social production in the twentieth and twenty-first centuries. Nature, conceived as the whole system of interactions of things and processes on the earth, is a close synonym for weather.

Climate expresses the interface of nature and society. Changes in the weather are highly complex and require thought of multiple possible times. For Serres, philosophy is the thought of time, and as such, it is also the thought of weather, for both are conceptions of the possible. Serres joins Hobbes in his insight into the link between weather and time (for which one term in French suffices, *du temps*).

Yet Serres’ attitude is more like that of Epicurus. For Hobbes, the storm and the natural battle of human beings must be removed, and their absence is defined as peace. For Serres, war forms part of social transcendence or removal, such that society and war are implicated and war and nature are dislocated. A social contract

is a war on nature. Peace is not just the absence of social war but the end of the war on nature. War, law, and society are akin. Peace is not the absence of war but the absence of the belief in the mutual exclusivity of society and nature. As Epicurean calm is not a stasis outside natural turbulence, so peace, for Serres, is no escape through the mirage of a self-constituting life achievable by society and law. The natural contract is the thought of the relation of the social and natural, the right harmony between different forms of turbulence.

Thinking the natural contract, the possibility of peace through the relation between nature and society, is the function of philosophy as the thought of time and the possible, the ethical act. "Il y va de la Terre, dans sa totalité, comme des hommes, dans leur ensemble. L'histoire globale entre dans la nature; la nature globale entre dans l'histoire: voilà de l'inédit en philosophie."⁵³

Human activity has become globalized, through our sheer mass in the twenty-first century, what Serres refers to as the becoming material of the human. The massification of humanity on the scale of tectonic plates may be seen in technologies of globalized communication, rapid speed, and intensive natural resource extraction and waste. The power of human activity is found primarily in the mass, the collective system of humans, be it in our numbers, the aggregation of the effects of individual acts of high numbers of persons, or the effects of highly intensified and organized human activity in the form of technology. The massification of human activity does not mean that individual acts of persons are no longer significant. Jumping to such a conclusion assumes an answer to the problem of aggregation, or how something becomes a mass of significant proportion. Human power is today a threat to the earth as a whole, natural system; human capacities have global level effects and are expressed in globalized dimensions. Such global effects as expressions of human activity are not ordinarily features of single persons but do pass, necessarily, through persons, in some cases a few (for example, nuclear reactors), in some cases many (like human waste). That such effects pass through persons does not place us in the same realm as a conducting material, though that potential exists, that is, humans may serve merely as forms through which effects are transmitted, but this would be so only as an abnegation of another power of persons, that is to say, our existence as generative causes, most commonly know as our ability to choose or decide.

With respect to the two types of global activity outlined above (effects of massification, effects of intensive and organized human labour) the single person may play a generative role in different ways. For example, I may choose not to eat certain substances or I may choose not to work in certain fields. Such decisions may be mundane but it is the massification of mundane features which gives rise to global effects of human activity in the first place, under one of its forms. More traditionally significant social and political acts also have effects of a global sort (constructing a world court, spreading news across global communication systems) but they are not the only ones to do so: knowing this is important if one

thinks singular activity is significant within human massification and not only on the basis of giant capital or technological ownership.

The study of complex systems like the weather shows that a single component or set of components may have a significant effect on the whole, and, vice versa, that the whole as such also has effects on its parts. The individual, ethical encounter with complex global systems—be they weather patterns, networks of capital or technological equipment, or highly sophisticated, multidisciplinary and transdisciplinary sciences—must be aware that such systems function unlike individual agents, yet their global or world-object status does not remove them from the domain in which individual actions matter. The issue of massification or aggregation is the problem of how something complex is constructed in time. And here the weather shows us that there are many possible constructions. The individual agent, together with local and global sets of such agents, is capable of having an effect on the whole. We need to exercise such control if the effects of the mass of humanity are not to destroy the earth. The natural contract is a proposal concerning the coupling and regulation of two highly complex systems, nature and society, such that they may co-exist in the whole. The weather expresses the turbulence of their encounter. The thought of time allows prediction of disaster and construction of peace.

The value of nature is the source of all value. Events that are perceived as events are complex processes that teach perception and calculation. The value of nature is the source of all value as that in which we dwell, as beauty: “Être même de beauté, rien n’est aussi beau que le monde; rien de beau ne se produit sans ce donateur gracieux de toutes les magnificences.”⁵⁴

Notes

1 It is interesting that the comparison between human and natural has, here, the reverse of the traditional connotation, wherein the human is plastic and nature rigid.

2 These three tales share a lineage: Serres' natural contract is indebted to Hobbes' social contract, and both Serres and Hobbes are naturalists in an Epicurean sense; they also share a fascination with the weather and a belief that philosophy is about how we approach nature, or, in other words, the system of the weather (though they differ in their understanding of the best approach).

3 Center for Diagnostic Climatology. Website: www.cdd.noaa.gov/review97, 1.1.

4 *ibid*, 1.1.

5 *ibid*, 6.1.

6 *ibid*, 5.1.

7 *ibid*, 5.1.

8 *ibid*, 5.1.

9 *ibid*, 5.1.

10 The latter is a simplification of the former: significant variables are ways in which the complex system is expressed in terms of its current agents.

11 Center for Diagnostic Climatology, 2.1.1.

12 *ibid*, 2.1.1.

13 *ibid*, 2.1.1.

14 *ibid*, 2.1.1.

15 *ibid*, 2.1.1.

16 *ibid*, 2.1.1.

17 *ibid*, 2.1.1.

18 *ibid*, 2.2.

19 *ibid*, 2.3.0

20 *ibid*, 2.3.

21 Stormtracks are defined as Aextratropical synoptic variability, with variance maxima over the western Pacific and Atlantic oceans.

22 Center for Diagnostic Climatology, 2.3.3.

23 *ibid*, 3.

24 *ibid*, 3.12.

25 *ibid*, 3.1.4.00

26 Here, in these depths, as in the permanent thermocline of the oceans, there is the earth itself and "the effect of gyrescale circulation changes" [CDC 4.1].

27 *Objet du monde* in Michel Serres' sense in his *Le contrat naturel* (Paris: Éditions François Bourin, 1990).

28 Epicurus, "Letter to Pythocles," *Hellenistic Philosophy: Introductory readings*, ed. B. Inwood and L.P. Gerson (Indianapolis: Hackett, 1988), 10.845.

29 *ibid*, 10.86.

30 *ibid*, 10.86.

31 *ibid*, 10.87.0

32 *ibid*, 10.87.

33 *ibid*, 10.93.

34 *ibid*, 10.95.

35 *ibid*, 10.95.

36 *ibid*, 10.97.

37 *ibid*, 10.1012.

38 Whether or not the fundamental *explanandum* takes a phenomenal or logical-conceptual form is a further question.

39 As Serres puts a similar point: “Les termes de nuage, température, turbulence, etc., sont autant de termes qui ne se referent à aucune situation physique singulière, mais a une distribution de situations possibles dont l’une seulement se réalise en fait”. See Michel Serres, *Le passage du nord ouest* (Paris: Les éditions de minuit, 1980), 37.

40 Even Plato argues such in *Philebus*.

41 What constitutes Epicurean text is itself a matter of heated dispute, given the mixture of authored writings, reports, disciples’ writings, and opponents’ writings.

42 Epicurus’ dictum in “Letter to Pythocles,” 136: *he men gar ataraxia kai aponia katastematikai eisin hedonai he de chara kai he euphrosune kata kinesin energeiai blepontai*.

43 G. Striker, “Epicurean hedonism,” *Essays on Hellenistic Epistemology and Ethics* (Cambridge: CUP, 1996), 207.

44 Striker continues her reading by stating that “[t]he claim that states of undisturbed perception and carefree thought are pleasures in themselves is strange,” but I do not see why; Plato’s discussion in the *Philebus* also makes true perception the greatest pleasure and that such aesthetic comportment should be seen as good seems plausible.

45 *ibid*, 207.

46 Stoicism, the major Hellenistic alternative to Epicureanism, has a correlate to the above form of thinking in its distinction between questions of the good and questions of value; according to Stoic axiology, concern in the latter realm should be avoided if it is also not merited in the former. The distinction between matters of good and value matters, while relative, bears upon the problem of the right attitude in Epicurus’ thought and whether the avoidance of tur-

bulence need be an escape from nature. Accordingly, in Stoic theory ‘freedom from,’ *apatheia*, is not an absence of emotion but an absence of concern regarding that which is not an appropriate or natural matter of concern. See G. Striker, “Following nature: A study in Stoic ethics,” *Essays on Hellenistic Epistemology and Ethics*, 279. As Striker explains, “the wholehearted acceptance of the order of nature the Stoics describe as virtue,” if achieved, forms “what Zeno called the ‘easy flow of life’ (*euoia bion*), and also what later Stoics like Seneca and Epictetus call tranquility or peace of mind (*euthumia and ataraxia*), like the inner state of a happy person.” (*ibid*, 279)

47 Michel Serres, *La naissance de la physique dans le texte du Lucrece: Fleuves et turbulences*. (Paris: Les éditions de minuit, 1977).

48 Thomas Hobbes, *Leviathan* (Cambridge: Cambridge University Press, 1991), 62.

49 The formation of understanding is largely dependent on good memory and the distinction between everyday experience and science hinges on science’s ability to extend good predictions about what is to come.

50 G. De Becker, *The Gift of Fear* (New York: Dell, 1997), 94.

51 *ibid*, 120.

52 *ibid*, 167.

53 Michel Serres, *Le contrat naturel*, 18.

54 *ibid*, 45.