

# Geofinance: Financialities of the Anthropocene

Sami Hammana

6-9-2017

*MA Research Architecture 2016/2017 dissertation*

*Centre for Research Architecture, Visual Cultures, Goldsmiths University of London*

Wordcount: 6470

- I. INTRODUCTION TO AN ERADICATION
- II. TOWARDS AN UNDERSTANDING OF URFINANCE
- III. POLITICAL ECONOMY OF GEOFINANCE
- IV. GEOFINANCIAL SPECULATIONS: IMPLIED VOLATILITY AS INVERSED GEOLOGY
- V. IMPLIED VOLATILE EARTH

## I. INTRODUCTION TO AN ERADICATION

Did you ever receive an actual cow? “Oh boy did I, not a cow, but forty of them.”<sup>1</sup>

Finance in the age of the Anthropocene generates a cognitive challenge for multi-disciplinarily tackling the socio-economic condition effected by financial violence. Futures traders making mistakes in trades, with physical commodities suddenly appearing in front of them as a result, problematizes the position of the *Anthropos vis-à-vis* finance. What is the threshold of perceiving the system of derivative finance? Can it still be theorised while leaning on anthropocentrism? Or is there rather a need for a non-correlationist<sup>2</sup> ontological understanding of finance, one that would be able to generate emancipatory politico-mathematical methods *without* the human in the centre of this philosophical framework? For doing so a turn to speculation becomes necessary: The 2007/2008 financial crisis resulted in several different negotiations on the ontological status of finance itself. Ontological reconsiderations of how finance effects discourses, ranging from culture and social interactions, to micro economic fluctuations and power-relations. Roughly speaking, all of these analyses are characterised by a concern for, and an approach influenced by, ‘speculation’ – a focus on risk and anticipation as being primary vehicles for capitalisation and financialization. Speculation as a prime vehicle for capitalisation can be traced from as early as the invention of Western rational philosophy, as it is articulated by Aristotle, all the way through to contemporary works like Suhail Malik’s *The Ontology of Finance*, wherein the claim is made that every form of capitalisation is always preceded by a process of financialization.

The aim of this essay lies within making a case for a convergence of power characterised by risk and speculation; namely the convergence of environmental degradation and financial violence. Since the promise of such a convergence cannot be fully explored in the scope of this dissertation, the focus will be –as referred to in the subtitle– on financiality, which “is finance qua structural a priori of capitalisation”<sup>3</sup> as a process deeply rooted in the

---

<sup>1</sup> Smith, Robert. “What Actually Happens At The End Of ‘Trading Places?’” NPR, NPR, 12 July 2013, [www.npr.org/sections/money/2013/07/19/201430727/what-actually-happens-at-the-end-of-trading-places](http://www.npr.org/sections/money/2013/07/19/201430727/what-actually-happens-at-the-end-of-trading-places).

<sup>2</sup> See Quentin Meillassoux’s definition: “By ‘correlation’ we mean the idea according to which we only ever have access to the correlation between thinking and being, and never to either term considered apart from the other. We will henceforth call *correlationism* any current of thought which maintains the unsurpassable character of the correlation so defined.”

Meillassoux, Quentin, et al. “After Finitude: an Essay on the Necessity of Contingency.” *After Finitude: an Essay on the Necessity of Contingency*, Bloomsbury Academic, an Imprint of Bloomsbury Publishing, 2015, pp. 5–5.

<sup>3</sup> Creorder. “DERIVATIVES -- Suhail Malik and Ulf Martin (September 2016).” YouTube. YouTube, 19 Nov. 2016. Web. 11 June 2017.

Anthropocene. Such a convergence ultimately marks a prepositional shift, one that necessitates a different understanding of the relationship between politics, economy and the Earth. It requires not only an understanding of a political economy *on* the Earth, but also one *of* the Earth. The hypothesis is as follows: if there is such a convergence, then capitalist violence and environmental degradation are not only inseparable, but hold similar, if not identical, logics in generating strategies of emancipation.

The first theoretical cornerstone for qualifying this hypothesis will be made on the basis of Suhail Malik's introduction to his essay *The Ontology of Finance: Price, Power and the Arkhéderivative*<sup>4</sup>, published in Urbanomic's 8<sup>th</sup> volume of COLLAPSE. The editor of this journal, Robin Mackay, describes Malik's essay as "reading [the notion of] price as the medium of political order, and the market as the medium of capital-power"<sup>5</sup>. It is precisely this concise explanation of Malik's political-philosophical framework that will help in constructing and considering a political economy of environmental catastrophes through finance. Malik starts his essay by drawing upon two nominal figures: "[T]he notional total value of the derivatives market at the end of 2012 was \$694.4 trillion." Juxtaposed to "the \$71.7 tn global market value of the 'real economy' of goods and services, Gross Domestic Product (GDP)" – with the 'real economy' being the global economy measured in GDP<sup>6</sup>. According to Malik, the difference of wealth between derivative markets and nation-states' GDP, could amount to a takeover of finance-power over nation-state sovereignty. This introduction to *The Ontology of Finance* forms the basis for what Malik calls, a '*power theory of finance*' that is advanced throughout the essay; the aforementioned power theory is characterised by the manipulability of future contingencies – a reordering control that is unique to derivative instruments and therefore unique to finance-capital compared to other formal counterparts of capital-power.<sup>7</sup>

Theorising finance as an operator in environmental conditioning becomes an unavoidable task once these two statistical figures are met with another: The International Energy

---

<sup>4</sup> Malik, Suhail. *The Ontology of Finance: Price, Power, and the Arkhéderivative*. Vol. VIII. Falmouth: Urbanomic, 2014. Print. COLLAPSE.

<sup>5</sup> Malik, Suhail. *The Ontology of Finance: Price, Power, and the Arkhéderivative*. Vol. VIII. Falmouth: Urbanomic, 2014. Print. COLLAPSE. Pp 31

<sup>6</sup> Ibid. Pp 629

<sup>7</sup> Malik makes the argument for finance-power as a typological power that allows for a political risk rationality, one that is able to construe and influence future outcomes through financial speculation, hedging and waging. Probably best explained in the conclusion of the essay: "[F]inance-power observes and instantiates a risk rationality to which even sovereign states as prominent modes of power are subordinated. [...] Politics itself now means not just what the future will be but also the power over the magnitude of futural contingency and who or what owns it across the entire social order, including but not limited to the sovereign state."

Malik, Suhail. *The Ontology of Finance: Price, Power, and the Arkhéderivative*. Vol. VIII. Falmouth: Urbanomic, 2014. Print. COLLAPSE. Pp 809-810

Agency’s research shows that the global economy increases and decreases simultaneously with CO2 emissions, with a 1.5% margin of error at the very least, and a perfect sync at best<sup>8</sup> (see figure 1). This similarity in behaviour points to a correlation between Gross Domestic Product and CO2 emissions: As the global economy grows so too do CO2 emissions, and vice versa as it shrinks. When juxtaposed with the overtaking of the ‘real economy’ by finance, as pointed out by Malik, such a correlation begs for an articulation of finance’s position, namely: Does the global financial market influence CO2 emissions, if not in the same, then in a more intense manner, as the numbers above show? And if that is the case and finance does manipulate CO2 emissions, can finance be theorised as having the ability to reorder Earth-systems at large? If so, then this statistical relationship suggests that finance must always be read in a reciprocal relationship to the Earth, that finance is always *geofinance*.

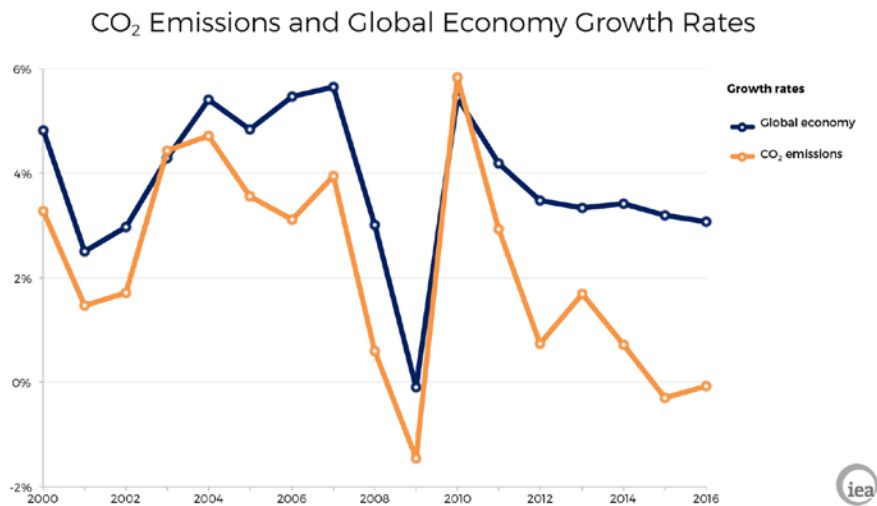


Figure 1. IEA plot of the behaviour of the global economy compared to CO2-emissions<sup>9</sup>

To test this hypothesis, an understanding of an *anthropocenic finance-power* needs to be elaborated upon – a finance-power surpassing the correlationist understanding of political power exertion by the Anthropos. For such an understanding to be attained, finance as a social practice, needs to be thought of as a reordering of social relations not only between humans (traders, socio-economic classes etc.), but also *beyond* the human.

To contend with this question, a cursory glance at existing ontological statements on finance need to be considered: What kind of a practice is it? Artist and former-trader Gerald Nestler

<sup>8</sup> “CAIT: WRI’s Climate Data Explorer.” World Resources Institute, [cait.wri.org/historical/Country%20GHG%20Emissions?indicator%5B%5D=Total%2BGHG%2BEmissions%2BIncluding%2BLand-Use%2BChange%2Band%2BForestry&year%5B%5D=2013&sortIdx=NaN&chartType=geo](http://cait.wri.org/historical/Country%20GHG%20Emissions?indicator%5B%5D=Total%2BGHG%2BEmissions%2BIncluding%2BLand-Use%2BChange%2Band%2BForestry&year%5B%5D=2013&sortIdx=NaN&chartType=geo).

<sup>9</sup> IEA. “CO2 Emissions and Global Economy Growth Rates.” IEA, [www.iea.org/newsroom/news/2017/march/iea-finds-co2-emissions-flat-for-third-straight-year-even-as-global-economy-grew.html](http://www.iea.org/newsroom/news/2017/march/iea-finds-co2-emissions-flat-for-third-straight-year-even-as-global-economy-grew.html).

would say that “[t]he market is a social construct”<sup>10</sup>; one that allows and mediates social relations. Without any disagreement, the hedge fund director of Energy Global, Ronald Huisman would say that “on the market prices are determined”<sup>11</sup>. In like manner, Peter Anker would say that “[t]he market is where anticipations are set”<sup>12</sup>. In other words, these three – in Nestler’s case former – traders all hint at the possibility of setting relations and prices through anticipation. Finance, for them, is a social practice where anticipations become norms through price-setting. Similarly, in Ray Brassier’s remarks on Malik’s *The Ontology of Finance*, we see that: “Finance is a social practice that reorders social relations of property”<sup>13</sup>, witnessing a widespread conviction of the revisability of social relations through finance. Maintaining this social constructability as an inherent component to finance, the following question could be asked: To what extent does the ‘social’ reach? Is finance an anthropocentric social practice, or have the functions of finance been here all along? Before the human, hidden in the architecture of the bushes? How did it operate? And how can it help to reveal the complex relationship it has with the Earth?

Dehumanizing the social reordering capabilities of finance is thus necessary, for two theoretical purposes: Firstly, to generate a framework for rectifying the complex situation of perceiving finance empirically, and secondly – perhaps more importantly – to prove the extent of finance’s effects on the Earth. Quentin Meillassoux’ notion of ancestrality will be helpful for both steps in this task of dehumanizing finance; particularly the discussion of ancestrality that arises out of an aim “to rehabilitate [...] the theory of primary and secondary qualities”<sup>14</sup> in his debut text *After Finitude*. Revisiting the discussion of qualities means to rethink the philosophical valences of the *for-us* – the human-perceived qualities that may vary from one human to another – and the *in-itself*, the qualities that are inherent to a thing.

[T]he ancestral does not designate an ancient event – it designates an event anterior to terrestrial life and hence anterior to givenness itself. Though ancestrality is a temporal notion, its definition does not invoke distance in time, but rather anteriority in time. This is why the arche-fossil does not merely refer to an un-witnessed occurrence, but to a non-given occurrence<sup>15</sup>

---

<sup>10</sup> Nestler, Gerald, and Sami Hammana. “Derivatives as Emancipatory Devices.” 2016.

<sup>11</sup> Huisman, Ronald, and Sami Hammana. “Derivatives as Emancipatory Devices.” 2016.

<sup>12</sup> Hammana, Sami, and Peter Anker. “Derivatives as Emancipatory Devices.” 2016.

<sup>13</sup> ISSH SKOPJE. “Ray Brassier - ‘Pricing Time: Remarks on Malik’s Ontology of Finance.’” YouTube, YouTube, 25 July 2017, [www.youtube.com/watch?v=VPYRdsHoCQk](http://www.youtube.com/watch?v=VPYRdsHoCQk).

<sup>14</sup> Meillassoux, Quentin, et al. “After Finitude: an Essay on the Necessity of Contingency.” *After Finitude: an Essay on the Necessity of Contingency*, Bloomsbury Academic, an Imprint of Bloomsbury Publishing, 2015, pp. 1–1.

<sup>15</sup> *Ibid.* pp. 20–20.

Arche-fossils are normally understood to be of tangible matter (e.g. Meillassoux' account of the arche-fossil)<sup>16</sup> that refers to an anterior event, however, for a materialist this cannot be a limit for seeing the particularity of generating, maintaining, revising and hedging social relations as a material thing, and therefore an anterior arche-fossil of contemporary finance. The claim that the arche-fossil can function on a systemic level generates the possibility of a functionally-anterior finance – the ancestral generating, maintaining, revising and hedging of social relations of property – that can aid in the necessity for maintaining and understanding finance's relationship to the environment. I will call *urfinance*, the primitive, originary form of finance that should be demarcated as a system that is very different from the contemporary one, while still maintaining that intrinsic axiomatic functions have the possibility of overlapping. This *urfinance* is the system of negotiating spatial social-relations over time; a negotiation practiced by one material entity over another, a practice that might have been widespread long before the introduction of institutionalised finance as we know it today. The coexistence of a plurality of entities doesn't rely on whether one entity is more likely to be harmed by another, but rather whether the teloses of those entities are attainable by maintaining property-ownership relations – which might include harming other entities if that is the entities sought after goal. In other words, such entities financially speculate and hedge risk to attain a telos, akin to contemporary negotiations of ownership on financial markets (which in a capitalist realist society is almost always a profit-accumulative telos). Ultimately, the main argument that could be set forth through *urfinance* lies within the eradication of the necessity of a human as the agent for establishing relations of capital negotiation with other entities, making the case for a non-human spatial context of negotiating social-relations that extends to environmental conditions.

## II. TOWARDS AN UNDERSTANDING OF URFINANCE

From a functional perspective, there is no fundamental difference between an animal pissing against a tree and a derivative trader going long on a financial instrument – these are both takes on markings of territorial ownership. The very mechanism that makes this comparison seem so odd lies in the phenomenological sophistication of contemporary finance technology; with the former we could easily picture how territories are marked, with the latter, less-so. There are moments where this technological sophistication slips, an interview that

---

<sup>16</sup> See Quentin Meillassoux's definition: "An *arche*-fossil thus designates the material support on the basis of which the experiments that yield estimates of ancestral phenomena proceed – for example, an isotope whose rate of radioactive decay we know, or the luminous emission of a star that inform us as to the date of its formation."

Meillassoux, Quentin, et al. "After Finitude: an Essay on the Necessity of Contingency." *After Finitude: an Essay on the Necessity of Contingency*, Bloomsbury Academic, an Imprint of Bloomsbury Publishing, 2015, pp. 10–10.

NPR conducted with futures trader Bob Lassandrello<sup>17</sup>, for example, points at a moment of rupture in the phenomenological layer of perceiving derivative finance. Lassandrello forgot to close out a derivatives contract and consequently had 40 cows *physically delivered* to him, because of a mistake he made in the trade<sup>18</sup>. Such a spatial reconfiguration of actual matter would have been impossible to locate if these ruptures did not exist, and newer technology such as the witching hour<sup>19</sup> does precisely that: The witching hour is a synthetic inducement of volatility which is used to close out trades so that physical deliveries cannot take place. Or, in other words, the witching hour eradicates any possibility of perceiving the spatial reconfiguration of matter. To get back to the distinction between urfinance and the contemporary technologically sophisticated system of finance, we can now see that the former could easily be thought of as a system of hedging risk that manipulates environments and with the latter, again, less-so. We are only left with perceptual instances as a result of technological glitches. Therefore, it could be said that contemporary finance—the finance that we have known since the dawn of humankind—is ironically operating beyond the phenomenological threshold of human perceptibility. Understanding a geofinancial link can therefore not happen along the lines of empiricism, or in other words, the effects of finance cannot be witnessed.

Why did philosophy not take the course exactly opposite to the one followed by transcendental or phenomenological idealism, viz., the course of a thought capable of accounting for the non-correlational scope of mathematics, which is to say, for the very existence of science, the latter being properly understood as the power to decentre thought?<sup>20</sup>

This means that not only researching, but also constructing strategies of emancipation have to be viewed through a non-correlational mathematical scope. In order to draft such a geofinancial mathematics, a more concise yet in-depth elaboration requires an enquiry into the politics of such an economy. But before doing so, contextualising philosophy as a

---

<sup>17</sup> Smith, Robert. "What Actually Happens At The End Of 'Trading Places'?" NPR, NPR, 12 July 2013, [www.npr.org/sections/money/2013/07/19/201430727/what-actually-happens-at-the-end-of-trading-places](http://www.npr.org/sections/money/2013/07/19/201430727/what-actually-happens-at-the-end-of-trading-places).

<sup>18</sup> Derivative contracts are essentially an agreement on the price of a commodity, asset or another derivative instrument in the future. For traders that trade in live cattle commodity futures, this means that what is set is the delivery price of cattle in the future. If traders just want to make a profit on a contract (which is almost always the case), then the contract needs to be 'closed out', i.e it needs to be sold to somebody that does want to buy the physical commodity (in this case, the cattle).

<sup>19</sup> The witching hour occurs on the last hour of trading on the third Friday of each month as options and futures on stocks and stock indices expire. This period is often characterized by heavy volume as traders close out options and futures contracts for the purpose of opening new positions in forward months. Staff, Investopedia. "Witching Hour." Investopedia, 8 Sept. 2008, [www.investopedia.com/terms/w/witching-hour.asp](http://www.investopedia.com/terms/w/witching-hour.asp).

<sup>20</sup> Meillassoux, Quentin, et al. "After Finitude: an Essay on the Necessity of Contingency." *After Finitude: an Essay on the Necessity of Contingency*, Bloomsbury Academic, an Imprint of Bloomsbury Publishing, 2015, pp. 121–121.

necessary component in the convergence between finance and environmental conditioning could aid in the understanding of such a political economy of power that influences the Earth through financial technology. With that in mind a urfinancial trace can be drawn to the beginning of Western rational philosophy as exemplifying the meeting of derivatives, environment, mathematics and political power.

Thales of Miletus used a money-spinning device [...], deducing from his knowledge of the stars that there would be a good crop of olives, while it was still winter and he had a little money to spare, used it to pay deposits on all the oil-presses in Miletus and Chios, thus securing their hire.<sup>21</sup>

As Aristotle indirectly points out in *The Politics*, Thales of Miletus is both the inventor of Western rational philosophy and derivative finance, both origins—according to Aristotle—can be attributed to this one pre-Socratic philosopher. The story goes like this: Thales sets out to prove the usefulness of philosophical reason by rationally speculating on the success of an olive crop harvest. He does this by studying the conditions of the Earth in relation to the stars. Thales' study eventually shows that indeed a good harvest is on the way, concluding that he should get a loan to buy all the olive trees in advance, in order to sell them with great profit later. By speculating on the price of a future commodity he essentially drafts an early form of a put-option derivative financial product. Studying the Earth and stars rationally outside of Greek mythology earns him the title of the first Western scientific philosopher – due to his use of an early form of astro- and geophysics. This genealogical complicity shows many things, but one thing in particular; that the derivative product has originally been engineered as a concept of philosophical and scientific reason: “[P]eople had been saying to him reproachfully that philosophy was useless”.<sup>22</sup> Reason becoming ‘practical’ thus results in the invention of the derivative financial product, or what Aristotle describes as a ‘*money-spinning device*’<sup>23</sup>. In that same chapter, Aristotle writes that:

[T]here was another man in Sicily, who used a sum of money that had been deposited with him to buy up all the iron from the foundries” and “when the merchants arrived from their shops, he used to be the only seller ... When the ruler Dionysius heard of this he told the man that he regarded such ways of raising money as detrimental to his own interests and that he must therefore depart from Syracuse at once.<sup>24</sup>

---

<sup>21</sup> Aristotle, Trevor J. Saunders, and T. A. Sinclair. *Aristotle: The Politics*. Middlesex: Penguin, 1982. Print. Pp 90

<sup>22</sup> *Ibid.*

<sup>23</sup> *Ibid.*

<sup>24</sup> *Ibid.*



The ruler Dionysius was quite the visionary for seeing the power capabilities of such a put-option derivative, since the story suggests a form of power, or a kind of reordering force, that might surpass the sovereignty of the ruler himself. The fear of Dionysius eventually becomes a contemporary truism, as Malik helpfully points out in his essay *The Ontology of Finance*:

If derivatives markets and states are now of the same order of magnitude of capital-power, this signals that sovereignty is no longer the supreme power in the quantitative regime of capitalization, but must contend with finance power on a more or less equal footing – and states are increasingly outpriced.<sup>25</sup>

Henceforth, the surpassing of nation-state sovereignty by finance-power is undoubtedly complicit with speculations and anticipations of price on the environment, which in turn necessitates a demand on the desired commodity. This assemblage of philosophy, politics, environment and finance demarcates the necessity for understanding finance as a social practice changing the Earth, a social practice manifesting itself as a *political economy of geofinance*.

### III. POLITICAL ECONOMY OF GEOFINANCE

Blythe Masters fervently hunted for a way to make credit derivatives work, and eventually she spotted an opportunity at Exxon. In 1993, after Exxon was threatened with a \$5 billion fine as a result of the Valdez oil tanker spill, the company had taken out a \$4.8 billion credit line from J.P. Morgan and Barclays.<sup>26</sup>

Blythe Masters, the former head of the derivatives department at JP Morgan Chase, and Thales of Miletus have, if not identical, at least very similar approaches to the environment-finance relationship. The coinciding factor lies in their apparent conviction of an existing reciprocal relationship between financial credit/debit structures, political power and the territories of the Earth. Juxtaposing the logics and strategies deployed by Thales who –most probably– plotted the very first derivative under an olive tree in Syracuse, and Masters who drafted the first ‘credit default swap’ on a £5,000 chair in a JP Morgan’s meeting room, the argument put forth here is that there is a complex relationship between conditioning climates and financial practices *inherent in the construction* of derivative instruments. The aim of advancing such a political economy of geofinance is not to blame financial institutions for

---

<sup>25</sup> Malik, Suhail. *The Ontology of Finance: Price, Power, and the Arkhéderivative*. Vol. VIII. Falmouth: Urbanomic, 2014. Print. COLLAPSE.

<sup>26</sup> Tett, Gillian. *Fool's Gold: How Unrestrained Greed Corrupted a Dream, Shattered Global Markets and Unleashed a Catastrophe*. Abacus, 2012.

ecological disasters (which one could rightly do), but rather to understand the functional mechanisms within the financial instruments that they deploy; understanding their geological consequences to build a strategic armamentarium that can contribute to environmental emancipation. A political economy of geofinance signals a macro-economic expansion, a transference of agency<sup>27</sup>, which is a crucially important lesson to be learned from the coinage of the term ‘Anthropocene’ as it demarcates an expansion in the understanding of social relations into the Earth itself. A traditional political economy would be concerned with the intersection of trade, customs and law horizontally transcending nation-state borders *on* the body of the Earth. Opposed to this traditional concept, a political economy of geofinance makes the case for an unconditional relationship between a vertical and a horizontal political economy – not one *on*, but rather a political economy *of* the Earth. This demarcation of the Earth as a participant that is alive in financial interactions redefines the vast handling of capital, and its by-products of risk, volatility and speculation. A political economy of geofinance is then, the study of finance-power of the Anthropocene.

On Friday March 24, 1989, an oil tanker owned by Exxon, named the *Exxon Valdez* collided into the Prince William sound in Alaska, causing the tanker to spill 10.8 million gallons of crude oil out into the ocean<sup>28</sup>. This oil-spill case has mainly been approached from two distinct perspectives, from a climate analysis of the event itself or from enquiries into the subsequent corporate legal complexities. However, analysing the Exxon Valdez case from a geofinancial perspective isn’t necessarily interested in either of these perspectives irrespectively of each other, but rather in the conjunctive relationship of these takes together, to read the oil spill from both a financial perspective and an environmental one simultaneously. In 1994, Blythe Masters led a team of quantitative financial mathematicians and strategists when ExxonMobil (Back then named just ‘Exxon’) began to feel their credit worth drop in the aftermath of the oil spill. The financial journalist John Lanchester remarks:

In late 1994, Blythe Masters, a member of the J. P. Morgan swaps team, pitched the idea of selling the credit risk to the European Bank of Reconstruction and Development. So, if Exxon defaulted, the E.B.R.D. would be on the hook for it—and,

---

<sup>27</sup> The understanding of the Earth as a participant in politics is essential for contemporary theory on the Anthropocene, Bruno Latour for example, explains this shift of agency as overtaking other facets of daily politics: “Four centuries after those of astronomy, facts of geology have become news, so much so that a piece of information about Charles David Keeling’s data at Mauna Loa has shifted from the “science and technology section” of the newspaper to a new section reserved for the damning tragedies of the Earth. We all agree that, far from being a Galilean body stripped of any other movements than those of billiard balls, the Earth has now taken back all the characteristics of a full-fledged *actor*. Indeed, as Dipesh Chakrabarty has proposed, it has become once again an *agent of history*”

Latour, Bruno. “Agency at the Time of the Anthropocene.” *New Literary History*, vol. 45, pp. 1–18., [www.bruno-latour.fr/sites/default/files/128-FELSKI-HOLBERG-NLH-FINAL.pdf](http://www.bruno-latour.fr/sites/default/files/128-FELSKI-HOLBERG-NLH-FINAL.pdf).

<sup>28</sup> “Learn about the Valdez Oil Spill.” ExxonMobil, [corporate.exxonmobil.com/en/environment/emergency-preparedness/spill-prevention-and-response/valdez-oil-spill](http://corporate.exxonmobil.com/en/environment/emergency-preparedness/spill-prevention-and-response/valdez-oil-spill).

in return for taking on the risk, would receive a fee from J. P. Morgan. Exxon would get its credit line, and J. P. Morgan would get to honor its client relationship but also to keep its credit lines intact for sexier activities. The deal was so new that it didn't even have a name: eventually, the one settled on was "credit-default swap."<sup>29</sup>

The credit default swap (CDS) has thus been engineered for the hedging of future credit contingencies as a result of an environmental catastrophe, giving the CDS the ability to reorder the responsibility and power of a corporation inflicting an environmental catastrophe. The CDS makes these events lie at the oppressive mercy of the territory-reordering capabilities and the technological negotiation of social-relations inherent to speculative financial instruments – giving finance the power to decide on the social-relations of an environmental condition by manipulating credit. The derivative in general, and the CDS in particular, are therefore devices capable of geological planning. The CDS as it is deployed in the Exxon Valdez case is a violent reminder that derivative instruments do not only operate as temporal devices, but simultaneously, as this case clearly shows, as a technology capable of reconfiguring relations *spatially*. In that case, the formal notion of 'spatiality' in finance starts to occupy several different manifestations on different scales – in that regard, perhaps the classic formula needs to be rewritten; maybe time isn't money, as much as space is money. This hypothesis coincides with the widespread defaulting of mortgage-backed-security (MBS) collateralised debt obligations (CDO) in the 2007/2008 financial crisis. The MBS CDO, is a specific derivative instrument that allowed for extremely risky bonds to be sold as safe and trustable investments, which created a collective neglect of the increasing mortgage defaults in 2007. Capital accumulative practices neglecting signs of defaulting allowed for an imbalance of supply (the number of banks that are willing to give mortgages) and demand (the amount of people able to pay a mortgage). The imbalance of this event is not so much a collapse or a crash as a reordering of the market. Being too late at the office probably doesn't really matter, as long as you make up for it in the renegotiations of social relations spatially. Alongside housing, the extraction industry's similar use of derivatives points towards the effectuation of environments as a result of the spatial reconfiguration of property.

Next to the causal link between the environment and finance, the inverted version needs be elaborated upon as well. For that we must turn to frozen concentrated orange juice to get a better understanding of this entanglement. Frozen concentrated orange juice (FCOJ) futures and options are one of the most volatile and earliest agricultural commodities traded on in

---

<sup>29</sup> Lanchester, John. "Outsmarted." *The New Yorker*, *The New Yorker*, 18 June 2017, [www.newyorker.com/magazine/2009/06/01/outsmarted](http://www.newyorker.com/magazine/2009/06/01/outsmarted).

the futures market<sup>30</sup>. In this specific market, the environment-finance link becomes quite easy to see: The condition of the orange crop growth determines the price; however, it works both ways. Once the price fluctuates, the *demand* also fluctuates – and this means that a different demand is placed on the environmental condition of the orange crops. The price-setting of oranges, which happens on the FCOJ futures market, therefore directly exerts power on the environment by placing different demands on the production of the oranges reflected in their price. This relation of demand can be explained by a three-step negotiating process. Traditionally with FCOJ's a first report gets published on the environmental condition of the orange production, in the case of the US it is the Florida Department of Citrus that publishes Frozen Orange Juice reports each year. Clearly this influences the FCOJ futures and options price, however it is the response to the crop harvest by the market (the so called *market opinion*) which claims a future on this commodity, and therefore places a demand on the conditions of the orange crop harvest. It is thus the market opinion on this contingency that initiates a negotiation as a response to the orange crop report. Correspondingly, the institutions responsible for the crop harvest will adjust their operation according to the market demand (accommodate the market through – postharvest – agricultural technology). And since this happens through futures and options, it could be claimed that FCOJ derivatives have a direct influence on the environment of orange production, i.e. the Earth territory where the crop grows on.

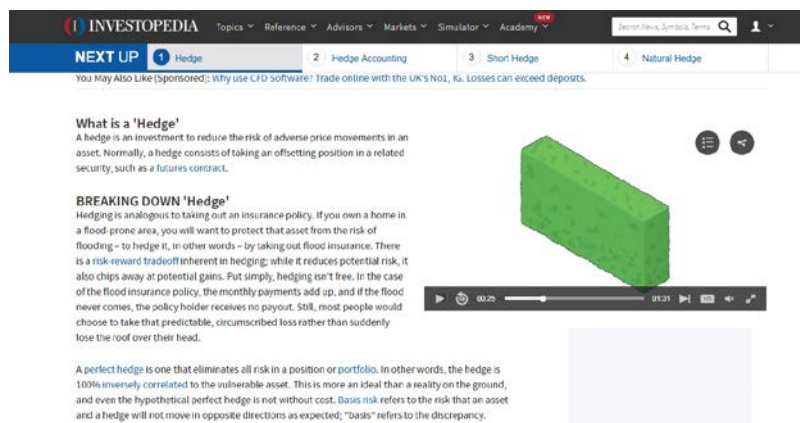


Figure 2. Investopedia explaining financial hedging with the metaphor of an actual hedge<sup>31</sup>

To shortly recapitulate a conceptual claim that is made in the beginning of this essay: Finance doesn't operate under the phenomenological threshold for us—as humans—to empirically engage with. It can therefore not be fully sensed; it can only be made sense of along different lines of engagement than sensorial experience. With this in mind, the idea of the financial graph as a universal and average capture of mathematical behaviour of

<sup>30</sup> Orange Juice History | Orange Juice Futures, [tradesofts.net/ojcontracthistory.html](http://tradesofts.net/ojcontracthistory.html).

<sup>31</sup> Staff, Investopedia. "Hedge." Investopedia, 25 Mar. 2016, [www.investopedia.com/terms/h/hedge.asp](http://www.investopedia.com/terms/h/hedge.asp).

financial instruments over a specific time, starts to tell us more about the social power-structures around those commodities that directly create, effect and or change the credit/debit of that field, which in the case of agricultural commodities is directly the very surface of the Earth. Territory and the process of territorial negotiation is, if not always, at least often a discussion of credit and debit. The notion of financial hedging has (unfortunately) incorrectly been read as a *metaphor* (see figure 2), hedging is *real* bordering, instantiating negotiations through *volatile-borders*<sup>32</sup>. If this is juxtaposed to more well-known forms of architectural maps, then an interesting difference and similarity appears. From a materialist perspective of functional ontologies, the following could be claimed: The financial derivative graph tells us more about the behaviour and activity of a territory than base-maps claim to do. In that regard, perhaps base-maps and remotely-sensed 'classic architectural' maps tell us less about a space than derivative graphs. Especially when it is considered that these graphs encompass, what Timothy Morton would call a hyperobjective<sup>33</sup> condition of a territory or commodity. They don't only encompass but also have the ability of making sense of the underlying commodities/assets, since the contingencies of that dispersion are mathematically intelligible and temporally-actual (the actual price and volume of trades are plotted on the graphs). The chances of finding your way out of an orange crop field when lost are probably higher with the latest FCOJ derivative graphs than with any other 'common field map' that the Florida's Department of Citrus issues.

Anthropocenic finance-power is mobilised by 'contingent claims' (a technical term for a derivative) with demands that reflect in speculations of the strike-prices<sup>34</sup>. The producer of the underlying accommodates this claim/demand by adjusting forms of production, for example, to quickly draw upon the GDP/CO2 emission data again, it is clear that CO2 emissions are subordinate to economic fluctuations<sup>35</sup>. What this means is that the financial act of price-setting, of for example oil, places a direct demand on the production, distribution and usage of oil. The anthropocenic finance-power in CO2 emissions happens through the price-setting of the biggest oil futures and options such as: Brent crude oil, WTI crude oil<sup>36</sup> etc. What this means is that there is a form of material manipulation inherent to derivative trading that renders anthropocenic finance-power as non-teleologically pre-inscribed

---

<sup>32</sup> Through *volatile-borders* I mean to say that derivatives are politically capable of separating ownership in a temporally accelerated manner. Next to the speed and intensity that this operates on derivatives are essentially inseparable from actual political bordering.

<sup>33</sup> For Morton a *hyperobject* is an object that is non-local and massively dispersed over time and space. See: Morton, Timothy. *The Ecological Thought*. Harvard University Press, 2012.

<sup>34</sup> "A strike price is the price at which a specific derivative contract can be exercised." Staff, Investopedia. "Options Contract." Investopedia, 29 Aug. 2015, [www.investopedia.com/terms/o/optionscontract.asp](http://www.investopedia.com/terms/o/optionscontract.asp).

<sup>35</sup> "CAIT: WRI's Climate Data Explorer." World Resources Institute, [cait.wri.org/historical/Country%20GHG%20Emissions?indicator%5B%5D=Total%2BGHG%2BEmissions%2BInclud%2BLand-Use%2BChange%2BAnd%2BForestry&year%5B%5D=2013&sortIdx=NaN&chartType=geo](http://cait.wri.org/historical/Country%20GHG%20Emissions?indicator%5B%5D=Total%2BGHG%2BEmissions%2BInclud%2BLand-Use%2BChange%2BAnd%2BForestry&year%5B%5D=2013&sortIdx=NaN&chartType=geo).

<sup>36</sup> Names of popular crude oil future and option financial products.

(because you will always need somebody to bet against you to make a profit with a derivative trade). If a teleological indeterminacy of geofinancial control over territories can be located in the logic of derivative instruments, then re-engineering the usage of these instruments opens up possibilities for environmental emancipation. Proving that derivative finance is a risk-rational, mathematic and speculative endeavour of power-exertion through setting prices (as the Thales of Miletus story shows), means that working against a furthering of the Anthropocene has to utilise this technology: Not so much only cleaning up oceans as redeveloping financial strategies of trading and investing.

#### IV. GEOFINANCIAL SPECULATION: IMPLIED VOLATILITY AS INVERSED GEOLOGY

Anti-capitalist financial organisations that trade, invest and disinvest are operational. Organisations like Investee-Activism<sup>37</sup>, for example, respond to finance capitalism by drafting trading strategies as a way of countering neoliberal capitalist violence. It is such an understanding of investing and disinvesting that becomes interesting for environmental emancipation. Another organization, Carbon Tracker<sup>38</sup>, on the other hand, is similarly concerned with the convergence of finance and environmental degradation. Carbon Tracker functions as a think tank working on locating the financial instantiations responsible for carbon emissions. However, their method is very different from Investee-Activism's, since they are not concerned with trading as a methodological response. Their "aim is to raise awareness among key decision makers about the risks that fossil fuel investments pose to financial stability"<sup>39</sup>. Environmental emancipation has to go through a reconciliation of both Investee Activism and Carbon Tracker's methodologies to locate and understand environmental fluctuations through price, with the aim of responding through generating trading strategies – for that a return to the map is necessary.

The conditions of a political economy of geofinance argue against the efficacy of the major methodological approaches mobilised towards establishing emancipatory environmental politics (post-cause methods such as cleaning oceans and the separation of waste). The main geofinancial argument goes as follows: Financial relations are deeply rooted in the formation of geology and territory, therefore the reactive approach shouldn't be focused on the effects of this relation, but rather on the cause – which lies within financial conditions.

---

<sup>37</sup> Activism, Investee. "Investee Activism with Michel Feher." Investee Activism with Michel Feher, 1 Jan. 1970, investeeactivism.blogspot.nl/.

<sup>38</sup> "Carbon Tracker is an independent financial think tank which provides in-depth analysis on the impact of climate change on capital markets and investment in fossil fuels, mapping risk, opportunity and the route to a low carbon future."

"About Carbon Tracker." Carbon Tracker Initiative. Financial Specialists Making Carbon Investment Risk Real Today in the Capital Market., [www.carbontracker.org/about/](http://www.carbontracker.org/about/).

<sup>39</sup> About Carbon Tracker." Carbon Tracker Initiative. Financial Specialists Making Carbon Investment Risk Real Today in the Capital Market., [www.carbontracker.org/about/](http://www.carbontracker.org/about/).

Establishing such a strategic methodology operating on a systemic and large scale, necessitates a thorough articulation of its advantages and possible fallacies. For this to happen, three components of this method need to be explicitly elaborated on; beginning with a concern for the conceptual status of this anti-capitalist method: What precedes the suffix 'logos' here? What framework is necessary for such a method? Operating on a systemic and macro-scale to deploy a communist project of emancipation sounds a lot like the aim of cognitive mapping as a concrete methodological instantiation. Cognitive Mapping, as it is articulated by Frederic Jameson in his like-named text, is understood as "a situational representation on the part of the individual subject to that vaster and properly unrepresentable totality which is the ensemble of society's structures as a whole"<sup>40</sup>. The notion of intelligibility in relation to our own position is fundamentally a discussion about the acquired knowledge in relation to said position. Or in other words, cognitive mapping is fundamentally constructed with a biased concern towards epistemology. The cognitive map is too much of an epistemological concern, and too little of a teleological project. Any reconciliation with cognitive mapping needs to rethink the position of teleology in the map itself. It is not our own individual position that needs to be of concern, but rather the position to come – which is a concern for purpose and goal. These aims are an inherent component of the derivative instrument, meaning that the conceptual lack of an aim in the cognitive map might be reconciled by introducing derivative mathematics as the vehicle for teleological design. To substantiate this, a closer look at Malik's closing argument in *The Ontology of Finance* as it is summarised by Ray Brassier will help, namely: "epistemic uncertainty is turned into an ontological indeterminacy"<sup>41</sup>. For our methodological reconciliation, this position (or ontological location) of cognitive mapping shouldn't be subdued to epistemology only, but rather it needs manipulability to rely on both the constructability of teleology *and* epistemology. This manipulability lies within trading, meaning that the mathematical possibilities of constructing and using derivative instruments are able to reconfigure aim and purpose. So, to add to the summary: An "epistemic uncertainty is turned into an ontological indeterminacy"<sup>42</sup> as the rational basis for teleological reconfiguration. This rearranging of purposes effectively operates on the reordering of social-relations, or in other words, on the level of hedging and price-setting. Simply put, the teleological trick lies within volatility.

Next to the conceptual understanding of this methodological reconciliation of cognitive mapping, the actualisation of speculative mathematics needs to be elaborated on. So secondly, to insist on the teleological reconfiguration of volatility is to say that the

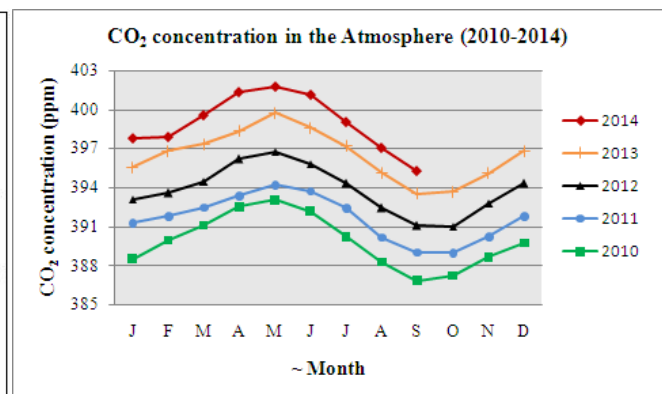
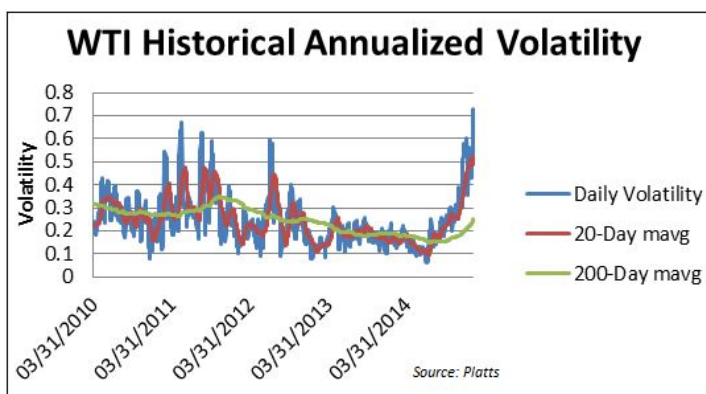
---

<sup>40</sup> Jameson, Fredric. *Postmodernism, Or, The Cultural Logic of Late Capitalism*. Durham: Duke UP, 1991. Print.

<sup>41</sup> ISSH SKOPJE. "Ray Brassier - 'Pricing Time: Remarks on Malik's Ontology of Finance.'" YouTube, YouTube, 25 July 2017, [www.youtube.com/watch?v=VPyRdsHoCQk](http://www.youtube.com/watch?v=VPyRdsHoCQk).

<sup>42</sup> Ibid.

mathematical workings of volatility itself are politically reconfigurable. The most widely used option-pricing formula, the Black-Scholes formula, holds the ability to do this. Investopedia explains: “The Black-Scholes formula (also called Black-Scholes-Merton) was the first widely used model for option pricing. It's used to calculate the theoretical value of European-style options”<sup>43</sup>. Which means that it is only functional for contracts that settle on an expiration-date, however the formula can be tweaked for American options that can be settled at any time, (“using current stock prices, expected dividends, the option's strike price, expected interest rates, time to expiration and expected volatility”<sup>44</sup>). This formula holds ontological indeterminacy as a practical and malleable manifestation in mathematical terms. Specifically, the implied volatility (IV) of such a Black-Scholes formula is the major mathematical component for any teleological reconfiguration, as it is the one piece of information that elaborates on the possible change of the price that the derivative might mediate. Regarding environmental disasters this means that a clear set of mathematical outcomes elaborate on the anticipation of social-relations. And for geofinance specifically, this means that the implied volatility, as a mathematical speculative variable, becomes the anticipation on the prices that set spatial relations of demand and property. The anticipation on the movement of the volatile-border which, as FCOJ markets for example show, makes actual geological shifts on the Earth possible: Derivatives *are* geological stratification devices. A geofinancial elaboration could be articulated by claiming that derivative trading binds non-anthropocentric time to territorial relations. On the other hand, in terms of arche-fossils (urfinance), derivatives bind geological-time. Conceptually this boils down to a bold hypothesis: Speculative financial mathematics allow for teleological reconfigurations of geological strata to come.



<sup>43</sup> Folger, Jean. “Options Pricing: Black-Scholes Model.” Investopedia, 15 Oct. 2012, [www.investopedia.com/university/options-pricing/black-scholes-model.asp](http://www.investopedia.com/university/options-pricing/black-scholes-model.asp).

<sup>44</sup> Ibid.



Figure 3 (left). Historical Volatility of the average of a major crude oil future and options product<sup>45</sup>

Figure 4 (right). The movement of the amount of CO<sub>2</sub> in the Atmosphere<sup>46</sup>

This hypothesis could be argued by illustrating (fig. 3 and 4) a spurious behavioural correlate between the historical volatility of crude oil (which is influenceable via implied volatility), and the result of the usage of crude oil measured in the atmosphere. These two figures show that volatility, as a speculative financial mathematical notion, has the ability to indirectly influence Earth-systems. A closer look at the relation between implied volatility and historical volatility would explain this influence in more detail: Investopedia defines "[h]istorical volatility (HV) [as] ... the realized volatility of a financial instrument over a given time period."<sup>47</sup> Historical Volatility is therefore a statistical measure of past price instantiations of social-relations as a measure of speculating where the volatility of a price is heading to. HV as a geofinancial device is a mathematical capture of the strata beneath our feet, and the ones slowly being formed by sedimentation through geological time-binding.

Conclusively, the third important notion to consider in reconciling with cognitive mapping as a method lies within the mobilising of positions. And this must go through both the conceptual teleology and the mathematical volatility of derivative instruments as speculative counterparts to historical volatility. According to Investopedia "Implied volatility is a way of estimating the future fluctuations of a security's worth based on certain predictive factors."<sup>48</sup> The explanatory page of Investopedia continues with: "Even though investors take implied volatility into account when making investment decisions, and this dependence inevitably has some impact on the prices themselves, there is no guarantee that an option's price will follow the predicted pattern."<sup>49</sup> Implied volatility is therefore a mathematised variable of the market opinion, a variable that informs trading strategies and is in turn a speculative outlook on the setting of prices. If prices set the social conditions of territories, then IV is the space where negotiations of prices are speculatively exercised. Any future change of price is first a volatile possibility. Henceforth, environmental emancipation has to go through IV in order for any price fluctuations of social-relations to occur. Implied Volatility has to be embodied to influence price, i.e. one has to trade to manipulate the conditions. This completely re-renders the notion of cognitive mapping into a practice of mathematically modelling the variables

---

<sup>45</sup> "Petchem Markets Uncertain after Increase of Crude Oil Volatility." The Barrel Blog, 7 Apr. 2015, [blogs.platts.com/2015/04/07/volatility-crude-petrochemicals/](https://blogs.platts.com/2015/04/07/volatility-crude-petrochemicals/).

<sup>46</sup> Singh, Govindh. "Anthropogenic Climate Change – An 'Urban' Reality Check." Delhi Greens Blog, 19 Mar. 2015, [delhigreens.com/2014/12/04/anthropogenic-climate-change-an-urban-reality-check/](https://delhigreens.com/2014/12/04/anthropogenic-climate-change-an-urban-reality-check/).

<sup>47</sup> Staff, Investopedia. "Historical Volatility - HV." Investopedia, 21 June 2005, [www.investopedia.com/terms/h/historicalvolatility.asp](https://www.investopedia.com/terms/h/historicalvolatility.asp).

<sup>48</sup> Staff, Investopedia. "Implied Volatility - IV." Investopedia, 13 May 2016, [www.investopedia.com/terms/i/iv.asp](https://www.investopedia.com/terms/i/iv.asp).

<sup>49</sup> Ibid.

affecting the market opinion, which then according to implied volatility effects the actual price of financial instruments. In turn, implied volatility needs to be impacted by trading.

## V. IMPLIED VOLATILE EARTH

For the future of environmental contingencies, an emancipatory political process must be mobilised by financially modelling the behaviour of contingent claims with the aim of setting the prices that are most favourable to the environment. By acting cunningly and accordingly, manipulating those prices through reconfiguring the anticipations of the prices, specific strategies of investing/disinvesting can be developed to effectively change environmental conditions. Such a speculative, but more importantly, pragmatic project lends itself to be constructed via the reconciliation of cognitive mapping, since it inherently holds the conviction of large scale and strategic response to capitalist violence. So, how can the most favourable price for the environment be set through derivatives trading? For such a financial model, we must once again turn to the map, this time with special attention to the volatility that imprints a territory: Turning to the *volatility surface* as the main component for a financial model of environmental emancipation.

Investopedia explains: “The volatility surface is a three-dimensional plot where the x-axis is the time to maturity, the z-axis is the strike price, and the y-axis is the implied volatility.”<sup>50</sup> It is a speculative take on what the derivative instrument will behave like. For extraction industries, this means that a specific desired outcome has a financial equivalent in the graph: If the price of an underlying changes  $x$  amount, then this will correspond to change  $y$  in the extraction of such commodity from the Earth. A volatility surface doesn't therefore only allow for a speculation on prices to come, but it also sets the condition for the influencing of these prices that generate trading strategies. This notion of the financial equivalent requires a sketch of the Earth as an assemblage of financially contingent entities, ones that are influenced by price-setting. Such a financial model of the Earth with their correlating mathematical derivatives allows for a mapping of environmental conditions through the volatility surface. The volatility surface would then encompass both the current conditions of commodities reflected in the price, and the ones to come, reflected in the implied volatility. Collecting these volatility surfaces and mapping them on their respective position on the globe generates a model with which variables could be calculated to financially enhance these environments.

---

<sup>50</sup> Anthony, Craig. “The Volatility Surface Explained.” Investopedia, 19 Aug. 2016, [www.investopedia.com/articles/stock-analysis/081916/volatility-surface-explained.asp](http://www.investopedia.com/articles/stock-analysis/081916/volatility-surface-explained.asp).

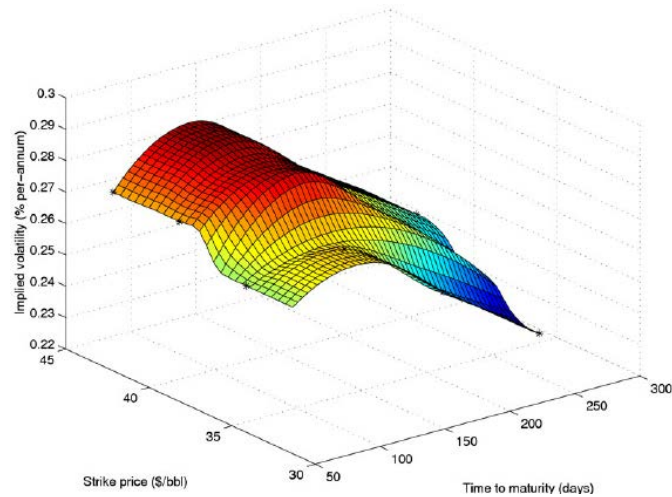


Figure 5. An example of a volatility surface, the time to maturity is on the x axis, the strike price is on the y axis and implied volatility is plotted on the z axis<sup>51</sup>

To conclude with a return to the Frozen Oranges, a specific desired outcome of how the orange crop field should behave like will have a financial equivalent that could be mapped on to the volatility surface. For example, an environmental volatile surface of South Florida's orange crops, existing of several FCOJ futures and options that influence the demand placed on this land. Such a convergence of mapping territories of environmental degradation with volatility mathematics afforded by Meillassoux' speculative materialism allows for the calculation of the desired price for such an environment to change. It allows for the generation of investment and disinvestment alongside trading strategies to revise environments through price-setting. Environmental emancipation necessitates an *Implied Volatile Earth* financial model. A model that is constructed with philosophical and speculative resources to allow for the mapping of financial equivalents through locating geographies with volatility surfaces. Such an approach would effectively allow for actual and material influence on the next sedimentation process to come. Geofinancial speculations are able to interfere in the formation of geological strata by fully embracing the emancipatory scope hidden within speculative financial mathematics. Volatile surfaces in the sky cast speculative shades of the coming strata on the Earth. To put it bluntly: Any effective reckoning with the Anthropocene must be performed financially.

<sup>51</sup> "Non-Parametric Implied Volatility Surface for a Dataset from the Energy-Trading Desk of a Major Investment Bank. ." Researchgate, [www.researchgate.net/figure/46493859\\_fig4\\_Fig-4-Non-parametric-implied-volatility-surface-for-a-dataset-from-the-energy-trading](http://www.researchgate.net/figure/46493859_fig4_Fig-4-Non-parametric-implied-volatility-surface-for-a-dataset-from-the-energy-trading).

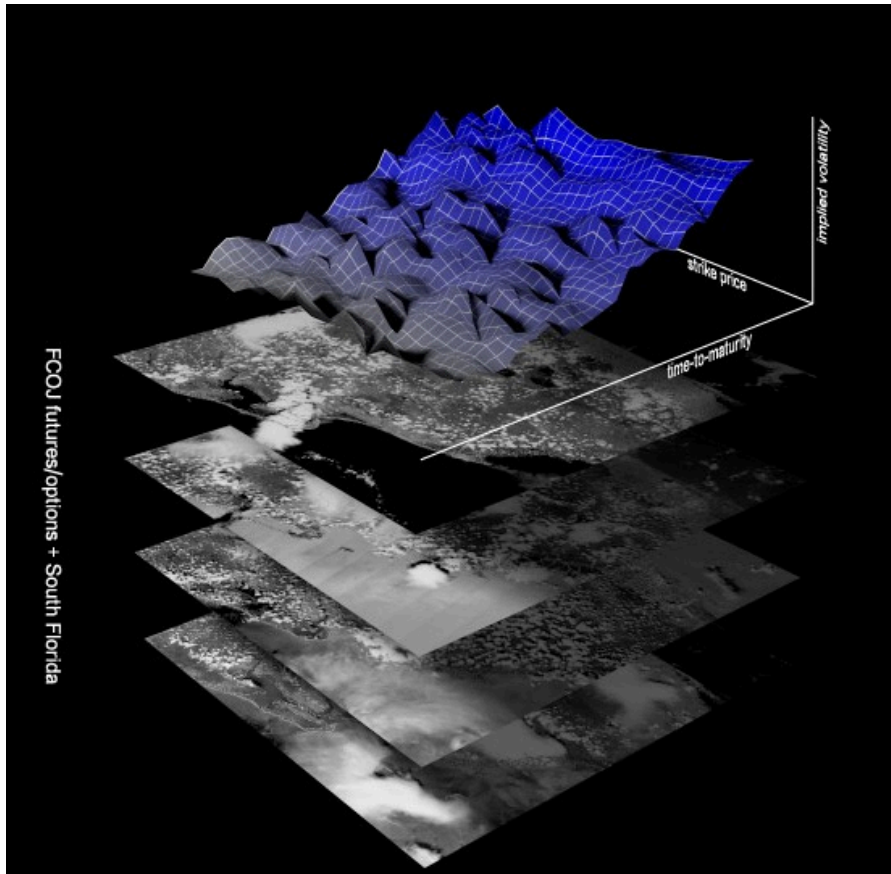


Figure 6. A section of the *Implied Volatile Earth* model, consisting of a Frozen Oranges volatility surface plotted over South Florida<sup>52</sup>

---

<sup>52</sup> Hammana, Sami. FCOJ Futures/Options + South Florida.

## References/bibliography

1. Smith, Robert. "What Actually Happens At The End Of 'Trading Places'?" NPR, NPR, 12 July 2013, [www.npr.org/sections/money/2013/07/19/201430727/what-actually-happens-at-the-end-of-trading-places](http://www.npr.org/sections/money/2013/07/19/201430727/what-actually-happens-at-the-end-of-trading-places).
2. See Quentin Meillassoux's definition: "By 'correlation' we mean the idea according to which we only ever have access to the correlation between thinking and being, and never to either term considered apart from the other. We will henceforth call *correlationism* any current of thought which maintains the unsurpassable character of the correlation so defined."  
Meillassoux, Quentin, et al. "After Finitude: an Essay on the Necessity of Contingency." *After Finitude: an Essay on the Necessity of Contingency*, Bloomsbury Academic, an Imprint of Bloomsbury Publishing, 2015, pp. 5–5.
3. Creorder. "DERIVATIVES -- Suhail Malik and Ulf Martin (September 2016)." YouTube. YouTube, 19 Nov. 2016. Web. 11 June 2017.
4. Malik, Suhail. *The Ontology of Finance: Price, Power, and the Arkhéderivative*. Vol. VIII. Falmouth: Urbanomic, 2014. Print. COLLAPSE.
5. Malik, Suhail. *The Ontology of Finance: Price, Power, and the Arkhéderivative*. Vol. VIII. Falmouth: Urbanomic, 2014. Print. COLLAPSE. Pp 629
6. Ibid. Pp 629
7. Malik makes the argument for finance-power as a typological power that allows for a political risk rationality, one that is able to construe and influence future outcomes through financial speculation, hedging and waging. Probably best explained in the conclusion of the essay: "[F]inance-power observes and instantiates a risk rationality to which even sovereign states as prominent modes of power are subordinated. [...] Politics itself now means not just what the future will be but also the power over the magnitude of futural contingency and who or what owns it across the entire social order, including but not limited to the sovereign state."  
Malik, Suhail. *The Ontology of Finance: Price, Power, and the Arkhéderivative*. Vol. VIII. Falmouth: Urbanomic, 2014. Print. COLLAPSE. Pp 809-810
8. "CAIT: WRI's Climate Data Explorer." World Resources Institute, [cait.wri.org/historical/Country%20GHG%20Emissions?indicator%5B%5D=Total%2BGHG%2BEmissions%2BIncluding%2BLand-Use%2BChange%2Band%2BForestry&year%5B%5D=2013&sortIdx=NaN&chartType=geo](http://cait.wri.org/historical/Country%20GHG%20Emissions?indicator%5B%5D=Total%2BGHG%2BEmissions%2BIncluding%2BLand-Use%2BChange%2Band%2BForestry&year%5B%5D=2013&sortIdx=NaN&chartType=geo).
9. IEA. "CO2 Emissions and Global Economy Growth Rates." IEA, [www.iea.org/newsroom/news/2017/march/iea-finds-co2-emissions-flat-for-third-straight-year-even-as-global-economy-grew.html](http://www.iea.org/newsroom/news/2017/march/iea-finds-co2-emissions-flat-for-third-straight-year-even-as-global-economy-grew.html).
9. See Quentin Meillassoux's definition: "By 'correlation' we mean the idea according to which we only ever have access to the correlation between thinking and being, and never to either term considered apart from the other. We will henceforth call *correlationism* any current of thought which maintains the unsurpassable character of the correlation so defined."  
Meillassoux, Quentin, et al. "After Finitude: an Essay on the Necessity of Contingency." *After Finitude: an Essay on the Necessity of Contingency*, Bloomsbury Academic, an Imprint of Bloomsbury Publishing, 2015, pp. 5–5.
10. Nestler, Gerald, and Sami Hammana. "Derivatives as Emancipatory Devices." 2016.
11. Huisman, Ronald, and Sami Hammana. "Derivatives as Emancipatory Devices." 2016.

12. Hammana, Sami, and Peter Anker. "Derivatives as Emancipatory Devices." 2016.
13. ISSH SKOPJE. "Ray Brassier - 'Pricing Time: Remarks on Malik's Ontology of Finance.'" YouTube, YouTube, 25 July 2017, [www.youtube.com/watch?v=VPyRdsHoCQk](http://www.youtube.com/watch?v=VPyRdsHoCQk).
14. Meillassoux, Quentin, et al. "After Finitude: an Essay on the Necessity of Contingency." *After Finitude: an Essay on the Necessity of Contingency*, Bloomsbury Academic, an Imprint of Bloomsbury Publishing, 2015, pp. 1–1.
15. Ibid. pp. 20–20.
16. See Quentin Meillassoux's definition: "An arche-fossil thus designates the material support on the basis of which the experiments that yield estimates of ancestral phenomena proceed – for example, an isotope whose rate of radioactive decay we know, or the luminous emission of a star that inform us as to the date of its formation."  
Meillassoux, Quentin, et al. "After Finitude: an Essay on the Necessity of Contingency." *After Finitude: an Essay on the Necessity of Contingency*, Bloomsbury Academic, an Imprint of Bloomsbury Publishing, 2015, pp. 10–10.
17. Smith, Robert. "What Actually Happens At The End Of 'Trading Places'?" NPR, NPR, 12 July 2013, [www.npr.org/sections/money/2013/07/19/201430727/what-actually-happens-at-the-end-of-trading-places](http://www.npr.org/sections/money/2013/07/19/201430727/what-actually-happens-at-the-end-of-trading-places).
18. Derivative contracts are essentially an agreement on the price of a commodity, asset or another derivative instrument in the future. For traders that trade in live cattle commodity futures, this means that what is set is the delivery price of cattle in the future. If traders just want to make a profit on a contract (which is almost always the case), then the contract needs to be 'closed out', i.e it needs to be sold to somebody that does want to buy the physical commodity (in this case, the cattle).
19. The witching hour occurs on the last hour of trading on the third Friday of each month as options and futures on stocks and stock indices expire. This period is often characterized by heavy volume as traders close out options and futures contracts for the purpose of opening new positions in forward months.  
Staff, Investopedia. "Witching Hour." Investopedia, 8 Sept. 2008, [www.investopedia.com/terms/w/witching-hour.asp](http://www.investopedia.com/terms/w/witching-hour.asp).
20. Meillassoux, Quentin, et al. "After Finitude: an Essay on the Necessity of Contingency." *After Finitude: an Essay on the Necessity of Contingency*, Bloomsbury Academic, an Imprint of Bloomsbury Publishing, 2015, pp. 121–121.
21. Aristotle, Trevor J. Saunders, and T. A. Sinclair. *Aristotle: The Politics*. Middlesex: Penguin, 1982. Print. Pp 90
22. Ibid.
23. Ibid.
24. Ibid.
25. Malik, Suhail. *The Ontology of Finance: Price, Power, and the Arkhéderivative*. Vol. VIII. Falmouth: Urbanomic, 2014. Print. COLLAPSE.
26. Tett, Gillian. *Fool's Gold: How Unrestrained Greed Corrupted a Dream, Shattered Global Markets and Unleashed a Catastrophe*. Abacus, 2012.
27. The understanding of the Earth as a participant in politics is essential for contemporary theory on the Anthropocene, Bruno Latour for example, explains this shift of agency as overtaking other facets of daily politics: "Four centuries after those of astronomy, facts of geology have become news, so much so that a piece of information about Charles David Keeling's data at Mauna Loa has shifted from the "science and technology section" of the newspaper to a new section reserved for the damning tragedies of the Earth. We all agree that, far from being a Galilean body stripped of any other movements than those of billiard balls, the Earth has now taken back all the characteristics of a full-fledged *actor*. Indeed, as Dipesh Chakrabarty has proposed, it has become once again an *agent of history*"

- Latour, Bruno. "Agency at the Time of the Anthropocene." *New Literary History*, vol. 45, pp. 1–18., [www.bruno-latour.fr/sites/default/files/128-FELSKI-HOLBERG-NLH-FINAL.pdf](http://www.bruno-latour.fr/sites/default/files/128-FELSKI-HOLBERG-NLH-FINAL.pdf).
28. "Learn about the Valdez Oil Spill." ExxonMobil, [corporate.exxonmobil.com/en/environment/emergency-preparedness/spill-prevention-and-response/valdez-oil-spill](http://corporate.exxonmobil.com/en/environment/emergency-preparedness/spill-prevention-and-response/valdez-oil-spill).
29. Lanchester, John. "Outsmarted." *The New Yorker*, *The New Yorker*, 18 June 2017, [www.newyorker.com/magazine/2009/06/01/outsmarted](http://www.newyorker.com/magazine/2009/06/01/outsmarted).
30. Orange Juice History | Orange Juice Futures, [tradesofts.net/ojcontracthistory.html](http://tradesofts.net/ojcontracthistory.html).
31. Staff, Investopedia. "Hedge." Investopedia, 25 Mar. 2016, [www.investopedia.com/terms/h/hedge.asp](http://www.investopedia.com/terms/h/hedge.asp).
32. Derivatives are politically capable of separating ownership on a temporally accelerated manner. Next to the speed and intensity that this operates on derivatives are essentially inseparable from actual political bordering.
33. For Morton a hyperobject is an object that is non-local and massively dispersed over time and space. See: Morton, Timothy. *The Ecological Thought*. Harvard University Press, 2012.
34. "A strike price is the price at which a specific derivative contract can be exercised." Staff, Investopedia. "Options Contract." Investopedia, 29 Aug. 2015, [www.investopedia.com/terms/o/optionscontract.asp](http://www.investopedia.com/terms/o/optionscontract.asp).
35. "CAIT: WRI's Climate Data Explorer." World Resources Institute, [cait.wri.org/historical/Country%20GHG%20Emissions?indicator%5B%5D=Total%2BGHG%2BEmissions%2BIncluding%2BLand-Use%2BChange%2Band%2BForestry&year%5B%5D=2013&sortIdx=NaN&chartType=geo](http://cait.wri.org/historical/Country%20GHG%20Emissions?indicator%5B%5D=Total%2BGHG%2BEmissions%2BIncluding%2BLand-Use%2BChange%2Band%2BForestry&year%5B%5D=2013&sortIdx=NaN&chartType=geo).
36. Names of popular crude oil future and option financial products.
37. Activism, Investee. "Investee Activism with Michel Feher." *Investee Activism with Michel Feher*, 1 Jan. 1970, [investeeactivism.blogspot.nl/](http://investeeactivism.blogspot.nl/).
38. "Carbon Tracker is an independent financial think tank which provides in-depth analysis on the impact of climate change on capital markets and investment in fossil fuels, mapping risk, opportunity and the route to a low carbon future."  
"About Carbon Tracker." Carbon Tracker Initiative. *Financial Specialists Making Carbon Investment Risk Real Today in the Capital Market.*, [www.carbontracker.org/about/](http://www.carbontracker.org/about/).
39. "About Carbon Tracker." Carbon Tracker Initiative. *Financial Specialists Making Carbon Investment Risk Real Today in the Capital Market.*, [www.carbontracker.org/about/](http://www.carbontracker.org/about/).
40. Jameson, Fredric. *Postmodernism, Or, The Cultural Logic of Late Capitalism*. Durham: Duke UP, 1991. Print.
41. ISSH SKOPJE. "Ray Brassier - 'Pricing Time: Remarks on Malik's Ontology of Finance.'" YouTube, YouTube, 25 July 2017, [www.youtube.com/watch?v=VPyRdsHoCQk](http://www.youtube.com/watch?v=VPyRdsHoCQk).
42. Ibid.
43. Folger, Jean. "Options Pricing: Black-Scholes Model." Investopedia, 15 Oct. 2012, [www.investopedia.com/university/options-pricing/black-scholes-model.asp](http://www.investopedia.com/university/options-pricing/black-scholes-model.asp).
44. Ibid.
45. "Petchem Markets Uncertain after Increase of Crude Oil Volatility." *The Barrel Blog*, 7 Apr. 2015, [blogs.platts.com/2015/04/07/volatility-crude-petrochemicals/](http://blogs.platts.com/2015/04/07/volatility-crude-petrochemicals/).
46. Singh, Govindh. "Anthropogenic Climate Change – An 'Urban' Reality Check." *Delhi Greens Blog*, 19 Mar. 2015, [delhigreens.com/2014/12/04/anthropogenic-climate-change-an-urban-reality-check/](http://delhigreens.com/2014/12/04/anthropogenic-climate-change-an-urban-reality-check/).
47. Staff, Investopedia. "Historical Volatility - HV." Investopedia, 21 June 2005, [www.investopedia.com/terms/h/historicalvolatility.asp](http://www.investopedia.com/terms/h/historicalvolatility.asp).

48. Staff, Investopedia. "Implied Volatility - IV." Investopedia, 13 May 2016, [www.investopedia.com/terms/i/iv.asp](http://www.investopedia.com/terms/i/iv.asp).

49. Ibid.

50. Anthony, Craig. "The Volatility Surface Explained." Investopedia, 19 Aug. 2016, [www.investopedia.com/articles/stock-analysis/081916/volatility-surface-explained.asp](http://www.investopedia.com/articles/stock-analysis/081916/volatility-surface-explained.asp).

51. "Non-Parametric Implied Volatility Surface for a Dataset from the Energy-Trading Desk of a Major Investment Bank. ." Researchgate, [www.researchgate.net/figure/46493859\\_fig4\\_Fig-4-Non-parametric-implied-volatility-surface-for-a-dataset-from-the-energy-trading](http://www.researchgate.net/figure/46493859_fig4_Fig-4-Non-parametric-implied-volatility-surface-for-a-dataset-from-the-energy-trading).

52. Hammana, Sami. FCOJ Futures/Options + South Florida.