

Oasis Platform for Catastrophe and Climate Change Risk Assessment and Adaptation

LAB INSTRUMENT ANALYSIS

June 27, 2016



The Lab is a global initiative that supports the identification and piloting of cutting edge climate finance instruments. It aims to drive billions of dollars of private investment into climate change mitigation and adaptation in developing countries.

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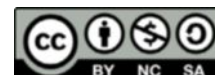


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CONTEXT

Insurance, in the context of broader disaster risk management strategies, can increase communities' climate resilience and reduce recovery times when disaster strikes. Total economic losses to property and infrastructure from natural disasters have averaged around USD 180 billion annually in the last decade, 70% of which (USD 127 billion or USD 1.3 trillion in total over the 10 years) are uninsured (Swiss Re, 2015). Developing countries are more severely underinsured relative to developed countries.

Asian low- and middle-income countries, in particular, have disproportionately low insurance coverage despite high susceptibility to natural disasters, with catastrophic economic and human consequences.¹ With the frequency and severity

¹ Based on EM-DAT (2016) data.

of natural disasters increasing as a result of climate change, the impact and cost of catastrophic impact is expected to increase (Swiss Re, 2015).

Although integral to improving the management of, and recovery from, extreme climate events, high quality catastrophe risk models to assess and price the severity and probability of losses are not readily available or adequately developed. Key barriers include the costs associated with developing and maintaining models, the lack of standardized hazard, exposure, and vulnerability data, and the difficulty in accessing local specialized knowledge. Under-developed insurance markets also inhibit demand for these products.

INSTRUMENT MECHANICS

By providing access to transparent and standardized analytics, the Oasis Platform aims to improve understanding and management of climate-related risks. Various elements of the Platform are currently being developed or tested, with the goal of piloting its use in support of insurance underwriting in Asian developing countries.

The Oasis Platform for Catastrophe and Climate Change Risk Assessment and Adaptation (the "Platform") is a set of tools that together aim to offer a more transparent, robust and comprehensive approach for analyzing and pricing risk from extreme events. Ultimately, it aims to increase

the penetration of insurance and the use of catastrophe models beyond the re/insurance industry to support risk-informed planning and decision-making.

Proponents of the Platform began its development in 2012. They aim to roll out a pilot in one to three low- and middle-income countries in Asia where the use of the Platform as modeling infrastructure of choice could culminate in the underwriting of catastrophe risk insurance. Toward this end, the Lab analysis focuses on demonstrating the value add of the Platform, identifying the most suitable context for the pilot, and suggesting an implementation pathway.

MAIN COMPONENTS

The Platform comprises three main elements, now at different stages of development:

1. **A Loss Modeling Framework** (“LMF software”): An open source loss modeling software allows users to ‘plug-and-play’ a range of standardized hazard, exposure, and vulnerability data, as well as economic and insurance data (e.g. policy coverage and limits) to calculate potential economic damages and financial risk associated with catastrophic events. The open source code of the calculator can interface with third party models and systems, enabling transparent sharing and modification of assumptions and calculations as well as standardization in the modeling community. Standards are critical to enable comparison across models’ results.

The LMF software was first released in 2014, and is currently in a final testing phase. Proponents aim to (i) complete or improve a number of its elements (e.g. web interfaces and services for managing model data, running analyses and retrieving results) and (ii) make its code fully open source to the broader public by the last quarter of 2016.²

2. **An e-Market:** An open access, web-based marketplace with a matchmaking function that links demand for risk analytics (from e.g. re/insurers) with suppliers of hazard, exposure, and vulnerability data as well as catastrophe risk models, tools, and services. The e-Market aims to allow commercial and non-commercial users, such as government and academia, to acquire data and license models either free, or for a licensing fee, depending on the preference of the data or model supplier. Proponents established the commercial limited company that will run the e-Market, and are now developing the related business plan and engaging with potential investors. They aim to launch it in November 2016 at the 22nd UNFCCC Conference of the Parties in Morocco.

3. **Capacity building:** Online training modules will be available to modelers and model users to increase their ability to develop and use catastrophe risk models compatible with the Platform and that can meet the needs of a range of users, including the re/insurance industry. In particular, training modules could help users beyond the insurance industry to understand the value of and use catastrophe risk models. Workshops and training courses linked to existing education and entrepreneurship programs would promote knowledge sharing between organizations such as insurance companies and academic institutions. Demonstration projects would also help to build know-how and develop internationally recognized standards. This component is currently under development and the first training course is planned to be freely available online by the last quarter of 2016.

Proponents have recently initiated the development of a final, fourth component, a global exposure database with the aim to provide standardized, accessible inputs for model development.

STAKEHOLDERS INVOLVED

A consortium of partner organizations provide the broad range of industry experience, technical expertise, and outreach capacity that will help underpin the roll-out of the Platform in Asia and elsewhere. These include:

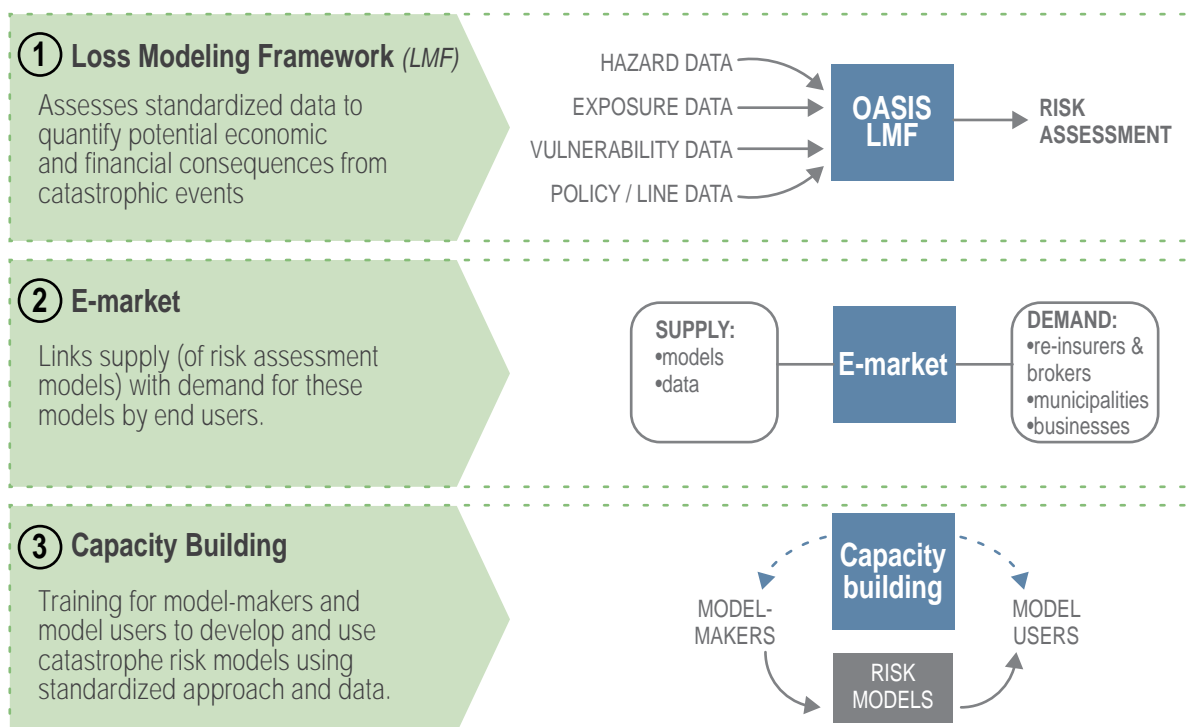
- A non-profit company (Oasis LMF Ltd) managing and promoting the development, use, and maintenance of the LMF software component for a group of 44+ member organizations including insurance and re-insurance companies and brokers,³ and an EU-funded public-private partnership driving climate change innovation (Climate-KIC);

² Currently, this feature is available only to members and approved associate members of the Oasis LMF Ltd

³ Members include: Lloyd’s, SCOR, Ren Re, Guy Carpenter, Willis, Partner Re, Allianz, Swiss Re etc. See Oasislmf.org.

Figure 1. The structure of the Oasis Platform.

Better risk assessment achieved through the **3** components of the OASIS Platform:



- A pan-European public and private consortium of universities, research institutes, and modeling companies developing new models, methodologies, and business services (Oasis, 2015);
- A for-profit company managing the e-Market (Oasis Hub);
- A commercial service company (Oasis Palm Tree Ltd) responsible for the capacity building component through the development of an online training course (Massive Open Online Course) for modelers and model users, and ensuring the development of data and models compatible with the Platform.

Proponents are also members of the Insurance Development Forum's Risk Modeling and Mapping Group (RMMG),⁴ a public-private

⁴ Announced in November 2015, the Insurance Development Forum is a joint initiative of the insurance industry, development organizations and policy makers aimed at (1) incorporating insurance industry risk measurement know-how into existing governmental disaster risk reduction and

working group of practitioners from the disaster risk assessment, insurance and finance industries. The RMMG, which aims to enhance collaboration and efficiency in the understanding of risks from extreme natural disasters, identified the Oasis Platform as a technological solution that could underpin the collaborative efforts of the Group (RMMG, 2016a,b).

BUSINESS MODEL

A €4.5 million grant supported the initial development of the LMF software and new catastrophe risk models for Europe.

A £30,000 annual membership subscription fee to Oasis LMF Ltd supports the development of the LMF software. Members also provide strategic direction and contribute to the growth of the Platform by developing or running catastrophe

resilience frameworks; 2) building out a more sustainable and resilient global insurance market in a world facing growing natural disaster and climate risk" (ICMIF, 2016).

risk models and data on the Platform, and supporting the establishment of common industry standards for model development, data collection and sharing.

Revenue to sustain the e-Market will be generated through a fee on commercial licensing of models and possible advertising of products and services relevant to climate resilience. The Proponents seek investors to support its further development.

TARGET COUNTRIES FOR A PILOT

To identify the most suitable countries in which to demonstrate the use of the Platform in Asia, the priority region for the pilot, we developed the following criteria:⁵

- Exposure and vulnerability to weather and/or climate events
- Maturity of the insurance market
- Potential financial benefits stemming from risk pooling
- Data and model coverage

⁵ See Annex A for more details.

- Country potential interest and ability to engage in the development of disaster risk financial strategies
- Donor priorities as highlighted by existing and potential initiatives
- Membership in regional political entities such as the Association of Southeast Asian Nations (ASEAN).

In order of ranking, Philippines, Vietnam, Thailand, Indonesia, and Bangladesh emerged as the most suitable to undertake a pilot.

Despite being highly prone to natural disasters, these countries have limited insurance coverage, and disaster risk models are lacking or have severe limitations. In particular, models for floods and typhoons, key perils in these countries, are inadequate.

Of the five countries initially analyzed, Philippines, Indonesia, and Bangladesh have garnered the most interest from potential stakeholders, including governmental authorities, academic institutes, and insurance companies. The final list of countries for the pilot projects, however, will depend on confirmation of local interest as well as funding availability.

BARRIERS AND INNOVATION

The Platform could transform the way catastrophe risks are assessed, lowering costs to access transparent and standardized analytics, giving users the power to customize models, and potentially facilitating penetration of insurance into vulnerable countries.

BARRIERS ADDRESSED: THE PLATFORM IS DESIGNED TO ADDRESS KEY OBSTACLES THAT INHIBIT RISK ASSESSMENT

The Platform is specifically designed to address key barriers inhibiting an adequate understanding of risk and, ultimately, the provision of insurance products for climate-related events. The key barriers the Platform seeks to address include:

- **Lack of transparency on how risks are estimated.** Most widely available models in the market do not allow re/insurers to fully

understand how risks are quantified, or to access or manipulate underlying assumptions or parameters.

New regulations in Europe and the U.S. (which are expanding to Asia)⁶ and improved enterprise risk management approaches are driving increased transparency and requiring re/insurers to demonstrate a comprehensive understanding of risk.

- **Inadequate understanding of climate-related risks.** Limited sources of data and models in the market hinder users' ability to gain a comprehensive, diverse view of a given risk. This reduces ability to price insurance products, including how much capital is required to meet the liabilities insured.⁷
- **High model costs and lack of standards.** Models have significant upfront capital costs that are typically recovered through annual license fees.⁸ Current costs also reflect the lack of a competitive modeling market and limited market efficiency. High costs inhibit users beyond the re/insurance industry to access and use risk assessment models. Furthermore, in the current market, data

and models are typically developed with different standards and formats, which can make it technically challenging and expensive for users to incorporate them in different analyses and to maintain multiple software platforms.⁹ The lack of a "common language" also results in reduced confidence in risk modeling outputs, and a reduced ability to coordinate efforts (RMMG, 2016a).

- **Transaction costs and a lack of visibility limit interactions between users and suppliers of catastrophe risk data and models.** On the side of financial modelers and re/insurers, costs are associated with finding local sources, such as academic institutes, to fill data or model gaps. Suppliers, in turn, may not have the ability or interest, capital, and demand-certainty needed to develop comprehensive software solutions that are required by re/insurers or other users to model catastrophe risk.

INNOVATION: THE PLATFORM WOULD ENABLE MORE TRANSPARENT, ACCESSIBLE, AND CUSTOMIZED ASSESSMENTS OF CLIMATE-RELATED RISKS

To assess the innovative nature of the Platform we reviewed 18 comparative tools and initiatives¹⁰ and interviewed 18 experts from the re/insurance sector, modeling industry, and development community.

Our analysis shows the Platform goes beyond existing tools and initiatives because it tackles these key barriers comprehensively and creates potential to increase insurance penetration.

The Platform's most innovative elements are:

- **Its open access and open source character enables users to customize and get multiple and transparent views**

⁹ Several experts interviewed referred to this issue as "software spaghetti".

¹⁰ See Annex B for details.

⁶ Insurance companies are now required to demonstrate a full understanding of the models and to "own" their view of risk. In Europe, Solvency II and, in the U.S, the Solvency Modernization Initiative, in fact, require insurers to file an own risk solvency assessment (ORSA) with state regulators to demonstrate their ability to remain solvent under various scenarios of risk (Willis Re, 2014); III (2013). Solvency II also raised the threshold of Regulatory Capital Requirements i.e. minimum amount of capital the insurer needs to cover its risks. Experts interviewed noted that many Asian countries are introducing compliance regimes, and that international insurers or reinsurers operating in these countries through e.g. subsidiaries have to comply with these regimes.

⁷ Sources: experts interviewed and e.g. Fitch Ratings (2016) and ADB (2009).

⁸ According to literature reviewed and the experts we interviewed, catastrophe risk models can cost from approximately USD 0.1 to 1+ million to build, depending on the country(ies) and peril(s) they cover. Model users (primarily re/insurers) typically license several models annually, with annual costs ranging from the low hundreds of thousands of dollars for smaller re/insurers to USD 1-8 million for larger insurance houses.

of climate-related risks. The open source and “plug and play” characteristics, in particular, allow users to modify the source code and understand how damages and financial losses are calculated. By supporting minimum standards, the Platform would also allow interoperability between the data and models made available, or users’ own data and models, and the open source LMF software. Hence, the Platform will enable a transparent view of risk and customization of models by, for instance, changing assumptions or input data.

- **The LMF software has superior technical capacity and speed over comparable frameworks**, and enables users to access a more nuanced view of climate-related risks, including improved understanding of the uncertainties associated with model results. Some experts interviewed noted that compared to existing tools, the LMF software enables users to calculate damages and financial losses quickly and objectively. Further, cloud-based availability will reduce the need for individual companies, particularly smaller insurance companies in developing or emerging countries, to invest in the hardware and software needed to run complex models.
- **Standardization and the e-Market would lower transaction costs by linking supply and demand for data and models.** Connecting small and disperse providers of data and models with possible customers will

meet market demand for localized knowledge of hazards, exposure and vulnerability and stimulate the development of new models where lacking, helping reduce the uncertainty associated with catastrophe models.

- Finally by facilitating the standardization of data and models across the industry, the Platform could lead to lower transaction costs, increased demand and supply for these types of products, and enhanced comparability across models.
- **The Platform’s holistic approach to catastrophe risk assessment could facilitate market entry to a broader range of users.** By bringing together the various elements needed to model catastrophe risk (hazard, exposure and vulnerability data as well as software for calculating damage and financial losses), with a marketplace and capacity development, the Platform could lead to efficiency gains, stimulate competition, and allow users beyond the immediate re/insurance industry to better understand climate-related risks.
- **The Platform has the potential to empower developing countries’ stakeholders to maintain datasets and models to ensure their sustainability.** In particular, capacity building and increasing the accessibility of the user interface will allow a wide range of users in developing countries to adopt – and adapt – the Platform’s tools for their own needs over the long term.

IMPACT

We estimate that the Platform could potentially reduce modeling costs by 25-50%, catalyze USD 1-9 million in new model development investments, and facilitate an additional USD 1.4 to 6 billion of property insurance coverage in the three potential pilot countries.

QUANTITATIVE MODELING

The upstream nature of the Platform implies that several steps are required to translate into increased insurance penetration and enhanced climate resilience. To identify the steps and accompanying metrics leading to impact, we developed and tested with experts a theory of change (see Annex C). This analysis highlighted that the Platform will have direct impacts on the modeling market in terms of achievable cost reduction and the number of models available. These direct impacts would subsequently translate into improved understanding of risks, which in turn would lead to more risk underwriting and risk-informed investment decision-making.

We developed estimates for the following indicators: cost reductions; investment in model development catalyzed; and market potential for insurance coverage. Our estimates are based on a combination of (i) expert interviews; (ii) discussions

with proponents regarding their targets for the Platform; and (iii) analysis of publicly available insurance, economic, and financial data.

The results are preliminary and prepared for illustrative purposes only.

PRIVATE FINANCE MOBILIZATION AND REPLICATION POTENTIAL

Pilot impact

The Platform could directly save re/insurers 25-50% in modeling costs, as well as catalyze USD 1 to 9 million in new investments for risk model development in the Philippines, Indonesia, and Bangladesh, the three potential pilot countries in Asia.

We estimated the cost savings potential through expert interviews. Several re/insurers who estimated savings in the lower part of the range noted that they may see some increases in in-house modeling costs associated with using the Platform, as it requires some work for “assembly” of models and data.

We estimated the total investments catalyzed for developing new models in the three potential pilot countries based on a range of model development costs and assuming three new models (e.g., flood, typhoon, and drought) are built in each country by 2020 (see Table 1). Replication in other Asian countries would catalyze additional investment.

Table 1: Assessing the Platform's catalytic potential: investment in climate risk model development

Range of Investment	Cost to develop model (depends on country & perils)	Total cost for 3 new models in each of 3 focus countries
Lower	USD 100,000	USD 900,000
Mid	USD 500,000	USD 4,500,000
High	USD 1,000,000	USD 9,000,000

Sources: expert interviews. Note that the cost of modeling depends on country, number and type of perils (some perils are more data intensive than others), and existing data availability, and that some of the more expensive models are multi-peril and multi-country.

Transformative potential

Assuming the Platform became the technical infrastructure supporting the underwriting of catastrophe risk in the three potential pilot countries, we estimate:

- Up to USD 300 million in additional catastrophe risk insurance coverage, if reaching a similar level to existing natural catastrophe risk pools.
- An additional ~USD 1.4 to 6 billion of property insurance coverage could be generated by a broader catastrophe risk insurance market in the selected countries, based on their current levels of economic development, insurance coverage, and exposure to catastrophe.

We estimated the lower bound of market potential by examining the risk coverage that has been mobilized by national catastrophe risk pools and funds in Turkey, Taiwan, Mexico, and the Caribbean. We assume that the three focus countries would form risk pools similar in scope and penetration.

Table 2. Assessing the Platform's transformative potential: market potential for insurance

Country	2014 level of property premiums (USD bn) (1)	Potential additional premiums through a risk pool (USD bn) (2)	Estimated level underinsurance (USD bn)	Estimated natural catastrophe protection gap (USD bn) (3)
Philippines	0.40	0.06	0.20	3.20
Indonesia	1.00	0.18	0.90	2.50
Bangladesh	0.06	0.04	0.31	n/a
Total	1.5	0.3	1.4	>6

Property insurance is used as a proxy as catastrophe risk-only insurance market data are not available. Sources: Swiss Re Sigma Reports 4/2015 and 5/2015, IMF World Economic Outlook October 2015, TREIF (2015), CCRIF (2015), TCIP (2012), IBRD/World Bank (2012, 2013); 1/ Data for countries not included in Sigma 5/2015 are estimated based on available data and comparisons; 2/ Estimated based on other government based risk pool premiums; 3/ n/a= not available, as the protection gap for Bangladesh was not modeled in Swiss Re 5/2015.

Figure 2: Assessing the Platform's transformative potential: Insurance penetration in the potential pilot countries, 2014 data (property insurance as % of GDP).



We evaluated the upper bound by analyzing the gap between insured losses and total expected (modeled) annual catastrophe losses ("estimated natural catastrophe protection gap"). For the intermediate potential we analyzed the gap in insurance penetration at the country level compared to what would be expected based on benchmarks for countries at similar levels of development ("estimated level of underinsurance"). Intermediate and upper bound methods are based on Swiss Re's Sigma Report (2015b).

ENVIRONMENTAL AND SOCIAL IMPACT

The Platform could strengthen climate resilience by helping to reduce the gap between insured and actual losses stemming from natural catastrophes, and by opening up the use of catastrophe risk modeling to users beyond the insurance industry. By easing access to data, stimulating model development where

lacking, and facilitating reduction in modeling costs, the Platform holds the potential to open up the use of catastrophe risk models and services to users beyond the insurance industry, such as to government authorities, city planners and corporate risk managers. We did not specifically model this impact, but note the Platform's potential to have impacts beyond those considered in our modeling are wide ranging.

IMPLEMENTATION PATHWAY

We estimate that it could take at least two years and seed funding of about USD 10-14 million to forge necessary partnerships and finalize the underlying architecture for the Platform to be used in support of an insurance mechanism

The piloting of the instrument in one to three of the identified Asian pilot countries – the Philippines, Indonesia and Bangladesh – rests on developing strategic partnerships with suppliers and users of data and analytics in these countries and beyond, as well as attracting investors.

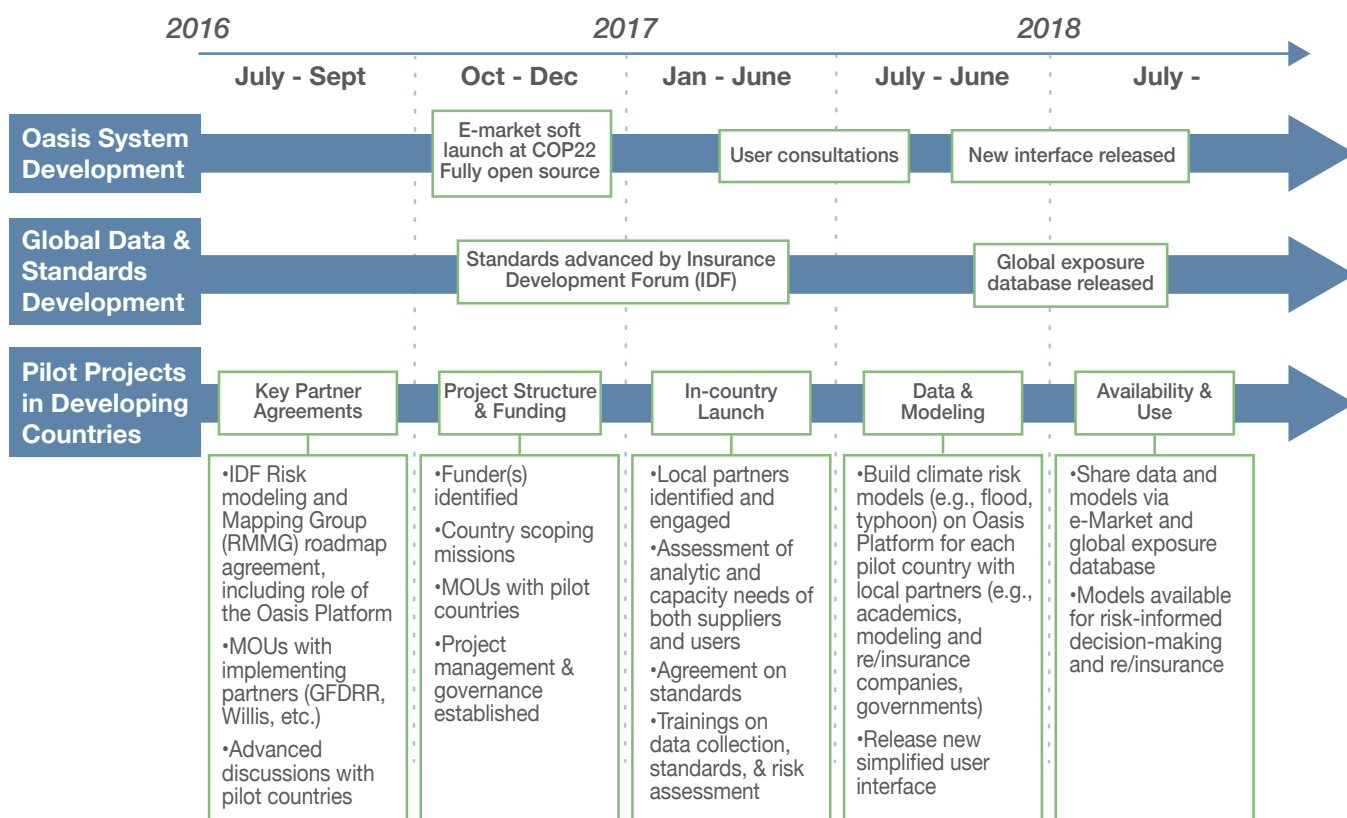
The Platform proponents have already made steps in this direction by engaging with the Insurance Development Forum's Risk Modeling and Mapping Group (RMMG), a working group established to increase risk understanding for disaster risk finance and insurance solutions. The RMMG, co-chaired by the Global Facility for Disaster Reduction and Recovery and RenaissanceRe, and composed of development organizations, re/insurance companies and modeling providers, is considering using the Platform's open-source framework to test standards that would meet the needs of the modeling community as well as those of users and has proposed building open

catastrophe risk models within the Platform in 2-3 developing countries. The implementation pathway outlined under the Lab is consistent with and reinforced by the draft road map outlined by the RMMG.

Figure 3 describes the implementation pathway for these pilot projects, which would run in parallel to both the completion of the Platform's system components and a global exposure database to improve data availability and accessibility. Pending the finalization of the RMMG work plan and formalization under the Insurance Development Forum, the pilot projects would be carried out in partnership with the RMMG and in collaboration with other working groups of the Insurance Development Forum, particularly those focused on market development and capacity building of the users of risk analytics.

Agreements will also be established with the Global Facility for Disaster Reduction and Recovery and re/insurance companies such as Willis Re, Lloyd's and RenaissanceRe. These partnerships would bring additional expertise and contacts to the initiative, including relevant local partners (e.g. academic institutions, modeling companies and local re/insurance companies), and support linkages with disaster risk finance and insurance solutions. Similar to an initiative run by the Platform in Europe's Danube River Basin,

Figure 3: Implementation pathway



the pilot projects would be managed overall by an Oasis+ Consortium program manager, in addition to an advisory steering committee and local project managers.

INVESTMENT NEEDS

We estimate that around USD 10 to 14 million in private and public investment would be needed to implement the pathway in the three potential pilot countries.

As an upstream solution that will become self-sustaining as it attracts more and more users, the Platform would benefit from early stage development risk capital to demonstrate its potential. The investment would support the development of the underlying system and several risk models, as well as capacity building

for the long-term sustainability of the investment (see Table 3).

In particular, public investment to accelerate the development of new models for the selected pilot countries using the Platform standards and e-Market would begin to create positive momentum and ensure the initiative would generate development impacts. Public investment could also be used to develop training solutions and build interfaces with development organizations such as the World Bank and governments, which are currently developing disaster risk management facilities and procuring new models for disaster risk finance and insurance initiatives.

Private investors such as insurance companies, philanthropic organizations, or tech companies could support the further development of the technical infrastructure, models, and e-Market.

Table 3. Investment needs estimates for advancing the development of the Oasis system (above) and the developing country pilot projects (below)

Activities	Financing needs (USD mln)	Type of financing needs**
Oasis Platform system		
e-Market	3.4*	Equity / concessional loans / convertible grants
New user interface	0.3	
Activities	Financing needs (USD mln)	Type of financing needs**
Supply		
Risk model development	4.5 - 9	Grants & in-kind contributions
Capacity building for model development and adoption of standards	0.3	Grants
Development of global exposure database	0.5	Grants
Users		
Capacity building for model use	0.3	Grants
Management costs		
Project management & oversight	0.4	Grants & in-kind contributions
Total	10 - 14	

Notes: (*) Climate-KIC has pledged support if a matching contribution is found.

(**) Implementing partners will be expected to provide in-kind and cash contributions, as appropriate, to demonstrate buy-in.

IMPLEMENTATION CHALLENGES

The biggest implementation risks may stem from failing to rapidly achieve a critical mass of models to attract users and attain financial sustainability due to complexity, coordination requirements, and the lack of appreciation of the value of the Platform.

Key challenges associated with implementing the Platform are:

Complexity and coordination needs. As an integrated solution, the Platform has a number of distinct pieces that must be coordinated, sequenced, and aligned. Establishing adequate

governance of the Platform and its non-profit and for-profit members could add further complexity, particularly given the absence of a centralized oversight mechanism or Board. In particular, as the RMMG pilots the Platform in developing countries, a governance and project management structure will need to be established. This structure must provide coordination among the projects, the development of standards and the global system, while balancing the need for local stewardship and keeping the flexibility that the Platform's modular, open access structure provides.

The need for rapid scale-up of quality data and models to demonstrate value to users means new partnerships must be established with key suppliers and those engaged in the development of ad hoc models to fill modeling gaps and achieve a critical mass in the Asian region. To ensure user trust, the Platform will need to develop a quality

assurance process that can meet the needs of the full range of potential users, from re/insurers to planners. Ultimately, the value to users will be in the offering of superior models built with local knowledge and expertise.

Achieving financial sustainability could take longer than anticipated. The Platform's e-Market envisions reaching financial sustainability through charging user fees on commercial transactions. This business model relies on rapidly building a significant user base with repeat customers. The Platform should therefore focus on building a user community through demonstrations, capacity building, and communication, in addition to developing supply offerings. Early public sector support will be important to help the Platform gain a foothold and begin to scale.

An insurance product or other risk management facility requiring modeling may not materialize. Currently there are a number of discussions to develop regional, national, provincial, or municipal-level risk pooling mechanisms or other

risk management approaches in Asia, including in the focus countries identified. Ultimately, a demand-driven demonstration and use of the Platform linked through one of these mechanisms will be the most important way for the Platform to reach scale and market trust. As the pilot projects progress, they will need to establish collaborations with these initiatives early on in order to be able to meet the needs of potential users.

Non-insurance users may fail to fully appreciate the value of the Platform. One of the aims of the Platform is to expand its use beyond re/insurance to companies and governments to enable better risk-informed decision-making. Initial scoping will help determine whether these additional users have appetite and capability to take advantage of catastrophe risk modeling. In addition, the Platform will require the cooperation of some users, particularly governments, to obtain data, which may prove difficult. Consequently, awareness-raising and training activities will need to engage with these potential users, and country ownership of the pilot projects will be crucial.

KEY TAKEAWAYS

Our analysis of the key characteristics and value of the **Oasis Platform for Catastrophe and Climate Change Risk Assessment and Adaptation** suggests it would enable improved assessment and pricing of catastrophe risks and ultimately lead to increased insurance penetration and investments in resilience.

The Platform scores well against the Lab's key criteria for the following reasons:

- **Innovative:** As an open source and open access tool, the Platform could transform the way natural disaster risks are assessed and how the catastrophe risk modeling market works, lowering costs to access transparent climate-related models and empowering users to customize them.
- **Catalytic:** The Platform could reduce modeling costs by 25-50% by lowering transaction costs and enhancing competition, thereby opening up the use of risk models to users beyond the re/insurance industry. It could catalyze investments for USD 1-9 million in new model development in the Philippines, Indonesia, and Bangladesh.
- **Transformative:** The Platform could indirectly facilitate an additional USD 1.4 to 6 billion of property insurance coverage in the three potential pilot countries. It may also empower local actors to develop and use their own risk models and better manage risks, thereby creating a broader transformation in the sector.

- **Actionable:** Proponents have begun to develop strategic partnerships of relevance for the pilots, notably with the Insurance Development Forum's Risk Modeling and Mapping Group and local stakeholders, to test the Platform in 2-3 developing countries. Further work is needed to forge additional in-country strategic partnerships on both the supply and demand sides of data and modeling in order to help the Platform achieve a critical mass of users and gain market acceptance to be used in investment decision-making.

To move forward, the Platform will require support from The Lab and other stakeholders. This support could include financial backing, as proponents are seeking to raise around USD 10 to 14 million in private and public investment for the pilots, as well as connections with relevant partners such as development banks or aid agencies, local governments, and investors. The partnerships already established with key initiatives signal that the Platform is addressing a crucial market need and has strong potential to achieve its intended impact.

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ANNEX A – SELECTION OF PILOT COUNTRIES

Criteria developed and evaluated to identify potential pilot countries in South and Southeast Asia.

Criteria & Sub-Criteria	Notes	Sources
Countries' exposure and vulnerability to climate events	Historical impacts of climate hazards	EMDAT Database 1990-2015
Expected Losses & Economic Impact	Expected Annual economic losses as % of GDP	World Bank (2012)
Income Level	Income level as proxy for adaptive capacity	World Development Indicators, The World Bank
Maturity of the insurance market	# non-life insurance market actors (moderate amounts indicate healthier market)	World Bank (2012)
Insurance penetration	Property Insurance penetration (USD premiums as % of GDP)	Swiss RE SIGMA (2015)
Comparison to benchmark insurance level	Underinsurance based on benchmark	World Bank (2012), Swiss RE SIGMA (2015)
Income Level	Income level as proxy for ability to pay for insurance	World Development Indicators, The World Bank
Potential financial benefits stemming from risk pooling	Proxy => 200 year probable maximum loss in \$m and as % of GDP.	World Bank (2012)
Data and model coverage	Coverage by existing models and existing data initiatives such as OpenDRI and PERILS	Expert interviews; comparative Assessment (see Annex B)
Donor priorities	Survey of existing & potential initiatives	Expert interviews; comparative Assessment (see Annex B)
Country potential interest and ability to engage in the development of disaster risk financial strategies	Survey of existing & potential initiatives	Expert interviews; comparative Assessment (see Annex B)
Membership in regional political entities such as the Association of Southeast Asian Nations (ASEAN)¹	Member of ASEAN	www.asean.org

ANNEX B – ASIAN DISASTER RISK FINANCING AND INFORMATION ECOSYSTEM

Table B.1: Data and modelling initiatives in Asia

Name	Description	OASIS Comparability/ Complementarity	Coverage	Source
Insurance Development Forum Risk Modelling and Mapping Group	<ul style="list-style-type: none"> IDF working group established to increase collaboration in the understanding of natural hazards risk by developing model and data standards and methods of interoperability. 	<ul style="list-style-type: none"> Components: global exposure database, e-Market End users: re/ insurance, planners, scientists 	<ul style="list-style-type: none"> Country: Global. Seeking to pilot in 2-3 developing countries 	Willis Press release Interview with staff
PERILS	<ul style="list-style-type: none"> Data provider of natural catastrophe industry loss and exposure information for key hazards such as floods and windstorms. 	<ul style="list-style-type: none"> Components: global exposure database, e-Market End users: insurers and reinsurers, Insurance-Linked Securities /Industry Loss Warranty investment funds and other financial institutions. 	<ul style="list-style-type: none"> Peril: Natural hazards (floods, windstorms and earthquake) Country: more than 15 EU countries- Now expanding to Asia (Indonesia, Philippines, Thailand, Taiwan with focus on typhoon, flooding, earthquake). 	PERILS website Interview with PERILS staff
Natural Catastrophe Data and Analytics Exchange (NAT CAT DAX)	<ul style="list-style-type: none"> Multi-stakeholder initiative to develop exposure and loss database, starting with three Asian capital cities (Manila, Bangkok, and Jakarta) 	<ul style="list-style-type: none"> Components: global exposure database, e-Market End users: re/ insurance, city planners 	<ul style="list-style-type: none"> Country: Philippines, Thailand, Indonesia 	NatCatDax research programme Interview with staff
Global Earthquake Model (GEM) OpenQuake Platform	<ul style="list-style-type: none"> Open source web-based hazard and vulnerability risk assessment tools, data, and community for earthquake modeling, and training. It allows users to combine and use open-source applications with homogenized data and models for integrated assessment of earthquake risk. 	<ul style="list-style-type: none"> Components: Data and modeling facility; matchmaking; and training End users: public sector 	<ul style="list-style-type: none"> Peril: Natural hazard (earthquake) Country: Global (models are developed by regional partnerships – none yet in S.E. Asia) 	GEM website Interview with GEM staff

UNISDR Science and Technology Partnership for the Implementation of the Sendai Framework	<ul style="list-style-type: none"> • Research programme to improve access to and standardization of exposure data. 	<ul style="list-style-type: none"> • Components: global exposure database, e-Market • End users: scientists, planners 	<ul style="list-style-type: none"> • Country: Global 	Aitsi-Selmi et al 2016
Open Data for Resilience Initiative (OpenDRI) WBG (GFDRR) ²	<ul style="list-style-type: none"> • Open data platforms developed to increase public access to risk information through community risk mapping and risk visualization. • Focused on data and standardization, not risk assessment 	<ul style="list-style-type: none"> • Component: Data and matchmaking facility • End users: policy-makers 	<ul style="list-style-type: none"> • Peril: Natural hazards • Country: More than 20 developing countries 	OpenDRI website
In A Safe	<ul style="list-style-type: none"> • Free and open source software that produces natural hazard impact scenarios for better planning, preparedness and response activities. • It allows to rigorously combining data from scientists, local governments and communities to provide insights into the likely impacts of future disaster events. 	<ul style="list-style-type: none"> • Component: Data facility and training • End users: policy-makers, disaster managers and planners 	<ul style="list-style-type: none"> • Peril: Natural hazards (flood, tsunami, earthquakes, landslides & volcanic). • Country: Indonesia. 	InAsafe website GFDRR website
Climate Services for Resilient Development	<ul style="list-style-type: none"> • Multi-stakeholder initiative led by USAID to provide climate services – including access to data – to developing countries. 	<ul style="list-style-type: none"> • Components: global exposure database, e-Market • End-users: planners 	<ul style="list-style-type: none"> • Country: Bangladesh 	White House Fact Sheet Interview with staff

Table B.2: Disaster climate-related risk financing initiatives in the three pilot countries

Sponsor	Initiative	Coverage
ASEAN	Regional Programme on Disaster Risk Financing and Insurance	ASEAN countries
Global Facility for Disaster Reduction & Recovery (GFDRR)/ World Bank Group	Regional Facility for Disaster Risk Finance	Southeast Asia
	Sovereign risk financing and property CAT risk insurance	Indonesia
	Sub-national joint catastrophe insurance facility for local governments	Philippines
	National Sovereign DRFI Strategy	Indonesia
Global Index Insurance Facility	Typhoon Index and Indemnity Insurance	Philippines
Asian Development Bank	Developing a disaster risk financing capability (disaster risk financing options)	Indonesia & Philippines
	Pilot Program on Weather Index-Based Crop Insurance	Bangladesh

Table B.3: Commercial models available in Asia

Name	Activities	OASIS Comparability/ Complementarity	Coverage	Source
RMS RMS(one)	<ul style="list-style-type: none"> • Cloud-based exposure and risk management platform. It allows open modeling to enable clients to customize and shape their own models, analytics and tools. Aims to help clients to take control and develop own view of risk • Developed by RMS, one of the two world's primary catastrophe risk modeling company.³ 	<ul style="list-style-type: none"> • Components: LMF + plug in through 'Developer Network' that allows client and model developers to integrate or develop tools, applications, services, & models • End users: more than 400 insurers, reinsurers, trading companies, investment banks, lenders, industry organizations, governments and NGO. 	<ul style="list-style-type: none"> • Peril: Natural and human-made catastrophes • Country: 100 countries worldwide; South Korea, and Taiwan. It is developing models for Malaysia, China and Japan. • Asia coverage: 4 earthquake, tropical cyclone & pandemic. Philippines (earthquake & typhoon under development), Vietnam (typhoon under development); Indonesia, Malaysia and Thailand (earthquake under development) 	<p>RMS website RMS(one) website; RMS (2014)</p>
AIR AIR Touchstone	<ul style="list-style-type: none"> • Open platform offering hazard and exposure data for modeling losses and support underwriting⁵ • Allows users to import own or third-party data providers that have agreements with Touchstone • Allows modification of assumptions • Developed by AIR, one of the two world's primary catastrophe risk modeling software and services company 	<ul style="list-style-type: none"> • Components: LMF, e-Market, allowing plug in i.e. the integration of non-AIR hazard data and models • End users: insurers, reinsurers, brokers, development finance institutions (World Bank) and other financial institutions, and governments. 	<ul style="list-style-type: none"> • AIR peril: Natural and human-made catastrophes. Covers also agriculture-related risks via crop models and climate change enabling to explore the sensitivity of catastrophe risk to a changing climate • AIR country: >90 countries worldwide • Asia coverage: Tropical cyclone in China, India, & Philippines (agriculture in China) 	<p>AIR website</p>

Name	Activities	OASIS Comparability/ Complementarity	Coverage	Source
CoreLogic (former EQECAT) RQE - Risk Quantification & Engineering	<ul style="list-style-type: none"> Platform for catastrophe risk models across several hazards and regions Loss modeling based on probabilistic analyses that evaluate all potential loss-causing catastrophic events —both gross and net of reinsurance contracts 	<ul style="list-style-type: none"> Components: LMF End users: Insurance, reinsurance and financial clients 	<ul style="list-style-type: none"> Peril: Natural and human-made catastrophes Countries: >96 worldwide Asia coverage: earthquake, cyclones and typhoon. Typhoon in, among the others, China, Philippines & Thailand. Earthquakes in, inter alia, India, Pakistan, Philippines and Thailand. 	CoreLogic website CoreLogic (2015)
Impact Forecasting ELEMENTS	<ul style="list-style-type: none"> Open and customizable platform for catastrophe loss modeling. Exposure data can be analyzed at both an aggregated and individual level using primary insurance policy conditions Allows implementation of customized solutions, model validation and quantification of risks. Enables to understand how hazards and vulnerability components are connected to help understand model outputs, thereby how cat models work; Developed by Impact Forecasting, a model development firm embedded in a reinsurance brokerage (Aon Benfield). The company focuses on developing models in under-served regions and hazards. 	<ul style="list-style-type: none"> Components: LMF End users: mostly insurance & reinsurance companies 	<ul style="list-style-type: none"> Peril: Natural and human-made catastrophe risks Country: US, Europe, Asia Asia coverage: Pan-Asian typhoon model Supports some existing insurance pools (New Zealand, Romania) 	Aon website

Name	Activities	OASIS Comparability/ Complementarity	Coverage	Source
JBA Risk Management JCalf	<ul style="list-style-type: none"> • Flood specialists • Provider of flood hazard maps, catastrophe models and other flood-related data • Flood hazard maps in all countries worldwide • JCalf loss modeling platform provides an open and flexible architecture, based on full Monte Carlo sampling. User can adjust and test assumptions • JBA also has agreements for model provision with third-party platform providers 	<ul style="list-style-type: none"> • Components: LMF • End users: Mostly insurers and reinsurers 	<ul style="list-style-type: none"> • Perils: Flood including River, surface water, sea surge, groundwater and man-made flood perils • Countries: Mapping for all countries globally; probabilistic models for selected territories • Asia coverage: Mapping for all Asian countries; probabilistic models in Thailand, India, Sri Lanka and Malaysia 	<p>JBA Risk Management website Input from JBA staff</p>
Catalytics Asia Catalytics	<ul style="list-style-type: none"> • Models for risks assessment in support of underwriting • Developed by first Asian (Singapore)-based and focused open platform cat modeling consultancy and developer company (RMS partner). It focuses on maintaining flexibility for users 	<ul style="list-style-type: none"> • Components: LMF; training • End users: insurers and reinsurers 	<ul style="list-style-type: none"> • Peril: Earthquake, flood, windstorm. • Country: ASEAN countries • Asia coverage: flood models for Thailand and Philippines, working on Vietnam. 	<p>Catalytics website</p>
Karen Clarke & Company RiskInsight	<ul style="list-style-type: none"> • Open loss fully probabilistic modeling platform. It offers a complete toolkit for exposure data management, modeling, and portfolio reporting • Allows customization of inputs • Connects users to pre-vetted experts to procure additional data + models • Delivers (i) transparency as assumptions underlying the models are fully visible to users; (ii) control as it models assumptions can be customized and (iii) efficiency as it allows building proprietary view with one comprehensive platform. • Developed by Karen Clarke & Company, a firm that in addition to provide catastrophe models develops processes to validate catastrophe models. 	<ul style="list-style-type: none"> • Components: LMF, Data facility and e-Market/ matchmaking web service⁶ • End-users: insurers, reinsurers 	<ul style="list-style-type: none"> • Peril: natural hazards • Country: U.S.; other countries not specified • Asia coverage: not specified 	<p>KC&Co website RiskInsightsConnect website Bloomberg Business website</p>

Name	Activities	OASIS Comparability/ Complementarity	Coverage	Source
Climada	<ul style="list-style-type: none"> • Open source probabilistic natural catastrophe damage model, that also calculates averted damage (benefit) from adaptation measures of any kind • Based on 4 elements: • Assets (i.e. geographical distribution of people, houses, activities, public infrastructure) • Damage functions (relating impact to economic consequence - or any other pertinent metric, like people affected) • Hazards (currently implemented are: tropical cyclones, storm surge, torrential rain, earthquake, volcano and meteorites on a global yet local (1km) resolution, plus winter storm in Europe and flood and mudslides in experimental stage) • Adaptation measures (i.e. improved building codes, seawall, sandbags, reefs, mangroves). 	<ul style="list-style-type: none"> • Components: LMF • End-users: adaptation planners, insurers 	<ul style="list-style-type: none"> • Peril: storm, cyclone, earthquake, volcano • Country: global (1 km resolution) 	Climada GitHub page
KatRisk	<ul style="list-style-type: none"> • catastrophe modeling company; focus on flood and wind risk • open architecture allows understanding of assumptions and modification • open source code in R shiny 	<ul style="list-style-type: none"> • Components: LMF • End users: insurers, reinsurers 	<ul style="list-style-type: none"> • Perils: flood, wind. Flood includes inland and typhoon • Country/Region: U.S., Asia (other regions expected) 	KatRisk website

TABLE B.4: Commercial models supporting sovereign risk pools in other regions

Name	Description	OASIS Comparability	Coverage	Source
Kinetic Analysis Corp. MPRES Caribbean Catastrophe Risk Insurance Facility (CCRIF)	<ul style="list-style-type: none"> Multi-Hazard Parallel Risk Evaluation System (MPRES) platform⁷ for the production of a wide range of real-time hazard and impact products, as well as long-term hazard and loss assessments for tropical cyclone, earthquake and severe weather.⁸ Developed by Kinetic Analysis, a multi-model risk assessment and extreme weather impact forecasting company engaged by CCRIF to develop the models underpinning the pool. Kinetic provides rainfall estimates that underlie the catastrophe parametric insurance products offered by CCRIF. According to Kinetic's website, they address the transparency issues of other commercial providers by using techniques implemented from published scientific literature, with citations available. 	<ul style="list-style-type: none"> Component: LMF End users: sovereigns, reinsurers 	<ul style="list-style-type: none"> Peril: natural hazards – tropical cyclones and earthquakes. Country: Worldwide – Caribbean for CCRIF. 	Kinetic website , CCRIF Q&A p. 15 CCRIF Annual Report (2010)
WFP Africa RiskView	<ul style="list-style-type: none"> Software platform used to trigger payouts from Africa Risk Capacity (ARC). It estimates the impact of observed weather data on vulnerable populations. It uses a rainfall-based drought index (WRSI) combined with a scaling factor. It relies primarily on satellite-based rainfall data as the primary variable for identifying drought and triggering payouts. It is customized by each ARC participating country. Developed by World Food Programme to underpin the Africa Risk Capacity (ARC) pool for droughts. 	<ul style="list-style-type: none"> Component: LMF End users: sovereigns and reinsurers 	<ul style="list-style-type: none"> Peril: drought Country: Africa 	ARC website WFP presentation on Africa RiskView (here)
Pacific Catastrophe Risk Insurance Pilot	<ul style="list-style-type: none"> Pilot supported by the World Bank Group to place a portfolio of catastrophe swap contracts that transferred catastrophe risk from five Pacific Island Countries.⁹ Trigger: modelled-loss trigger—losses estimated based on physical event parameters AIR Worldwide and Applied GeoScience Division (SOPAC) of the Secretariat of the Pacific Community (SPC) provided technical support. AIR developed country-specific cat risk models (tropical cyclones and storm surge, earthquakes, and tsunami) from scratch under the initiative. WB supported significant data collection, in particular for exposure module as parametric triggers require reliable, independent sources of real-time event data of sufficient scope to calculate loss. 	<ul style="list-style-type: none"> Component: LMF, Data facility End users: sovereigns, reinsurers 	<ul style="list-style-type: none"> Peril: Tropical cyclone, earthquake, and tsunami Country: Pacific Islands (Marshall Islands, Samoa, Solomon Islands, Tonga and Vanuatu). 	World Bank website GFDRR (2015)

Footnotes

- 1 We included these criteria because the sponsorship of ASEAN could be relevant for the development of regional risk insurance pool scheme or replication of national
- 2 It maps tens of thousands of buildings and urban infrastructure, providing more than 1,000 geospatial datasets (WB [website](#)).
- 3 RMS models and data in the context of climate-related peril, cover tropical cyclone, tsunami, windstorm, winter storm, severe convective storms and flood.
- 4 Among the others, it operates in partnership with flood modeler JBA Risk Management, Asia Pacific specialist Risk Frontier and Catalytic who have specific expertise/models in Asia.
- 5 Air Touchstone key components: (i) 'Exposure View' enables through interactive maps to grasp the geographic extent of portfolio and accumulations of risk on a global scale; 'Data Quality Analytics' enables to measure and improve your data quality through a validation and benchmarking system; (iii) 'Loss Analytics' to assess losses; (iv) 'Hazard Analytics' enables to identify the catastrophe hazards that threaten individual property locations as well as check if a risk complies with underwriting guidelines and, ultimately, enables to validate models. (v) Geospatial Analytics allows integrating exposure, hazard, and loss information; (vi) The Underwriting Mode provides detailed and customizable information about policies under consideration.
- 6 RiskInsightConnect gives access to global experts, detailed data, and advanced model components to allow users to customize model assumptions and build own models by peril region. RiskInsightConnect is automatically available when licensing RiskInsight.
- 7 Where no reliable published asset data are available, for loss assessment it uses a global, high resolution proxy exposure data base derived from recent satellite imagery, population and socio-economic statistics.
- 8 Kinetic also provides Real Time Forecasting System (RTFS) to enable enables all active members of CCRIF to access real-time estimates of the expected hazard levels and impacts on population for all tropical cyclones during the Hurricane Season (CCRIF, 2010). The RTFS system is built on our MPRES hazard modeling platform.
- 9 The form of the contract is a catastrophe swap contract; the World Bank intermediates the risk and mirrors transactions with the international reinsurance markets.

ANNEX C – OASIS PLATFORM THEORY OF CHANGE

