dClimate

A Transparent Truth Layer for Earth's Climate Record

dClimate.net | WTHR

dClimate is a decentralized network for climate data. The aim is to build an ecosystem where participants provide realized and forecasted data for various climatic variables in exchange for monetary rewards -- or, if they do not wish to monetize, to simply make their data available via a modern architecture that supports data immutability and is easy to use. Our mission is to democratize the data and models that describe Earth's climate.

Climate data collection,

interpretation, and reporting, as they currently exist, are a series of global processes that are behemothic in scale, while also being fractured and fragile in their organization. This has a dampening effect on the many entities seeking to contribute or consume climate data -- scientific projects, government policy making efforts, and private sector entities being the major categories. The current status quo also stymies innovation when it comes to new data collection and interpretation initiatives, as the barrier to entry is high and the path to success outside of a nonprofit model is unclear.

> dClimate's mandate is to build a new home for this critically important climate record, and to build it in such a way that encourages openness and innovation.

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Why Climate Data Matters

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Climate data refers to a vast corpus of records representing the entire terrestrial biome. This includes weather, crop output, forest biomass, soil health, carbon emissions, disease transmission -- essentially any timescaled record which describes nature or the human species' relationship with nature. Within these broad record categories, datasets are expressed in terms of specific climatic variables. Some typical weather variables are temperature, humidity, rainfall, wind speed and direction, and soil moisture.

But there are projects compiling datasets for countless other weather-like variables such as atmospheric pressure, glacial elevation, ozone, methane, and atmospheric dust levels, longwave and shortwave surface radiation, soil and vegetation evaporation, ice temperature, river discharge and runoff, snow density, ice sheet velocity, water quality indicators, seismic earthquake events, ocean color, sea level -- the list goes on.

Climate change research and policy implementations become impossible without historical climate data. But that is just the beginning when it comes to the public sector.

Governments also need climate data to make decisions around water infrastructure, agriculture, disaster relief efforts, health policy, macroeconomic policy, military spending, foreign policy, energy policy, highway infrastructure, environmental policy, scientific funding -- at the government level, weather, and more broadly climate, come into the equation in some shape or form in essentially every domain.

How much pollution are we generating? What is the state of a given ecosystem? What will the electricity needs of a given city be? What is the likelihood of a crop failure? How expensive will it be to maintain a building in a hurricane zone? Where is the best place to put a nuclear power plant or hydroelectric dam? Is there enough wind to justify a wind farm here? Is there enough visibility for an airport here? Climate data matters to all of this.

Forecasting

In the past few decades, weather forecasting has come a long way. Providing forecasts is no longer an exclusive role reserved for government weather agencies. An influx of new, private companies and organizations have entered the forecasting market (Freedman).

For many of us in urban areas, the only reason to look up a weather forecast is to decide when to carry an umbrella -- but such forecasts are extremely crucial across many regions and industry domains around the globe. In developing countries, accurate forecasts of upcoming droughts or monsoon failure can help governments to prepare food assistance programs in advance (Hellmuth et al. 16-17).

Hyper-local weather forecasts are becoming essential in shipping and trucking, where optimizing routes around weather is key to delivering goods in a timely manner (Walker).

A storm can cause a cascading series of events where a container ship is unduly forced to remain in port, delaying vessel berths to such a degree that incoming vessels have no choice but to incur the large operational and regulatory costs associated with idling in a bay, undocked -- forecasts in the shipping sector are needed to plan for this (Hellenic Shipping News).

On the leisure side, forecasts are important for planning outdoor events such as concerts and sports. Construction companies need good forecasts to avoid various costly scenarios associated with rain and wind during key building stages (Freeman).

Wind farms see their output rise and fall not just with wind speed, but with wind direction as well (Gallego et al. 9).

For example, Xcel Energy, a Minneapolis based utility with $11.5 billion in annual sales and a large wind-power division has been able to save its customers more than $60 million in fuel costs over seven years using private forecasts (Adams).

All of these entities and more need good forecasts to optimize operations, and good climate risk mitigation strategies to smooth out their output when plans can't be changed.

Parametric Financial Instruments

Traditional insurance covers loss, and as such, necessitates a “boots on the ground” approach when the time comes to evaluate how much money should be paid out to a policyholder.

This can work in wealthy, dense population centers, but it is not scalable across more geographically expansive domains (Sibiko et al. 1-2).

Human loss adjusters introduce a large degree of uncertainty and subjectivity to the process, bringing delays, disputes, high overhead, and occasionally fraud (Hammond).

Parametric financial instruments are a scalable alternative to traditional insurance policies, and are a compelling solution for business entities seeking to mitigate their climate risk.

Rather than creating a situation where both parties need to agree on whether subjective circumstances on the ground constitute a loss, a parametric instrument simply pays out based on objective data generated by 3rd parties. The classic example of a parametric coverage is a put or call option for a publicly traded stock that pays out if the given stock is trading at a certain price at a specific time.

This works because a stock’s price is public, uncontested information. Thus, when it comes to creating parametric products for climate risk, having uncontested, highly available climate data is foundational.

The unscalability of traditional insurance has resulted in hundreds of billions of dollars of uninsured losses due to a host of causes from hurricanes to micro-droughts to wildfires. In agriculture alone, $1 trillion of crops are estimated to be uninsured each year, and this estimate does not count the millions of agribusiness entities exposed to weather.

These financial losses not only hang over farmers’ heads and act as an occasional blow to earnings, they actually prevent farmers from specializing into certain crop areas, driving down profits and in many cases perpetuating a cycle of subsistence (G.E. Roesch-McNally et al.1-2).

As climate change increases general weather volatility, businesses in agriculture and beyond will need parametric financial instruments to build resilience against climate change instead of waiting for disaster aid after the fact.

Economic Opportunity of Climate Data

$415B

The cost of climate disasters in the last three years

90%

of crop losses are due to weather events

215

of the world's 500 biggest companies could lose an estimated $1 trillion due to climate change

Economic growth is increasingly intersecting with environmental and climatic constraints. As climate change and other environmental stressors build up, the economic value of understanding our climate systems and their historical evolution increases. This has become increasingly clear in recent years as losses from natural sources have been on the rise.

According to IBM, 90 percent of crop losses are due to weather events (Walker). Over the past few years, extreme weather has forced the U.S. Federal Crop Insurance Program to pay out indemnities ranging from $3.5 billion in 2016 to 17.5 billion in 2012 (Walker).

More broadly, according to Morgan Stanley, climate disasters have cost North America $415 billion in the last three years, much of that due to wildfires and hurricanes (Cho).

Losses from climate and weather risks exist across the economy with vulnerabilities showing in even the largest companies. 215 of the world's 500 biggest companies could lose an estimated one trillion dollars due to climate change, beginning within five years (Cho).

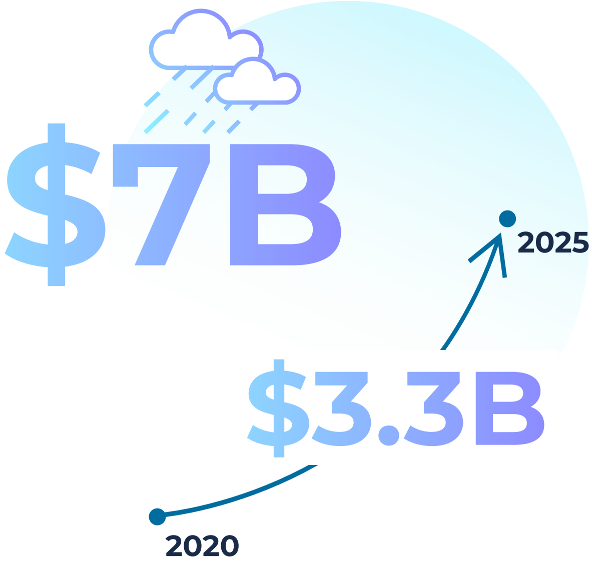
G500 -
Companies providing details on substantive risks

(Source: Carbon Disclosure Project)

Alphabet, Google's parent company, will likely have to deal with rising cooling costs for its data centers (Plumer). Hitachi Ltd.'s suppliers in Southeast Asia could be disrupted by increased rainfall and flooding (Plumer).

Beyond pure economic costs, the human cost of shifting weather patterns has been rising with billions of livelihoods at risk from increased droughts and floods while over a billion people globally are estimated to be at risk from rising heat in cities and towns (Earth Institute).

The rising costs of natural disruptions increase the value of weather and climate forecasting, which dClimate is well poised to capture. The private weather industry is currently estimated at $7 billion (National Weather Service) while the weather forecasting systems market is estimated to reach $3.3 billion by 2025 (Markets and Markets).

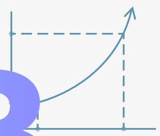


This increased demand for weather forecasting comes as companies and public sector agencies need more real-time and localized information to optimize supply chains, create proactive disaster plans, and manage uncertainties stemming from adverse weather.

Hyper Local weather forecasting is a particularly rapidly growing market with hosts of new companies competing for business (Adams).

As the space spawns ever more new entities, it can be difficult for a user to navigate complex considerations around what forecasts would work best for their use case. A 2013 article from the Wharton School estimated that overall revenues for climate and weather companies were about $3 billion and that, in aggregate, the industry was worth some $6 billion (Adams).

A 2017 report from the National Weather Service included a prediction that the sector could quintuple in size.



$12B by 2025

the growth of the carbon footprint industry

It is estimated that the cost of curtailing carbon emissions will be in the hundreds of billions or higher and accurate estimation of carbon emissions, an important climatic variable, will be a key part of this process (EPA). There are many companies involved in the estimation of carbon footprint where the industry is expected to rise to $12 billion by 2025, highlighting growing demand (Markets and Research). dClimate will be well poised to capture this growth as carbon footprint estimation models are a key use case for implementation.

More broadly, ESG (Environmental Social Governance) considerations are becoming important for asset managers and financial institutions to consider for their investments. Such financial institutions will increasingly need objective, validated data on environmental parameters related to their investments such as emissions, pollution, and other key metrics. For example, a public pension investing in a mining company or a power plant will need to assess the environmental impact of their investment via satellite monitoring of mine waste or emissions. Such analysis is increasing in demand but data is often delayed or lacking and analysis is cumbersome across a vast array of satellite data sources. dClimate will enable investment firms to have a standardized platform to access environmental impact data as well as interact with innovative companies offering relevant analysis on such topics.

Climate Data: A Fragmented Space

Climate Data: A Fragmented Space

Raw climate data is largely produced by academic research projects and government partnerships. Weather stations in airports, government facilities, and academic institutions record observations for variables such as rainfall, temperature, snowfall, and wind speed, and submit these observations to an international aggregation pipeline.

This aggregation pipeline is the manifestation of many nested bureaucracies submitting and forwarding their observations progressively farther and farther up the pyramid, with the results eventually finding their way to public release via endpoints controlled by various global organizations such as NOAA, NASA, WMO, and others (Bell-Pasht and Krechowicz).

In recent decades, satellites have come to play an increasingly important role. Satellites take raw observations in the UV, visible light, IR, microwave, and radio spectrums (National Aeronautics and Space Administration) of vast swathes of planet earth, and flow them through a similar aggregation process to what is in place for weather stations.

Climate datasets based on satellite observations are generally not as accurate as those based on weather stations, but satellites make up in coverage what they lack in accuracy (Abraham). Many areas have few or no major weather stations set up -- the nation of Cambodia, for example, has one major weather station -- so satellites are very important for large segments of the world.

However, the terrestrial weather station network needs to be expanded to get better quality data in many important parts of the globe.

Once satellite and weather station observations have been collected and released in the form of “primary datasets,” researchers and forecasters ingest them to build models and create new, “secondary datasets.” The secondary datasets are in turn released at new endpoints controlled and maintained by these groups (National Oceanic and Atmospheric Administration).

This process can repeat several times with tertiary, quaternary, etc, datasets being released along the way. What results is a fragmented marketplace of data where idiosyncratic formats abound, and where there is no way to measure up paid dataset providers against one another (Schomm et al. 12).

Even with the free datasets, the situation is so confusing for the end-user that many data consumers end up paying for expensive private subscription services that simply standardize and repackage data (Ciklum). This adds another layer of opacity and gatekeeping to the ecosystem.

Compounding the confusion is the sheer number of entities providing climate data. Many private companies focus on a particular area where climate data is lacking or may offer enhanced resolution or frequency of the data. In some regions of the world, especially emerging markets, these needs are acute as government data networks are sparse and unreliable.

Without data on climate, crops, or other key inputs, it is difficult to plan or prepare for natural disasters or even deal with routine seasonal patterns.

Even in developed regions, many rural areas where a host of data ranging from weather to soil to plant diseases is crucial, there are vast gaps where private companies have stepped in to provide better data.

More climate data is a good thing, but the downside of the heterogeneous nature of the providers is that there is little standardization or comparison between different providers and even basic information on which companies offer the highest quality data for a given area.

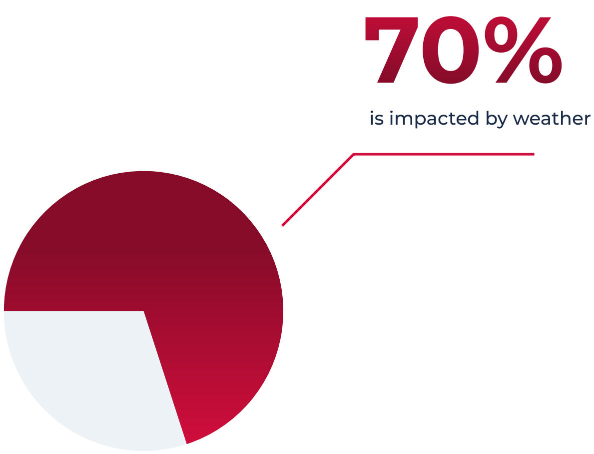
For example, how can a farmer in the United States or Brazil assess which companies provide the best data on soil quality for their farm area? Or how can a real estate developer assess which company has the best flood data for a prospective property development site? dClimate’s mandate is to standardize these varied datasets and provide easy to understand comparisons between them.

This would give data consumers a clear way to compare quality, resolution, and temporal frequency for any dataset, enabling them to quickly choose the best dataset for their needs.

Collection & Aggregation Status Quo

There is currently no easy way for a hobbyist or small company to set up a weather station and feed into a wider collection/aggregation effort. The major pipelines only work with established entities like governments and airports.

Given that 70% of companies around the world are impacted by weather with $5.7 trillion of direct and indirect impact just in the US, (Dobbie and Evershed 4) and given that the volatility of weather is increasing (Lazo et al.), there needs to be a better system for incentivizing wider terrestrial data collection. However, there are very few such incentive structures to encourage data contribution and most weather station data networks are operated by non-profits, governments, and academic institutions with highly varying degrees of coverage. As expected, such coverage is extremely poor in lower income areas or in low population density areas, but needs are growing rapidly to enable better forecasting and adaptation to shifting climate patterns.



Beyond standard weather data, carbon emission, biomass, wind speed, cloud cover, crop yields, soil moisture, and a host of other key variables are currently of poor resolution in many areas of the world. Some, such as soil moisture, are essential for agriculture and drougt forecasting, while others such as cloud cover and wind speed data are needed to plan wind and solar energy projects. Because of the highly centralized nature of the climate data collection and aggregation status quo, there is little incentive for smaller players to get involved and contribute much needed observations. Collection efforts are slow and bureaucratic, still mostly relying on government space programs with high barriers to entry for private players.

Interpretation & Access Status Quo

Once raw data has been collected and aggregated, it must be accessed via the government controlled endpoints. Accessing the correct files is a difficult, largely manual process. One must navigate through an elaborate directory structure of poorly documented acronyms and abbreviations. Then, once files have been found, it comes time to learn whatever esoteric local conventions the maintainer uses in their respective formatting and structuring. Servers are often down and do not follow modern security best practices -- FTP is still widely used. Datasets tend to be indexed on time rather than on location, so getting values for one location over time requires downloading hundreds of gigabytes of files and then combing through it all to extract the few bytes that are actually needed rather than making a simple query.

Data releases are often changed after the fact with no record of what the changes were as new observations from the slower weather stations come in on a staggered basis. One important dataset called PRISM revises every datapoint up to six times after their initial release, once per month, and none of these revisions are formally tracked. This creates huge problems for any parametric agreements that might reference this data, as parametric agreements require a single, uncontested source of truth to determine a payout. It should be said that this is not a fault of the projects themselves necessarily -- PRISM is a small academic operation -- but rather the fault of an ecosystem that places the burden of data hosting on the publisher. Dataset maintainers end up responsible for maintaining web infrastructure for these critical datasets, a task that is outside their wheelhouse, especially when parametric comes into play. They should be free to focus on science.

The reason that accessing climate datasets is so dire is twofold: a ponderous bureaucracy runs the initial aggregation, and then multiple levels of recombination and rehosting occur in the form of secondary datasets. Each publisher is trying to be “the destination” for data in general because no generalized marketplace exists where all the publishing entities can play nice with each other. There is no Amazon of climate data. What results is a situation where accessing climate data -- typically written off as a triviality in an early stage startup -- becomes an overwhelmingly burdensome barrier to entry. Whether it is a new participant who is just curious and wants to take a look, or a startup that wants to provide better data and forecasting for the market, or even a well funded insurance entity that is trying to build out a business based on weather data, all these participants hit the brick wall sooner or later.

Data Analysis Status Quo

Many crucial types of analysis related to the climate ecosystem are expensive, making them inaccessible to all but the largest firms.

Two key areas we can point to are cleaned data and natural catastrophe simulations. Cleaned weather station data is important for any type of climate analysis as weather stations are prone to maintenance, breakdowns, and other setbacks which lead to missing data.

While airport weather stations are the ones with the best data quality, many are still often missing large sections of their history. As we expand from these standard airport stations, the missing data problems rise significantly with rural areas and many urban areas having persistent problems with missing data. To remedy this situation, there are a number of "clean and fill" algorithms that can be run utilizing nearby stations or satellites to impute missing observations and provide a consistent weather history for a given station.

Cleaned data of this type from private sources can be extremely expensive even when the algorithms are not particularly complex. dClimate will host such algorithms providing clean weather station data for analysis, forecasting and insurance use cases in an accessible, transparent, and affordable manner.

Another major use case is modeling for natural catastrophe impact. This is important for activities like hurricane preparation, or for pricing large scale catastrophe insurance, or for understanding the likely impact of climate change on vulnerable areas.

For hurricanes, such modeling requires combining storm track data with data on building types and home insured values. For earthquakes, it would require earthquake simulation models with building type and insurance values. Such data is available across different academic and government sources but putting it all together is generally done by private entities that charge very high prices for their simulation results.

This creates a situation where these products become affordable only for large corporations such as reinsurers. The results also tend to be opaque and difficult to compare across private providers. dClimate will incentivize publisher nodes to run simulations in the natural catastrophe space, thereby opening the gates to small and medium sized entities.

By democratizing disaster analysis, dClimate aims to cultivate a range of participants to prepare, analyze, and insure events of the highest natural impact.

dClimate: An End to the Climate Data Status Quo

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A single, decentralized ingestion and distribution system should be implemented for all climate data. This will enable participants to provide and consume climate data that is clean, immutable, transparent, highly available, and monetizable. Once ingestion has been standardized and hosting has been decentralized, public and private sectors can begin to shed their behemothic data aggregation pipelines, and move toward a decentralized reporting system where all participants report directly to the same immutable hosting network rather than going through a long chain of intermediaries. Finally, through a decentralized, open marketplace, forecasts and new climate variable reporting will be free to blossom with WTHR as the governance mechanism and stablecoin as the incentive.

dClimate Stakeholders

dClimate is a novel ecosystem for organizing the climate data space -- a space which is composed of participating entities ranging vastly in size, focus area, and technological comfort. This begs the question, what are the incentives for different entities to participate in dClimate's reimagining of the climate data ecosystem? Here we discuss how the network would incentivize different participants.

Data Consumers

For consumers of climate data -- companies looking for better weather forecasting, farmers looking for better crop yield models, or NGOs looking for carbon sequestration data, to name a few examples -- the existing landscape of climate data is daunting. There are thousands of companies selling solutions for different special cases sitting on top of large government agencies offering vast amounts of raw data in archaic form. For all but the most expert clients, it is a difficult space to navigate. For example, a flour mill that imports wheat from Russia may need to find the company which had the best forecast record for wheat output in the last few years to prepare for contingencies in case of crop failure. Or, consider an event group responsible for throwing outdoor concerts that needs to find the best forecasting company with a focus on short term storm forecasts. Finally, consider a parametric provider wishing to sell an agreement to a fracking operation for hedging against low subterranean temperatures. There are many confusing options for these use cases, with the result being that a consumer is forced to rely on subjective and often cherry picked marketing materials provided by opaque private data providers.

For a climate data consumer, dClimate offers a protocol-level transparency coupled with a feature rich and intuitive UI. Through a simple and easy rating system, data consumers will be able to quickly judge which data publishers offer the most value for a particular need. Clients will also be able to set up payments with ease using digital stablecoin rather than any volatile token payment method. The validator nodes on the network will offer quality control that is not available when shopping for data or forecasts in the current system. Finally, a community of other users will be available to share information and lessons with.

Data Publishers

For publishers dClimate offers access to a sales channel that is very difficult for all but the largest firms to build. For smaller companies which may have superior models or data, the struggle is immense with client acquisition being haphazard and expensive.

And for a large company with a dedicated sales force and a constant stream of client business, dClimate offers an alternative sales vector that lets them spend less on distribution and more on data quality. The lack of organization in the current market leads to few gathering areas for users who would be interested in data or forecasts, leaving data publishers with high costs in time and dollars to find clients.

Once prospective clients are found, conversion is yet another long and painful process. This is because it is difficult to stand out, especially if the publisher is not a brand name. It takes time to check if a particular company is providing the right kind of data or forecasts and then checking if these are superior to other competitors. In this case, the market significantly penalizes smaller companies with smaller marketing budgets even if their product is superior.

dClimate puts publishers on a level playing field and allows the companies with the best data to naturally succeed. If a given publisher's weather forecast model is best-in-class for forecasting hurricanes or their model is a major improvement in forecasting wind speed for wind farms, dClimate sets them up for success.

Client acquisition and marketing costs are considerably lower and once set up, the network handles the validation, metrics, and payment for services. Given that the costs of adding a new publisher to the ecosystem will be minimal, dClimate makes publishing models and data an easy, low downside exercise. We expect this to bring forth many more players to the space, especially those with models that might currently be stuck at the academic level for lack of VC funding to build a marketing engine.

Governance

A Decentralized Autonomous Organization (DAO) is needed to ensure that the right data collection is incentivized and validated. For example, weather data provided by a node has very different value if it is just adding New York City data--already widely available--versus in an important emerging market with little reporting, such as Sudan. Validation of realized weather data for quality and tampering is another area where specialized functions are needed and general data checks are insufficient.

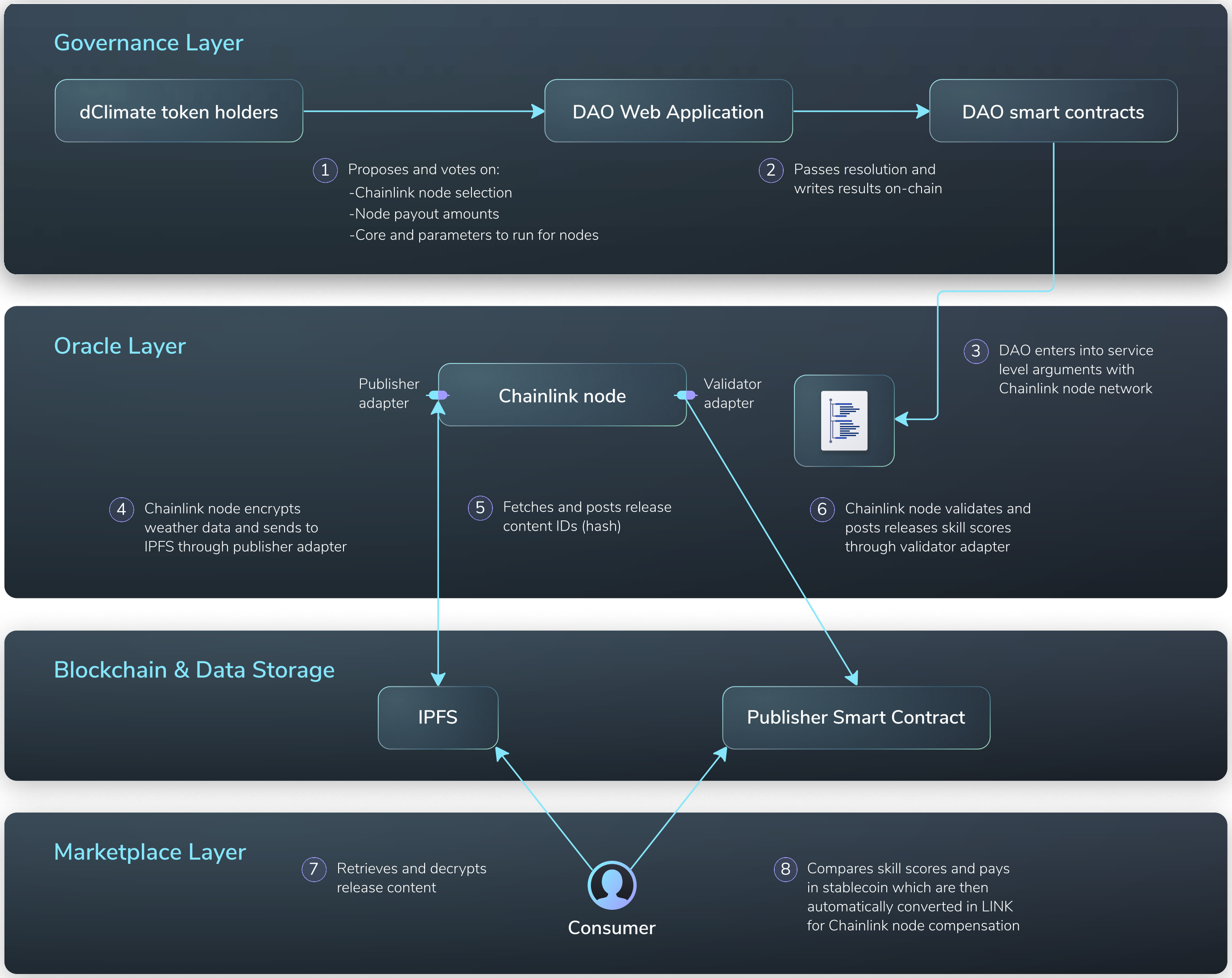
The DAO's validation role is also important for forecasts. Evaluating forecasts is a complex problem and nodes that provide weather forecasts need to be rewarded appropriately. Forecasts of weather data come in the form of probability distributions, not point estimates (such as 60% chance of rain). However, realizations are single outcomes (did it rain or did it not?). To measure errors between these disparate inputs and outputs, there are different accuracy scores that are used. Furthermore, some providers may excel at forecasting 1 week out, others 2 weeks out, and yet others a season out. For users needing weather forecasts at different horizons and for different climate variables, all these metrics matter.

A decentralized network that can present forecast comparisons in a transparent manner and enable appropriate rewards for higher quality forecasts while also solving the inefficiencies in data reporting and hosting will end the stagnation in the industry and bring increased access, lower costs, better security, better accuracy, and both wider and deeper data coverage. This will benefit everyone currently involved in the space, and will also immensely grow the utility of climate data so that it can reach its true potential with regards to real world applications.

Data consumers	Arbol	Academic projects	Governments	Sustainability funds	Insurers
Forecast consumers	Agriculture	Energy	Shipping & logistics	Tourism & travel	Construction
Data publishers	Data analysis teams	Agriculture collectives	Weather station networks		
Forecast publishers	Accuweather, other large entities	Government agencies	Area-specific forecasters	Renewable energy forecasters	Crop yield forecasters

How does dClimate.net operate?

dClimate is architected with four key layers that together provide a decentralized infrastructure for sourcing, delivering, storing, and incentivizing the use of high-quality climate data: Governance, Oracle, Blockchain and Data Storage, and Marketplace.



Governance Layer

The Governance Layer is run by the dClimate DAO, which will have two main responsibilities: 1) deploy and maintain validators and 2) create bounties. These represent ways for the DAO to incentivize the network's growth, and will be implemented by a proposal/voting mechanism. Successful proposals will be implemented in the dClimate codebase via the DAO smart contracts. Because proposals and voting will be highly technical and domain-specific in nature, it is important to cultivate a strong knowledge base of participants within the DAO.

Validators are special types of network participants that apply certain DAO-approved algorithms as a means of evaluating the quality of Publishers' data. These algorithms generate Skill Scores for the Publishers that are shared with consumers in order to aid them in filtering between publishers. For forecasts, these scores will be historical hit/miss tables, with a bottom line accuracy score that will take into account the time horizon to the predicted event. For realized data, Skill Scores will contain references to data gaps, possible errors, distance from the closest national weather station, signifiers of fraudulent behavior, and other metrics, with a bottom line credibility score that also takes into account how widely used the data is.

dClimate leverages Chainlink, the market-leading blockchain oracle network, to serve as its validator node network. Chainlink external adapters will be implemented to codify the validator algorithms used off-chain. Thus, the dClimate DAO votes on which Chainlink node operators are allowed to serve as validators, what kind of Chainlink adapters the Validator Nodes will run for each climate variable, what payout amounts will be to Validator Nodes, and various other decisions like bounty incentives for specific in-demand datasets. Bounties help the network grow by incentivizing deployment of new infrastructure and interpretation methods, as well as wider adoption of the network by “status quo” climate data participants.

The dClimate DAO enforces the fulfillment of various oracle jobs via Service Level Agreements (SLAs), which define the exact jobs carried out by the Chainlink oracle validators and the rewards/punishments for not meeting such requirements. The SLA is stored and enforced directly on the blockchain, providing the DAO with a pluggable governance framework capable of enforcing key functions on dClimate as voted on by its members.

Oracle Layer

For the oracle layer, we've chosen to adopt the existing Chainlink Network as an already widely used and provably secure solution. The oracle layer is run by Chainlink nodes which perform three key jobs: 1) retrieve weather data from publishers and store it in an encrypted format on IPFS (a peer to peer data sharing network), 2) post the resulting IPFS hash onto the blockchain to be referenced by consumers, and 3) validate the climate data by generating Skill Scores and publishing the Skill Scores on the blockchain in the publisher smart contract as a form of verifiable performance history on specific publishers. Through the usage of Chainlink External Adapters, which are selected by the dClimate DAO, oracle nodes perform validation computations off-chain and only post the final resulting Skill Score on-chain. As a result, Chainlink oracles act as the bridge between disparate on-chain and off-chain systems, such as data publishers, IPFS, and the blockchain, as well as the computation engine for generating privacy (encrypting publisher data) and running algorithms (validation).

Publishers can run their own official Chainlink node or take advantage of professionally-managed Chainlink node operators that simplify node maintenance and ensure reliability, redundancy, and upgradability. These nodes cryptographically sign each piece of data they provide to dClimate using a private key that only they possess, which serves as proof of the data's origination from a specific publisher and allows for the publisher's data to be tracked historically over time. Additionally, as both the IPFS hash identifier for each dataset and Skill Scores for each provider are posted on-chain, an immutable record is generated that data consumers can reference at any time.

Blockchain and Data Storage

The blockchain and data storage layer is designed to: 1) store publisher data on IPFS in a confidential manner until it's purchased by a consumer, 2) host a publisher smart contract on the blockchain, which serves as a historical and immutable reputation system of publishers' Skills Scores that consumers can reference, 3) host the DAO governance smart contract on the blockchain responsible for certain governance procedures stated above like permissions on validators nodes, validator node payments, validator algorithms, etc, and 4) host the on-chain Service Level Agreement smart contract between the DAO and Validator Nodes that outlines the exact jobs of the validators and enforces the correct rewards/punishments to validators based on their performance. By leveraging the immutability of the blockchain in combination with the decentralized data storage capabilities of IPFS, a hybrid approach is achieved as climate data is stored off-chain on IPFS in a cost-efficient manner with only a small hash and Skill Scores posted on-chain to ensure censorship-resistant discoverability.

The process is accomplished by the Chainlink node generating an incrementally nonced private key, which they then use to encrypt the climate data that a publisher wishes to monetize. The encrypted data is then posted to the IPFS network and pinned as a new record. The key generation, encryption, and IPFS hosting will be managed by the Chainlink node. Once the encrypted data has been posted on IPFS, the Chainlink node posts the data's IPFS hash and metadata to the Publisher smart contract. IPFS libraries will be implemented at the climate variable level, such as dWeather, dYield, dCarbon, dBiomass, dSoil, etc, all under the umbrella of the wider dClimate project.

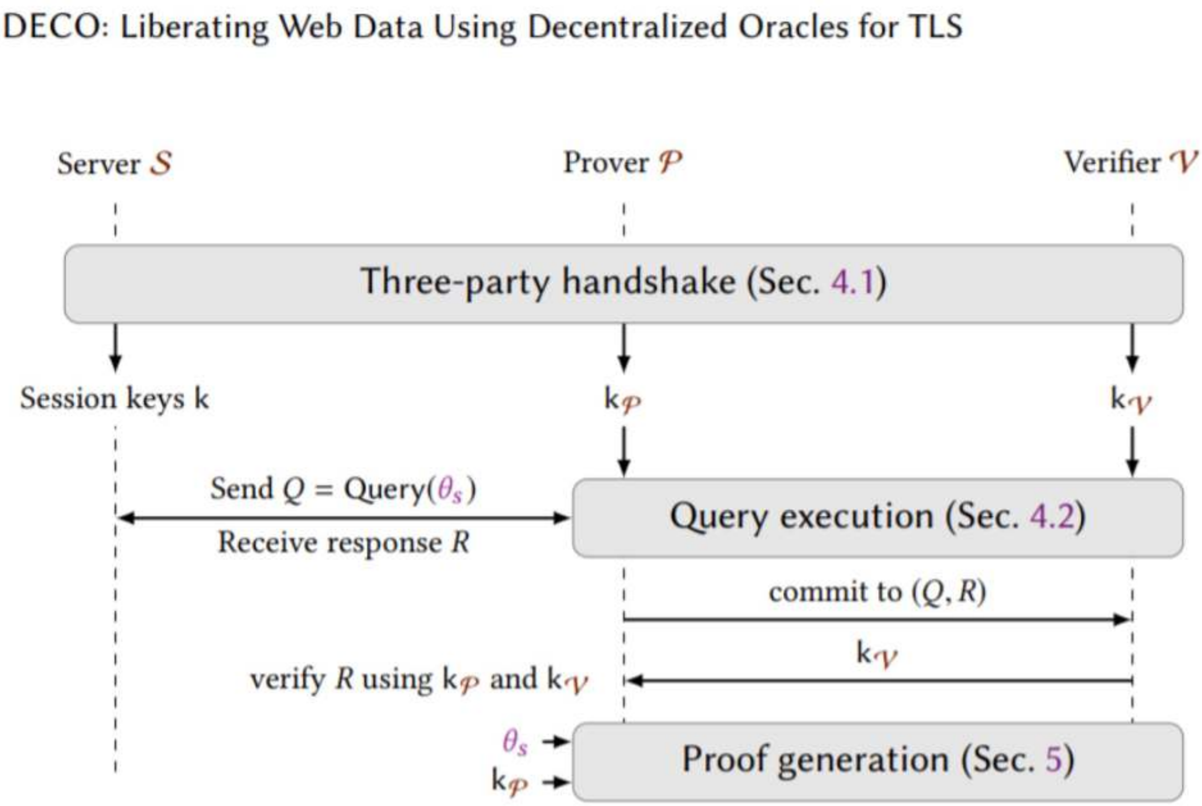
Marketplace

When a consumer wishes to access a datapoint in a monetized release, they submit an on-chain stablecoin payment to the Publisher smart contract and specify the IPFS hash of the data that they wish to obtain. The stablecoin payment is paid to the data publisher, with the Oracle Node being paid in the Chainlink Network's native cryptocurrency token, LINK, via a backend conversion such as using a decentralized exchange. This payment process operates entirely on-chain, ensuring consumers can pay for datasets in an entirely permissionless manner.

The Chainlink node will monitor the smart contract's events to confirm that a fee has been paid by a consumer. Upon receipt, the node will encrypt the incrementally nonced release key that provides access to the Publisher's IPFS data using the data consumer's public key and post it to the smart contract on-chain. The Consumer can then retrieve this encrypted release key, decrypt it using their personal private key, use the resulting release key to decrypt the desired dataset stored on IPFS, and subsequently gain access to high quality data validated by the dClimate ecosystem.

The consumer will also pay a stablecoin fee for using the marketplace, specifically to the Publisher smart contract as a means of evaluating publishers and their data. This fee is also converted to LINK on the backend and paid to the Chainlink node.

Additional Privacy Schema



Overview of DECO and how it generates a three-party handshake between network participants (source)

To provide publishers and consumers an additional layer of privacy, the dClimate ecosystem will use Chainlink for its DECO functionality, a privacy-preserving oracle protocol that ensures sensitive datasets are kept private, while allowing consumers to perform computations on the data using zero knowledge proofs. Through the creation of a three-party handshake between the publisher's web server, the Chainlink prover, and the consuming verifier, data can be kept private end-to-end and never revealed in its entirety.

Tokenomics

Total token supply: 100,000 WTHR

30%
will be sold in the WTHR offering.

20%
will be reserved for the dClimate Inc. in order to participate in network governance and cover costs associated with network construction and upkeep.

17%
will be allocated to Arbol Inc. for funding the start-up costs. Arbol will be an anchor client of the platform by providing initial, cleaned data for use and functioning as the first customer for the network as well.

23%
of tokens will be granted to devs and research organizations to further the development and data breadth on the network as determined by governance. Funds can also be used for customer acquisition through contests, referral bonuses, new sign up rewards, and general marketing as part of greater efforts to grow the community.

10%
will be held in reserves, which will be used to pay early staking rewards via an automated smart contract along a gradually decaying emissions curve.

The tokens granted to devs, community, and held in reserves to pay staking rewards will be unable to be used for governance until transferred. Governance votes can also take place to nominate and select recipients of these grants.

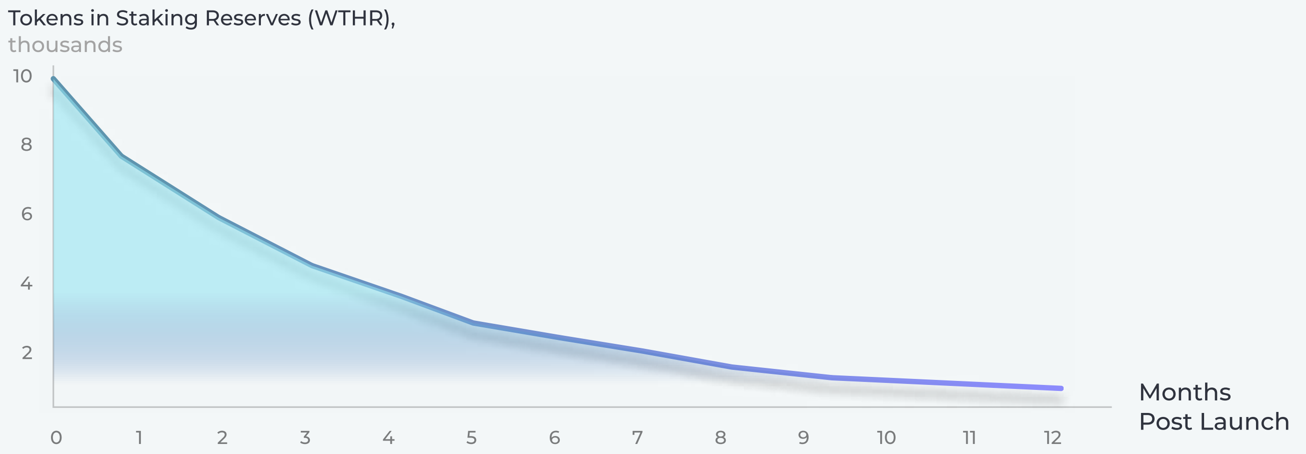
Staked WTHR tokens will allow a token holder to participate in governance. Initially, the WTHR holders will stake WTHR and earn WTHR as rewards. These rewards will be much higher at initial stages of the network in order to incentivize early adoption.

WTHR is a fixed supply token and so the token inflation rate will decline to 0% as network revenues start to ramp up. Staking rewards will not increase the total supply of the token, but instead will be supplied from the initial reserve. The WTHR held to pay staking rewards will follow an emissions curve described by:

$$f(x) = 10000e^{-1*\text{Emissions Factor}*x}$$

where Emissions Factor is set to a fixed 0.25.

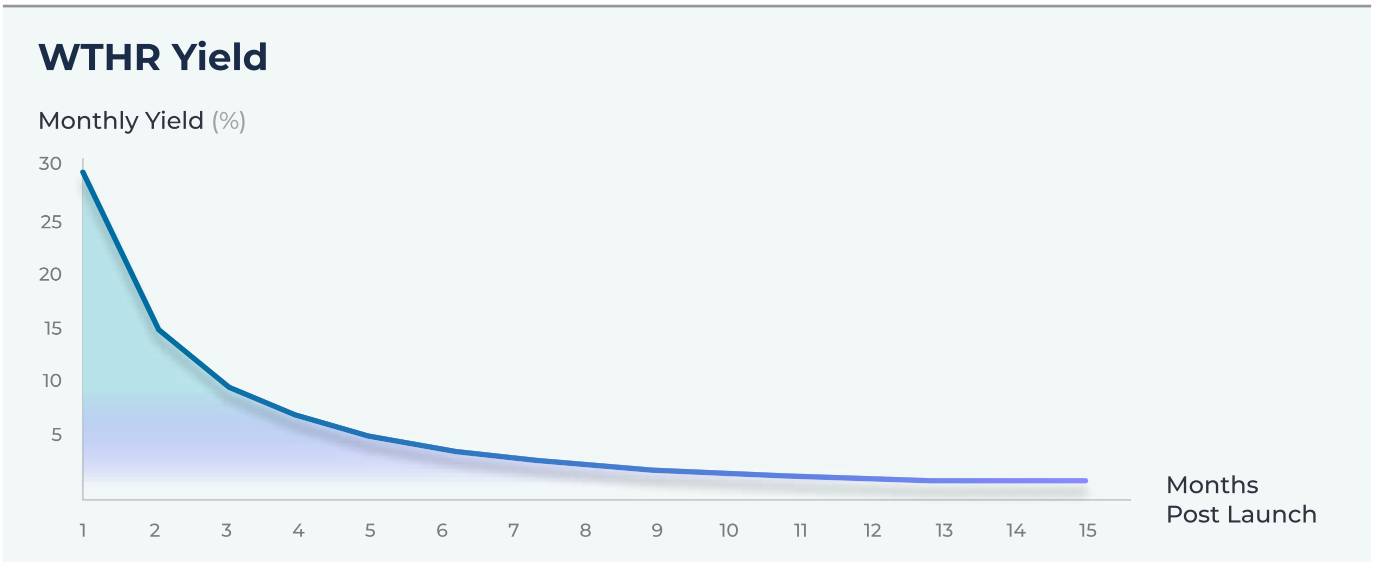
WTHR Emission Curve



This emission function rewards early adopters who aim to actively participate in governance and network growth. The yield generated for WTHR holders is described by the function

$$f(x) = \int_{t}^{t+1} e^{(-1 * Emissions\ Factor * x)}$$

This implies that the yield in the first month is roughly 30%, then 15% the month after, and 10% in the month after that.



After the first twelve months, network revenues will be distributed to token holders as a royalty payment. The royalty payments will start in small percentages of total revenue in order to ensure that the network is able to grow infrastructure and development, and gradually rise to a Royalty Cap of 70% of total revenue based on a logarithmic curve set using our earlier described Emissions Factor. The royalty rate as a function of revenue is described by

$$f(x) = Royalty\ Cap - Royalty\ Cap * e^{-1 * Emissions\ Factor * x}$$

There is no guarantee that WTHR Tokens will pay yield in the future. There is a significant risk that WTHR token holders will receive no remuneration related to their possession of WTHR tokens.

Arbol Inc: A dClimate Anchor Participant

dClimate's key founding members are also the founders and Key Employees of Arbol Inc. Arbol is an insurtech platform for parametric products that pay quickly and fairly covering external risks such as unexpected weather. Arbol uses Big Data, Machine Learning, and Smart Contracts to bring transparency and remove the delays and disputes that plague traditional insurance policies.

dClimate's key founding members are also the founders and Key Employees of Arbol Inc. Arbol is an insurtech platform for parametric products that pay quickly and fairly covering external risks such as unexpected weather. Arbol uses Big Data, Machine Learning, and Smart Contracts to bring transparency and remove the delays and disputes that plague traditional insurance policies. Arbol's products serve a range of industries including agriculture, energy, maritime, leisure, and a host of other bespoke risks. An example product would be a contract with a farmer that pays out if rainfall around a farm as measured by local data sources is lower than average. Such a contract would offset losses to the farmer's crop stemming from deficient rainfall. Beyond rainfall data, a plethora of contracts can be structured for different risk factors including temperature, snow, soil moisture, or wind speed.

Given Arbol's focus on parametric insurance, data is a key pillar of Arbol's business. As Arbol grows, its needs for data underlying its contracts will grow substantially. As discussed above, weather and climate data are not monolithic concepts but different subsets of data that are suited for different regions and situations. The data to be used in applications such as insurance require high levels of quality over a long history. Another layer of key importance are forecasts and simulations that are important to calculate a fair value premium for a range of weather and other parametric contracts. Examples of this would be the rainfall simulations for the contract with the farmer above or more complex simulations of hurricane damage incorporating simulated paths and real estate data for a natural catastrophe insurance policy.

As Arbol grows in size and scope, dClimate will grow in conjunction as Arbol will be an anchor user of dClimate. Arbol's data infrastructure already utilizes a decentralized framework and the company's core philosophy is based around the decentralization of parametric insurance. In this context, Arbol's use of dClimate is a natural next step towards building a decentralized climate data network which creates a positive feedback loop of usage growth of the platform and dClimate's network.

Arbol's platform is expected to show exponential growth in the upcoming year after quickly gaining traction with institutional clients in its first eight months of facilitating live transactions. Notional risk facilitated across the platform is projected to rise from $15 million to in excess of $1 billion in just one year. Arbol also projects to transact $65 million in gross premium through its platform in the upcoming year, a substantial increase from the $2.1 million in gross premium managed in the first eight months.

Arbol currently serves over 350 institutional clients across several industries with a footprint of 35,000 farmers covered. Those numbers are also expected to rise in the upcoming year as Arbol expands its existing line of product offerings to include programs for businesses in the maritime, energy, and hospitality industries.

dClimate DAO

The dClimate DAO is a distributed autonomous organization to guide the dClimate network's activities. The DAO will vote on key issues such as bounties for the addition of weather stations or new partnerships that the network may enter into.

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The DAO's mission will be to manage a thriving network with inputs from the community of WTHR governance token holders. dClimate Inc., a legal entity set up in Delaware, will be a member of the DAO and also responsible for coordinating and implementing the DAO's decisions subject to such decisions being feasible from a legal and operational standpoint. dClimate Inc. will have a board of directors representing experienced professionals spanning the weather and technology spaces.

Works Cited

Abraham, John.
"New Study Questions the Accuracy of Satellite Atmospheric Temperature Estimates"
The Guardian
Guardian News and Media, 7 Nov. 2014,
www.theguardian.com/environment/climate-consensus-97-per-cent/2014/nov/07/new-study-disputes-satellite-temperature-estimates.

Bell-Pasht , Kyra, and Dana Krechowicz.
"Why Does Access to Good Climate Data Matter?"
World Meteorological Organization
6 Dec. 2019
public.wmo.int/en/resources/bulletin/why-does-access-good-climate-data-matter.

Cho , Renee
"How Climate Change Impacts the Economy?"
Earth Institute at Columbia University
World Meteorological Organization, 6 Dec. 2019
public.wmo.int/en/resources/bulletin/why-does-access-good-climate-data-matter.

Ciklum
"Pros and Cons of Big Data.
Ciklum
27 June 2019
www.ciklum.com/blog/prosv-and-cons-of-big-data/

Dobie, Greg, and Tim Evershed.
"The Weather Business: How Companies Can Protect Against Increasing Weather Volatility."
The Guardian
Guardian News and Media, 7 Nov. 2014,
www.agcs.allianz.com/content/dam/onemarketing/agcs/agcs/reports/AGCS-Weather-Risk-Report.pdf"

Earth Institute
"Climate Change May Soon Hit Billions of People. Many Cities Are Already Taking Action."
State of the Planet
Earth Institute at Columbia University , 21 June 2018
blogs.ei.columbia.edu/2018/06/20/climate-change-may-soon-hit-billions-of-urban-dwellers-many-cities-are-already-taking-action/

EPA
"The Social Cost of Carbon."
The Guardian
Guardian News and Media, 7 Nov. 2014,
www.theguardian.com/environment/climate-consensus-97-per-cent/2014/nov/07/new-study-disputes-satellite-temperature-estimates.

Andrew Freedman
"Weather Is Turning into Big Business. And That Could Be Trouble for the Public."
The Washington Post
9 Jan. 2017
www.washingtonpost.com/business/2019/11/25/weather-is-big-business-its-veering-toward-collision-with-federal-government/.

Abraham, John.
"New Study Questions the Accuracy of Satellite Atmospheric Temperature Estimates"
The Guardian
WP Company, 5 Dec. 2019
www.washingtonpost.com/business/2019/11/25/weather-is-big-business-its-veering-toward-collision-with-federal-government/.

Abraham, John.
"New Study Questions the Accuracy of Satellite Atmospheric Temperature Estimates"
The Guardian
Guardian News and Media, 7 Nov. 2014,
www.theguardian.com/environment/climate-consensus-97-per-cent/2014/nov/07/new-study-disputes-satellite-temperature-estimates.

Appendix

A. Weather Station Bounty Thought Experiment

01 A DAO participant creates a proposal detailing the need for rainfall data in South Sudan. They explain that parametric weather agreements are needed for agriculture in the region and that global datasets are insufficient, and that a weather station should be set up to collect terrestrial observations. The proposal specifies the Helium blockchain-enabled weather station, which collects rainfall data and contains several “trustless” features -- GPS, an inaccessible execution environment, and direct data upload to IPFS/dWeather to name a few. The proposal also contains code (see Appendix B) that can be deployed to a Chainlink adaptor that will validate submissions as well as a small stablecoin bounty for fulfillment of the validator’s conditions, to be paid out directly to the publisher node.

02 A vote is taken by the DAO, and the proposal passes. The decision is made to deploy the chainlink adaptor containing the code in the proposal.

03 Some time goes by and nobody appears to be interested in deploying a weather station at that level of bounty. DAO participants and potential data consumers add additional funds to the bounty.

04 A hobbyist purchases the Helium weather station and installs it at the specified location. Regular data posts meeting the validator’s requirements are made. The validator code posts high skill scores to the Publisher’s smart contract, and after some time, the Bounty smart contract, which looks at the publisher’s skill scores, pays out the full amount to the station operator.

05 Parametric agreements using this data are implemented and consume the data. The hobbyist receives revenue from these payments.

06 After a few years, the hobbyist continues to enjoy a regular revenue stream from the data consumers, some of which is used to upkeep the weather station. The DAO receives a portion of this stream as well and the hobbyist publisher enjoys a high skill score for meeting the requirements of the validator.

07 Eventually, the station can be replaced with a unit that has better data collection capabilities. The hobbyist creates their own proposal to the DAO asking for a bounty to deploy a new station, and the cycle repeats.

B. Example DAO Proposal Chainlink Adaptor

```
# An example Chainlink adaptor for a weather station validator proposal.
# If the proposal associated with this adaptor is accepted by the DAO, this code will be deployed to a “validator node”
(Chainlink adaptor) which will validate new climate data releases.

PUBLISHER_SMART_CONTRACT_ADDRESS = %%%%;
STATION_PUBLIC_KEY = %%%%; # The station device’s public key/MAC ID
STATION_LOCATION = (6.120700, 30.984107); # South Sudan
EXPECTED_READINGS_PER_DAY = 48; # Expecting an observation every half hour to unlock bounty
EXPECTED_DOWNTIME = 1/40; # Allowing for one missed observation out of every 40 for battery changes, etc.
REFERENCE_DATASET = “chirps_05_final”; # A satellite dataset for sanity checks.

# This function is called by the Publisher’s smart contract with each new Release.
function validateRelease(releaseCID, decryptionKey)
decryptionKey = decryptionKey.decrypt(); # The decryption key comes encrypted, so the validator must decrypt first.
 releaseContent = ipfsClient.get(releaseCID); # Retrieve the encrypted release content.
 decryptedContent = releaseContent.decrypt(decryptionKey); # Decrypt the release content with the decryptionKey.
 assert(validateSignature(releaseContent, STATION_PUBLIC_KEY)); # Post must be generated by “locked down” weather
station software and signed.
 assert(validateLocation(releaseContent, STATION_LOCATION)); # Validate that the observations were taken at the
specified location, taking into account an expected amount of GPS drift/jitter.
 skillScore = validateReadingsPerDay(releaseContent, EXPECTED_READINGS_PER_DAY, EXPECTED_DOWNTIME,
REFERENCE_DATASET); # Generate a skill score based on the release versus what is expected.
 blockchainClient.postSkillScore(skillScore, releaseCID, PUBLISHER_SMART_CONTRACT_ADDRESS); # Publish the release’s
skill score for all to see.
```

C. Forecast Bounty Thought Experiment

01 1. A DAO participant creates a proposal detailing the need for good local forecasts of Indian monsoon outcomes. They explain that shipping, agriculture, and construction efforts are affected by this, and provide notices of intent by a parametric seller, and by several shipping and construction entities expressing their desire for these forecasts as well as their projected market value. The proposal also contains code that can be deployed to a Chainlink adaptor that will validate these forecasts against satellite images and global rainfall datasets as the source of truth. The proposal specifies a 45, 30, and 15 day time horizon for the forecasts, and the level of interest for each horizon. No bounty is provided.

02 A local meteorologist begins posting 45, 30, and 15 day forecasts to dClimate. The monsoons are a yearly event, so several years must pass before a statistically significant skill score can be generated based on this data alone. The meteorologist has been making local predictions about Indian monsoons for several decades, however, and wishes to be given a higher skill score sooner. They make an appeal to the DAO in the form of a proposal asking to be given a higher skill score based on their previous, albeit unverified forecasts.

03 The DAO decides to vote no on the proposal, but a second proposal is made in its place by a different network contributor. This proposal specifies that the meteorologist's skill score will remain unchanged, but that the meteorologist's profile page will receive a new kind of "badge" that contains reference to a DAO approved summary of the meteorologist's work history and scientific methods, as well as references to the meteorologist's scientific publications.

04 Two construction companies who are willing to pay for forecasts based on the meteorologist's credentials alone do so. The meteorologist receives a small income stream from this, a part of which passes to the DAO.

05 Several years pass, and the meteorologist's skill score has emerged as the best for Indian monsoons, with 92%, 94%, and 95% skill scores at the 45, 30, and 15 day horizons respectively. Many construction, shipping, and parametric entities are subscribing to the meteorologist's forecasts, with a portion of the revenues passing to the DAO. Secondary weather reporting entities begin subscribing as well. The meteorologist enjoys a healthy income stream, and the DAO is rewarded for its labor in helping to bootstrap the meteorologist's forecasting efforts.

D. Data Interpretation Bounty Thought Experiment

01 A DAO participant creates a proposal expressing the need for new methods for inferring atmospheric CO_2 levels globally. The proposal explains that there are several sustainability funds and carbon swap entities wishing to purchase access to this data, but that none is currently available, and that the instrumentation required for taking direct global observations of CO_2 would be unrealistically burdensome to deploy. Several DAO participants place large bounties on a satisfactory method as defined by a validator node. A training set of known good CO_2 leve ls is posted as part of the validator code. As new training data comes in, the validator code is updated to include it.

02 One year passes. During this time, several entities have made submissions that match the training set. However, as new training data comes out, their posts are found to have been an overfit to the training set, and the bounty is not paid out.

03 A chemist begins posting global CO_2 releases that have been generated from satellite IR observations and global temperature observations. He keeps his method private, but over the course of a year, it is shown that the method matches new training data. After a year of new matches, the entire bounty is paid out to the chemist over the course of a second year of matching observations. Concurrent with the bounty award, the publisher receives a high skill score that continues to be validated against the new training sets.

04 Sustainability funds and carbon swap entities purchase the data from the publisher at a high price, and portion of the proceeds flow to the DAO.

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