

Central Asia Regional Economic Cooperation Program Disaster Risk Engagement Meeting

Session 6: Risk Modelling

Islamabad, Pakistan
July 2023



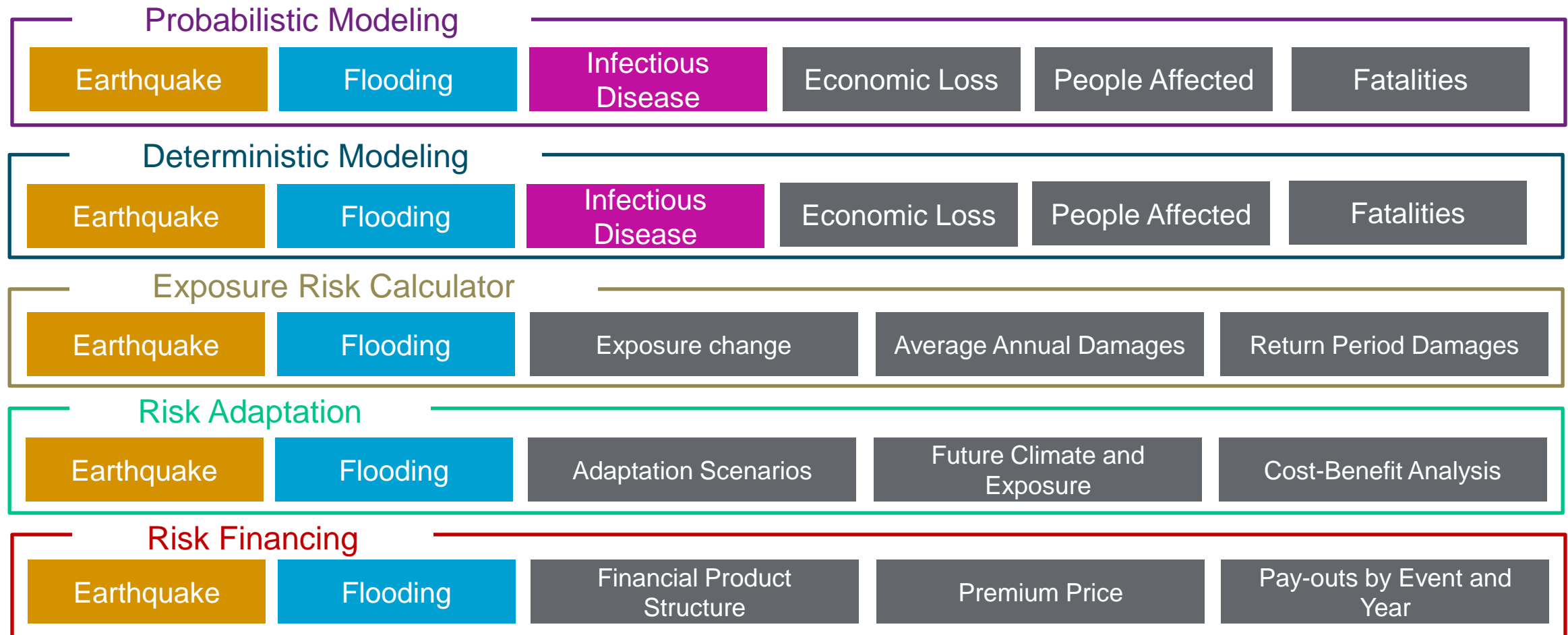
Part 1 – Introduction to the DRMI



The Disaster Risk Management Interface (DRMI)



The DRMI is a way to explore the outputs from risk modelling completed during this project. The DRMI has 5 sections



The Disaster Risk Management Interface (DRMI)



Probabilistic Modeling

Earthquake

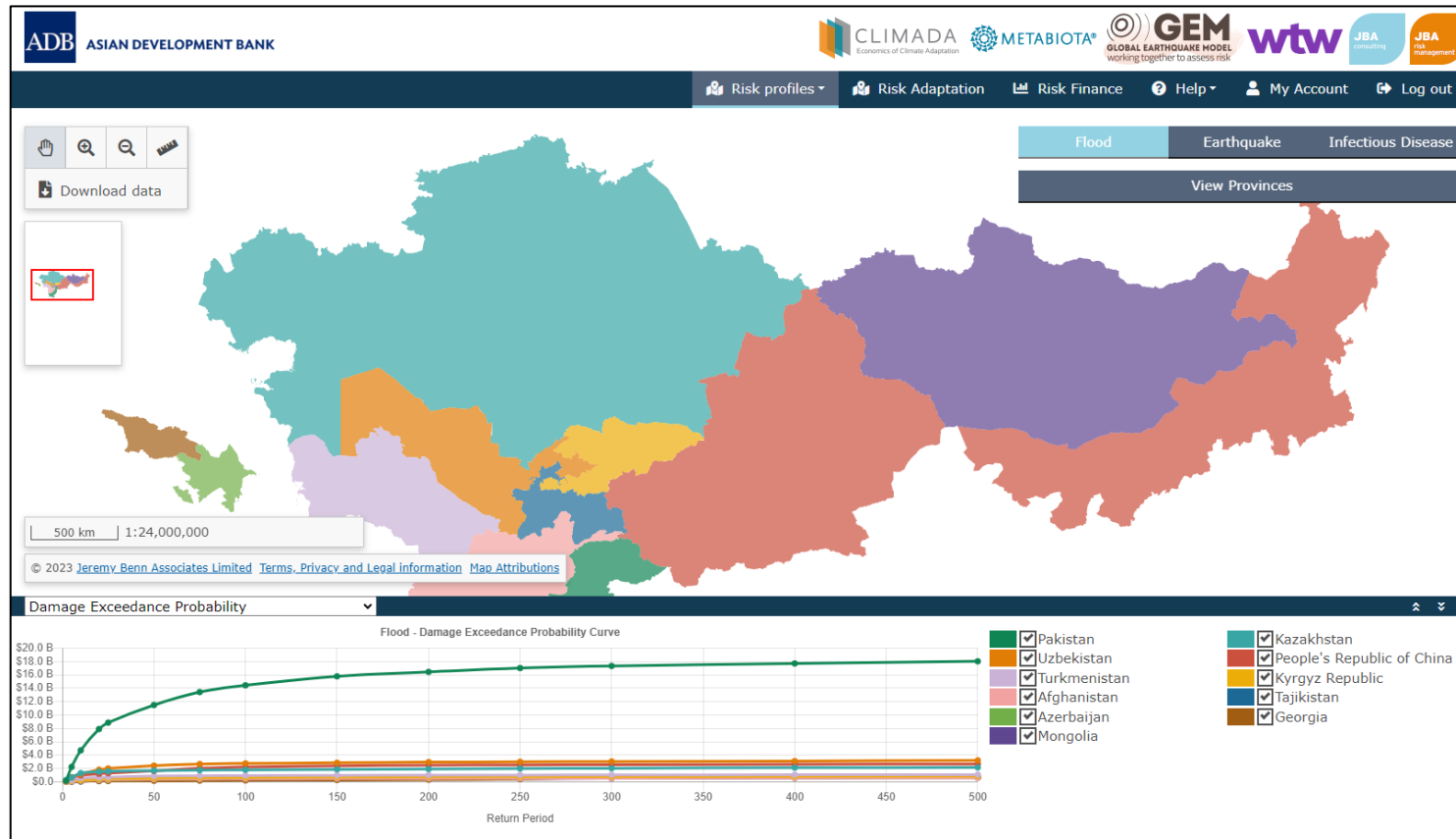
Flooding

Infectious Disease

Economic Loss

People Affected

Fatalities



The Disaster Risk Management Interface (DRMI)



Deterministic Modeling

Earthquake

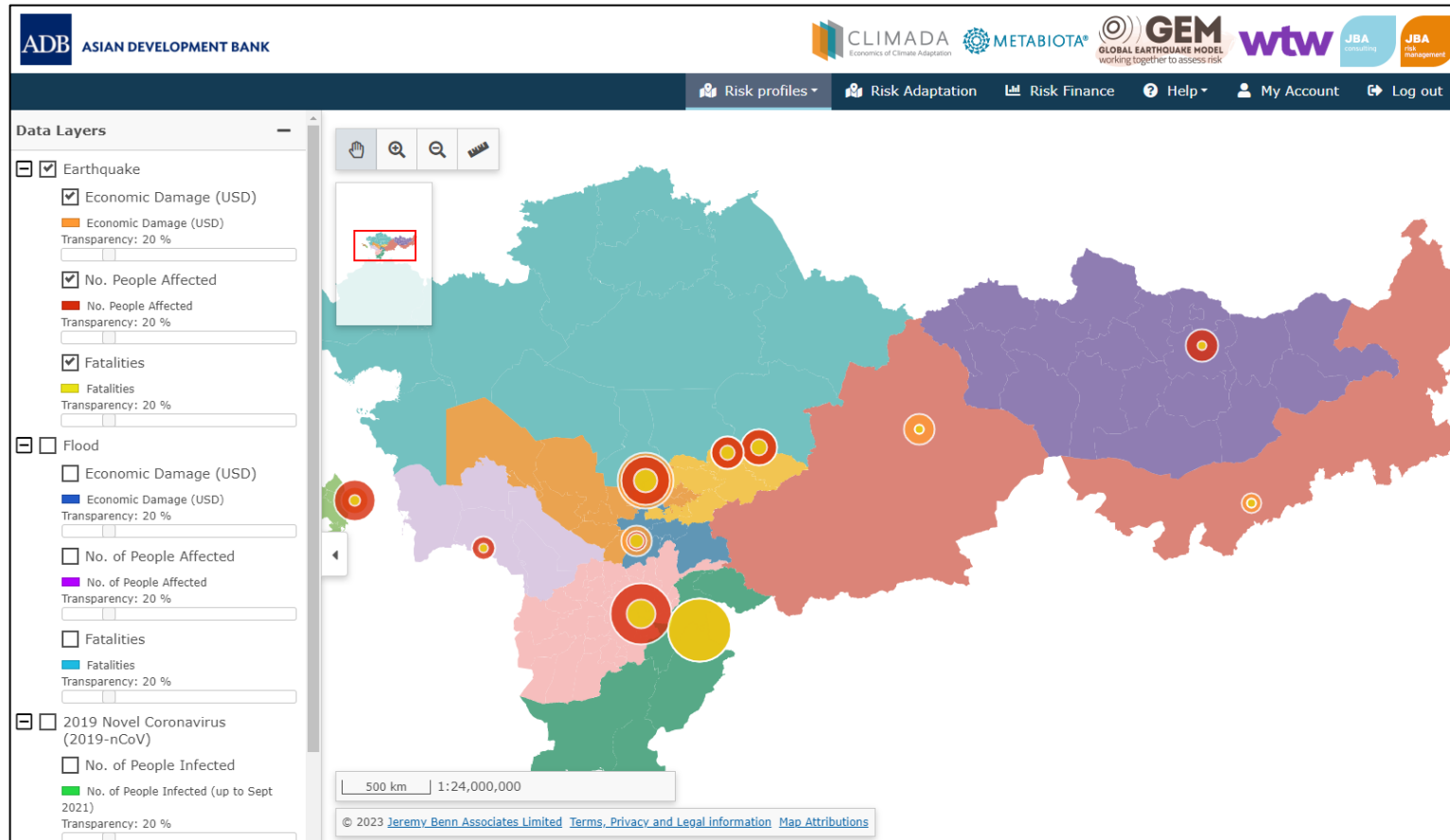
Flooding

Infectious Disease

Economic Loss

People Affected

Fatalities



The Disaster Risk Management Interface (DRMI)



Exposure Risk Calculator

Earthquake

Flooding

Exposure change

Average Annual Damages

Return Period Damages

Country

Current absolute exposure \$22,805,716,992 USD

Options to adjust exposure

Absolute exposure \$22,805,716,992 USD

Percentage change from absolute exposure 20 %

Update dashboard

Flood

Current Average Annual Damage (USD) \$31,789,983

Adjusted Average Annual Damage (USD) \$38,147,980

Return Period	Current OEP Damage	Current AEP Damage
2	\$22,696,325	\$23,443,576
5	\$63,624,810	\$76,776,470
10	\$86,779,433	\$103,291,568
15	\$101,936,194	\$120,754,767
20	\$109,949,229	\$132,554,530
25	\$116,542,087	\$141,625,879
30	\$122,541,795	\$149,262,425
40	\$136,587,199	\$160,983,223
50	\$148,828,672	\$174,170,805
75	\$174,712,072	\$200,620,861
100	\$212,322,281	\$229,736,342

The Disaster Risk Management Interface (DRMI)



Exposure Risk Calculator

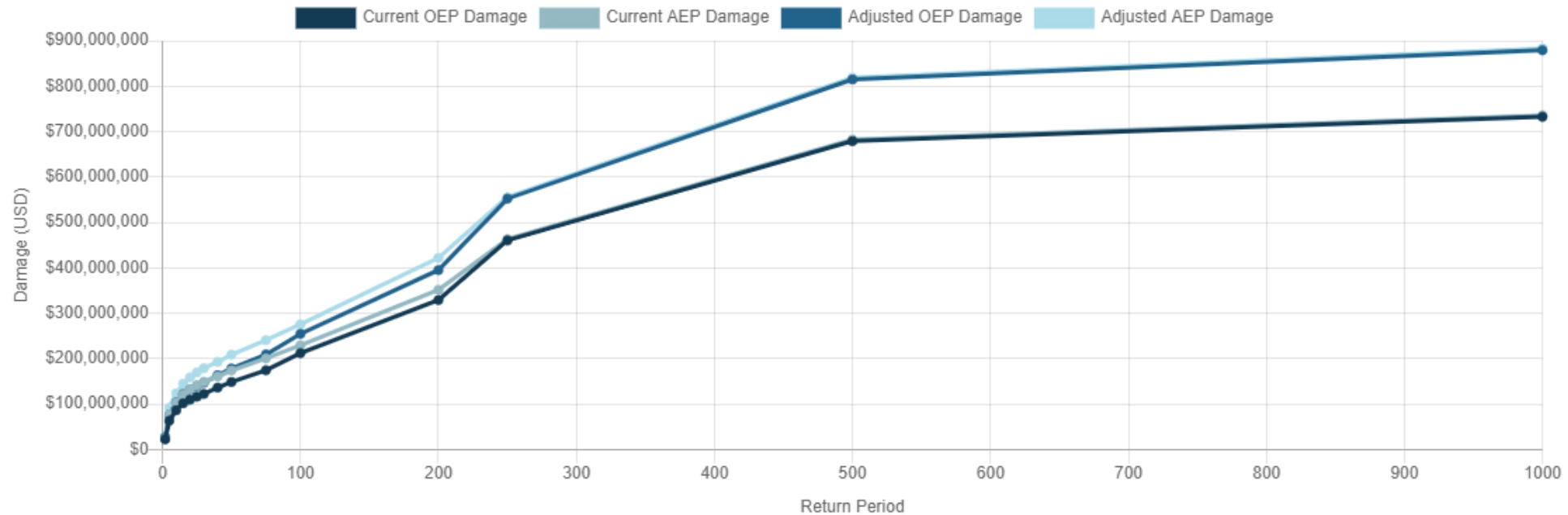
Earthquake

Flooding

Exposure change

Average Annual Damages

Return Period Damages



The Disaster Risk Management Interface (DRMI)



Risk Adaptation

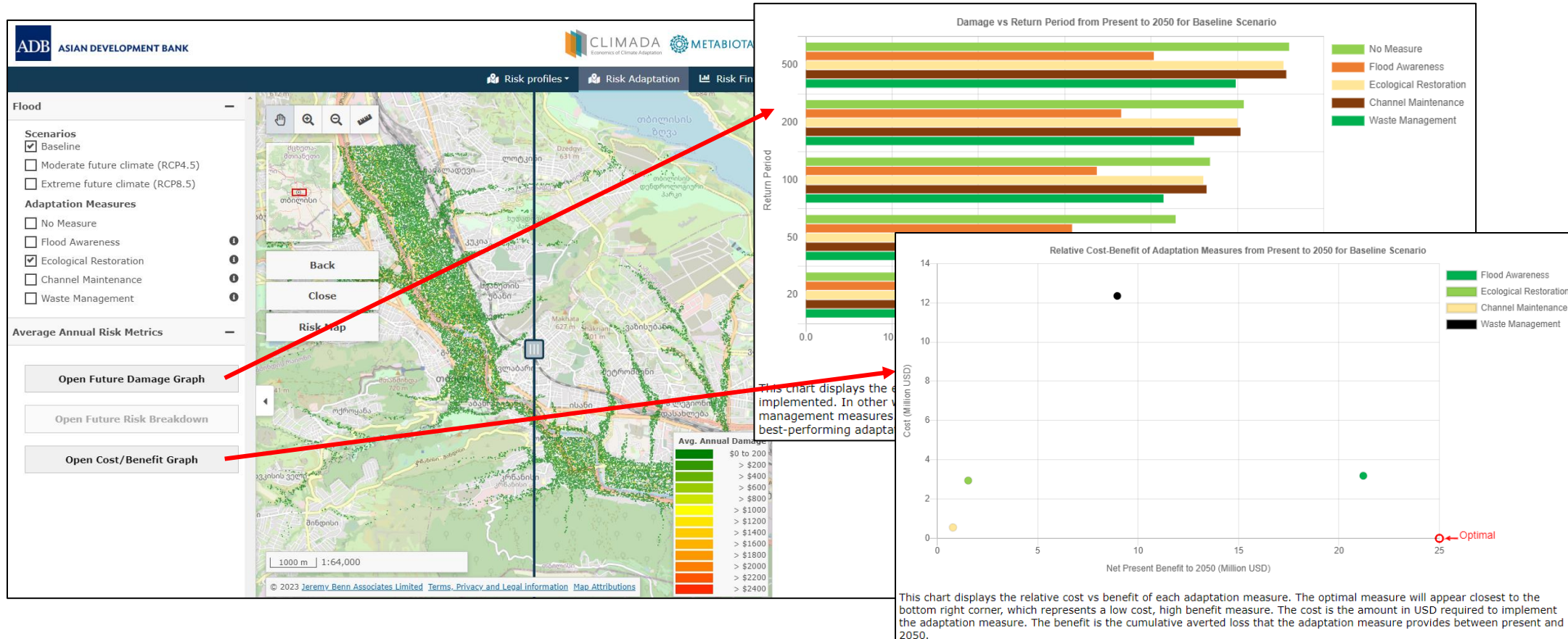
Earthquake

Flooding

Adaptation Scenarios

Future Climate and Exposure

Cost-Benefit Analysis



The Disaster Risk Management Interface (DRMI)



Risk Financing

Earthquake

Flooding

Financial Product Structure

Premium Price

Pay-outs by Event and Year

Flood risk transfer options

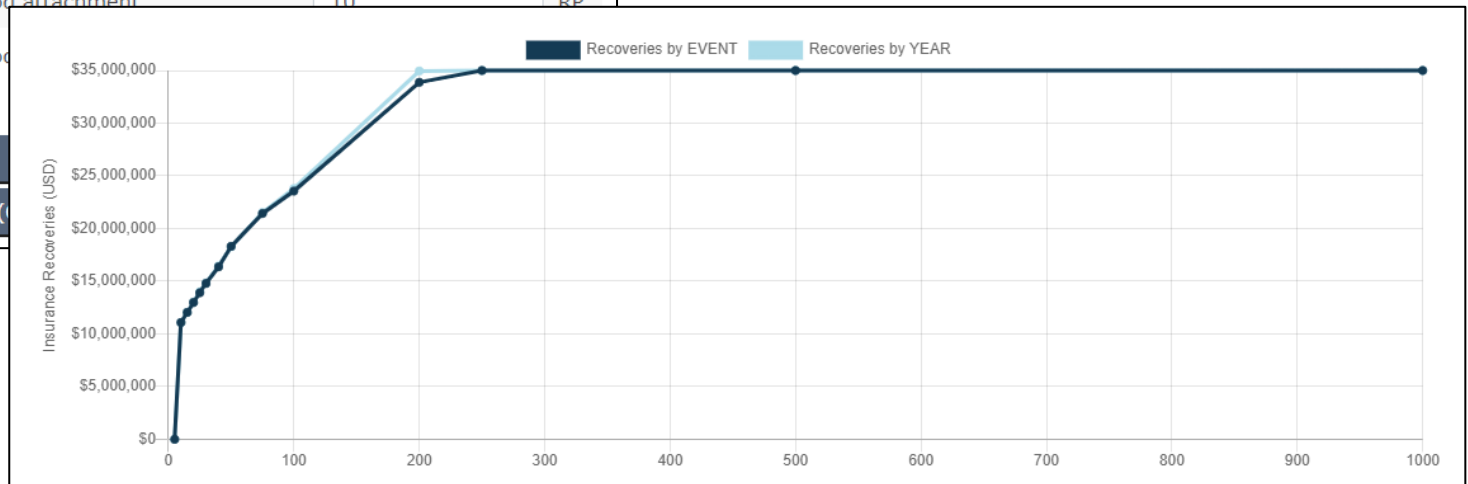
Event sum insured (Fixed)	<input type="text" value="\$10,000,000"/>	USD
Minimum Recovery (as a percentage of sum insured)	<input type="text" value="100"/>	%
Minimum Recovery (absolute)	<input type="text" value="\$10,000,000"/>	USD
Return period attachment	<input type="text" value="10"/>	RP
Return period exhaustion	<input type="text" value="100"/>	RP

Earthquake risk transfer options

Event sum insured (Fixed)	<input type="text" value="\$25,000,000"/>	USD
Minimum Recovery (as a percentage of sum insured)	<input type="text" value="100"/>	%
Minimum Recovery (absolute)	<input type="text" value="\$25,000,000"/>	USD
Return period attachment	<input type="text" value="10"/>	RP
Return period exhaustion	<input type="text" value="100"/>	RP

Update dashboard

Download current dashboard data (CSV)



The Disaster Risk Management Interface (DRMI)



Risk Financing

Earthquake

Flooding

Financial Product Structure

Premium Price

Pay-outs by Event and Year

Flood risk transfer options

Average annual premium	<input type="text" value="\$5,000,000"/>	USD
Minimum Recovery (as a percentage of sum insured)	<input type="text" value="50"/>	%
Return period attachment	<input type="text" value="10"/>	RP
Return period exhaustion	<input type="text" value="500"/>	RP

Earthquake risk transfer options

Average annual premium	<input type="text" value="\$5,000,000"/>	USD
Minimum Recovery (as a percentage of sum insured)	<input type="text" value="50"/>	%
Return period attachment		
Return period exhaustion		

Update dashboard

Download current dashboard data (CSV)

Flood					+
Earthquake					+
Combined					-
Average Annual Premium (USD)			\$10,000,000		
Average Annual Damage (USD)			\$205,853,100		
Event Sum Insured (USD)			\$434,209,300		
Return Period	Economic Damage (OEP)	Economic Damage (AEP)	Recoveries by EVENT	Recoveries by YEAR	
5	\$261,507,070	\$261,796,342	\$0	\$0	
10	\$465,672,978	\$467,636,846	\$217,104,650	\$217,104,650	
15	\$725,618,490	\$728,899,967	\$219,320,004	\$219,320,004	
20	\$986,879,765	\$995,243,983	\$221,535,357	\$221,535,357	
25	\$1,178,973,054	\$1,197,676,978	\$223,750,711	\$223,750,711	
30	\$1,362,405,611	\$1,368,743,240	\$225,966,064	\$225,966,064	
40	\$1,617,806,582	\$1,650,590,933	\$230,396,771	\$230,396,771	
50	\$1,882,590,652	\$1,882,590,652	\$234,827,479	\$234,827,479	

Part 2 – Interactive Sessions



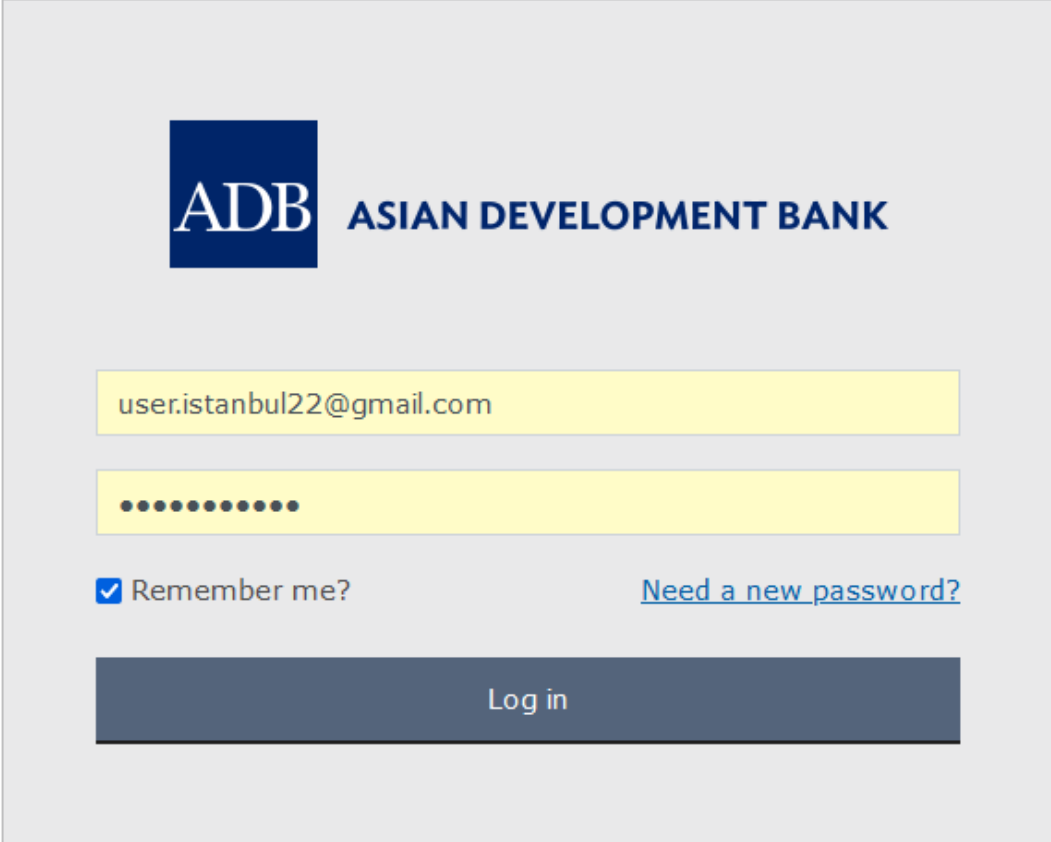
The Disaster Risk Management Interface (DRMI)



Website: <https://carec-engagement-tool.jbahosting.com>

Username: as provided

Password: as provided

A screenshot of the login page for the Asian Development Bank (ADB). The page has a light gray background. At the top left is the ADB logo (a dark blue square with 'ADB' in white) followed by the text 'ASIAN DEVELOPMENT BANK' in dark blue. Below this are two yellow input fields. The first field contains the email address 'user.istanbul22@gmail.com'. The second field contains ten black dots representing a password. Below the password field is a checkbox with a blue checkmark and the text 'Remember me?'. To the right of the checkbox is a blue hyperlink that says 'Need a new password?'. At the bottom of the form is a dark gray rectangular button with the text 'Log in' in white.

The Disaster Risk Management Interface (DRMI)



Probabilistic Modeling

Earthquake

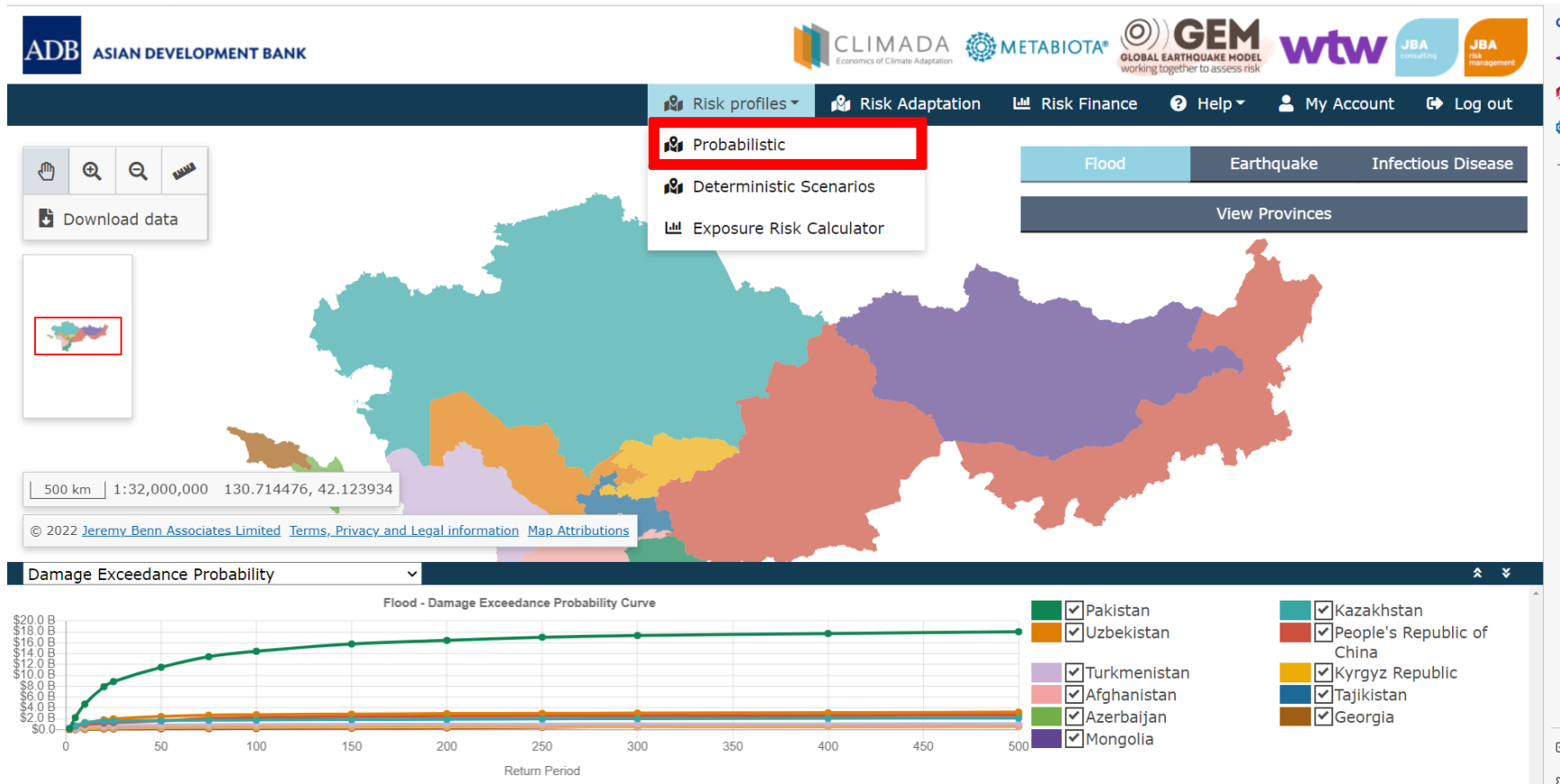
Flooding

Infectious Disease

Economic Loss

People Affected

Fatalities



Probabilistic Modeling

- Which hazard represents the biggest risk in terms of economic loss?
- Which hazard represents the biggest risk in terms of fatalities and people affected?
- What types of infectious disease impact my country?
- Which province is most impacted by flood?
- Which province is most impacted by earthquake?

The Disaster Risk Management Interface (DRMI)



Deterministic Modeling

Earthquake

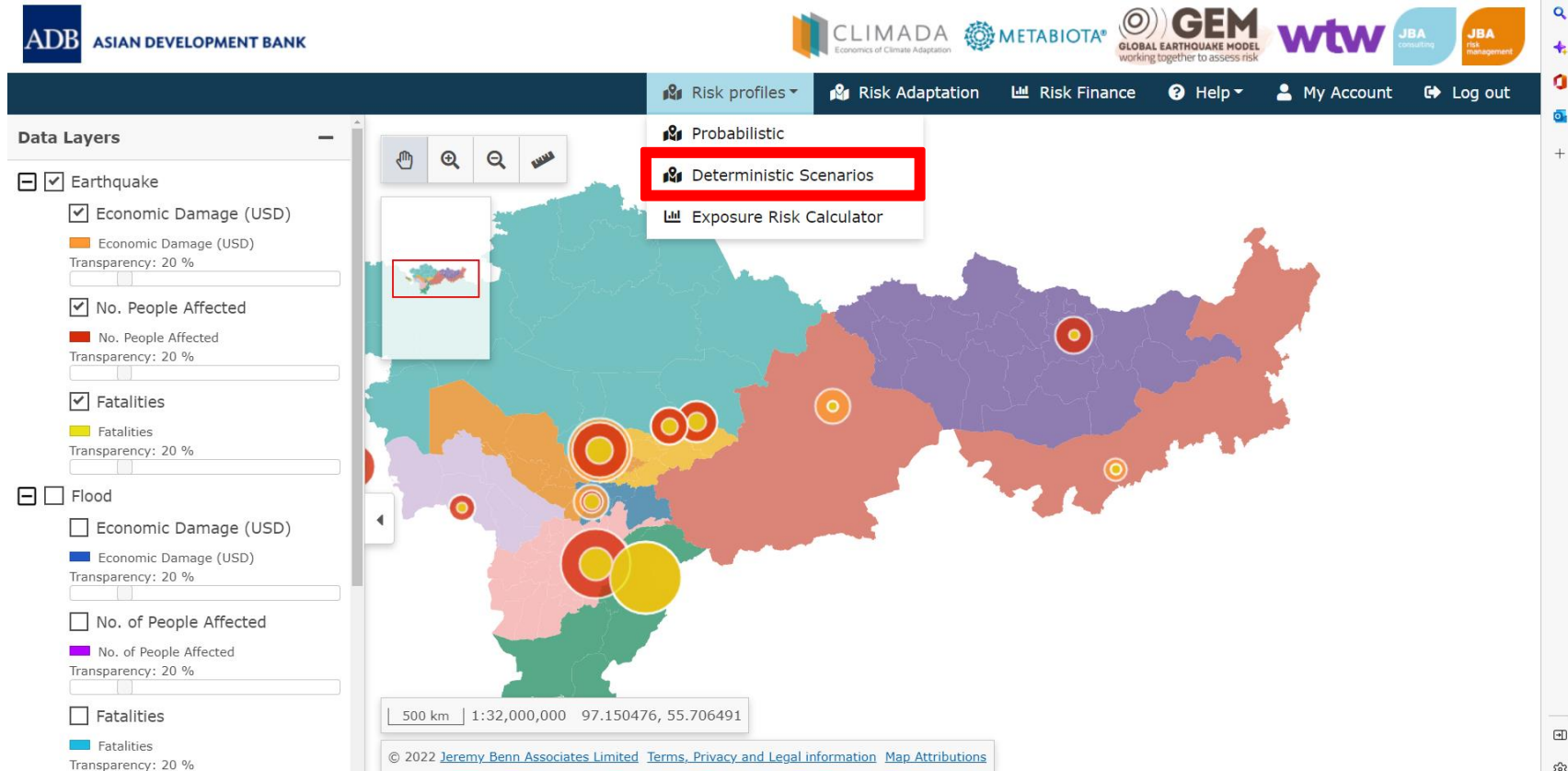
Flooding

Infectious Disease

Economic Loss

People Affected

Fatalities



Deterministic Modeling

- What is the economic loss caused by this flooding event in my country?
- What is the economic loss caused by this earthquake event in my country?
- What is the modelled number of people affected to population ratio?
- View the flood and earthquake maps.

The Disaster Risk Management Interface (DRMI)



Exposure Risk Calculator

Earthquake

Flooding

Exposure change

Average Annual Damages

Return Period Damages

The screenshot shows the web interface for the Exposure Risk Calculator. At the top, there are logos for ADB, CLIMADA, METABIOTA, GEM, wtw, and JBA. A navigation bar includes links for Risk profiles, Risk Adaptation, Risk Finance, Help, My Account, and Log out. The main content area has a breadcrumb trail 'Home > Exposure Risk Calculator' and a dropdown menu with options: Probabilistic, Deterministic Scenarios, and Exposure Risk Calculator (highlighted with a red box). Below this is the title 'Exposure R' and a descriptive paragraph. The 'Country' section has a dropdown menu. The 'Options to adjust exposure' section includes input fields for 'Absolute exposure' (set to \$400,000,000 USD) and 'Percentage change from absolute exposure' (set to 0 %). At the bottom, there are buttons for 'Update dashboard' and 'Download current dashboard data (CSV)'.

Exposure Risk Calculator

- How much do you expect exposure to grow over the next 5-years, 10-years?
- Which parts of your country do you expect to experience the greatest increase in population, buildings, building values?
- Do areas of high population / buildings overlap with areas of high flood and earthquake hazard?
- How would a 10% increase in exposure adjust your Average Annual Damage for flood, earthquake and combined?

The Disaster Risk Management Interface (DRMI)



Risk Adaptation

Earthquake

Flooding

Adaptation Scenarios

Future Climate and Exposure

Cost-Benefit Analysis

The screenshot shows the DRMI website interface. At the top, there are logos for ADB, CLIMADA, METABIOTA, GEM, wtw, JBA consulting, and JBA risk management. Below the logos is a navigation bar with the following items: Risk profiles, Risk Adaptation (highlighted with a red box), Risk Finance, Help, My Account, and Log out. Below the navigation bar is a breadcrumb trail: Home > Adaptation Cost-Benefit Analysis. The main content area is titled 'Adaptation Cost-Benefit Analysis' and is divided into two columns. The left column lists countries and their respective data links: Afghanistan (Kabul - Flood, Kabul - Earthquake), Azerbaijan (Baku - Flood, Baku - Earthquake), Georgia (Tbilisi - Flood, Tbilisi - Earthquake), Kazakhstan (Almaty - Flood, Almaty - Earthquake), and Kyrgyz Republic (Bishkek - Flood). The right column is titled 'Adaptation Modelling' and contains an 'Introduction' section. The introduction text states: 'Adaptation case studies are presented here at city level for key locations, usually the country capital, to capture areas with the highest value at risk. Where an alternative urban area has been selected this is due to nature of the hazard or exposure; for example, some cities are not exposed to significant flood and earthquake risk. This analysis provides an initial view of the potential costs and benefits of implementing different disaster risk reduction measures to mitigate the impacts of earthquake and flood events. The risk reduction impact of adaptation measures is modelled using the CLimate ADaptation open source modelling platform (CLIMADA). CLIMADA combines flood hazard maps from JBA's Global Flood Model and earthquake hazard from GEM's OpenQuake model with exposure data covering multiple lines of business (commercial, industrial, residential), and regionally tailored vulnerability curves. In addition to modelling the performance of adaptation scenarios under present conditions, future climate change and future exposure change were also included. The impact of alternative future scenarios can be compared in the data visualisation. To access the visualisation of the Adaptation Modelling click on the links on the left. To download data, click on the "data" links.'

Risk Adaptation

- Which adaptation measures do you think would be appropriate for managing flooding?
- Which adaptation measures do you think would be appropriate for managing earthquakes?
- What major adaptation projects are already in place? Are any being planned at the moment?
- Do you think these projects are cost-effective?
- How do you think these adaptation measures will perform under future climate scenarios (for flood)?

The Disaster Risk Management Interface (DRMI)



Risk Financing

Earthquake

Flooding

Financial Product Structure

Premium Price

Pay-outs by Event and Year

The screenshot shows the web interface for the Disaster Risk Financing Tool. At the top, there are logos for ADB, CLIMADA, METABIOTA, GEM, wtw, JBA consulting, and JBA risk management. Below the logos is a navigation bar with links for Risk profiles, Risk Adaptation, Risk Finance (highlighted with a red box), Help, My Account, and Log out. The breadcrumb trail reads 'Home > Disaster Risk Financing Tool'. The main heading is 'Disaster Risk Financing Tool'. Below this is a paragraph explaining the tool's purpose. There are two dropdown menus: 'Dashboard type' (set to 'Fixed premium') and 'Country' (set to 'Select a country...'). Below these are two columns of input fields for 'Flood risk transfer options' and 'Earthquake risk transfer options'. Each column has four rows of inputs: Average annual premium, Minimum Recovery, Return period attachment, and Return period exhaustion. At the bottom, there are two buttons: 'Update dashboard' and 'Download current dashboard data (CSV)'.

ADB ASIAN DEVELOPMENT BANK

CLIMADA Economics of Climate Adaptation

METABIOTA

GEM GLOBAL EARTHQUAKE MODEL working together to assess risk

wtw

JBA consulting

JBA risk management

Risk profiles Risk Adaptation Risk Finance Help My Account Log out

Home > Disaster Risk Financing Tool

Disaster Risk Financing Tool

Based on outputs from the probabilistic flood and earthquake models, this tool allows you to model different risk transfer options at the country level for both hazards individually or combined, based on the selection of parameters that determine the structure of the risk transfer. To use the tool, either adjust the parameters or simply click "Update dashboard" to view the modelled damage and the insurance coverage (recoveries) that your chosen selections provide. More information on using this screen is available in the [User Guide](#) (a [Russian version version](#) is also available).

Dashboard type

Fixed premium

Country

Select a country...

Flood risk transfer options

Average annual premium	<input type="text" value="\$500,000"/>	USD
Minimum Recovery (as a percentage of sum insured)	<input type="text" value="50"/>	%
Return period attachment	<input type="text" value="10"/>	RP
Return period exhaustion	<input type="text" value="250"/>	RP

Earthquake risk transfer options

Average annual premium	<input type="text" value="\$1,000,000"/>	USD
Minimum Recovery (as a percentage of sum insured)	<input type="text" value="50"/>	%
Return period attachment	<input type="text" value="10"/>	RP
Return period exhaustion	<input type="text" value="250"/>	RP

Update dashboard

Download current dashboard data (CSV)

Risk Financing

- Select “Dashboard type” = Fixed Premium
- For both Flood and Earthquake, enter:
 - Average annual premium = \$100,000
 - Return period attachment = 50
 - Return period exhaustion = 500

Dashboard type

Fixed premium

Flood risk transfer options

Average annual premium	<input type="text" value="\$100,000"/>	USD
Minimum Recovery (as a percentage of sum insured)	<input type="text" value="0"/>	%
Return period attachment	<input type="text" value="50"/>	RP
Return period exhaustion	<input type="text" value="500"/>	RP

Earthquake risk transfer options

Average annual premium	<input type="text" value="\$100,000"/>	USD
Minimum Recovery (as a percentage of sum insured)	<input type="text" value="0"/>	%
Return period attachment	<input type="text" value="50"/>	RP
Return period exhaustion	<input type="text" value="500"/>	RP

- Based on these input parameters, look at the “Event Sum Insured” compared to the “Average Annual Damage”
- How would you change the input parameters to ensure that you have cover for more frequent flood events? What impact does this have on the “Recoveries by Event”?
- How would you change the input parameters to ensure that you have cover for frequent flood events and infrequent earthquake events? What impact does this have on the “Recoveries by Event”?
- What amount of premium would you be willing to pay for an insurance cover for each hazard?

Risk Financing

- Select “Dashboard type” = Fixed sum insured
- For both Flood and Earthquake, enter
 - Return period attachment = 50
 - Return period exhaustion = 500

Dashboard type

Fixed sum insured

Flood risk transfer options			Earthquake risk transfer options		
Event sum insured (Fixed)	\$0	USD	Event sum insured (Fixed)	\$10,000,000	USD
Minimum Recovery (as a percentage of sum insured)	0	%	Minimum Recovery (as a percentage of sum insured)	0	%
Minimum Recovery (absolute)	\$0	USD	Minimum Recovery (absolute)	\$0	USD
Return period attachment	50	RP	Return period attachment	50	RP
Return period exhaustion	500	RP	Return period exhaustion	500	RP
Number of reinstatements	1		Number of reinstatements	1	

- The fixed sum insured is the maximum pay-out amount that could be received for an event. Enter the amount of “sum insured” required to respond to a major flood and / or earthquake event?
- Are you more concerned about flood or earthquake?
- How would you change the input parameters to focus the entire cover on this hazard?

Part 3 – Future Developments



Future Developments

Exposure Risk Calculator



Exposure Risk Calculator

Based on outputs from the probabilistic flood and earthquake models, this tool allows you to model different exposures at the country level for each hazard. It presents losses as Occurrence Exceedance Probability (estimations of loss for a range of return periods based on analysis of the largest single event in each year) and the Aggregate Exceedance Probability (estimations based on all events in a year). To use the tool, either adjust the exposure by a percentage or supply an absolute value. Click "Update dashboard" to view the modelled damage that your chosen selections provide. More information on using this screen is available in the [User Guide](#) (a [Russian version](#) is also available).

Country

Mongolia

Current absolute exposure \$9,854,938,112 USD Current population exposure 3,171,860

Options to adjust exposure

Ulaanbaatar exposure change %

Khuvsgul exposure change %

Uvurkhangai exposure change %

Update dashboard Download current dashboard data (CSV)

Flood

Current Average Annual Damage (USD) \$20,121,957 Adjusted Average Annual Damage (USD) \$22,134,153

Return Period	Current OEP Damage	Current AEP Damage	Adjusted OEP Damage	Adjusted AEP Damage	Current population exposure
2	\$2,257,711	\$3,102,659	\$2,483,482	\$3,412,921	1,860
5	\$10,101,267	\$12,826,133	\$11,111,394	\$14,108,746	11,263
10	\$47,601,279	\$48,238,398	\$52,361,407	\$53,062,231	24,369

- Enable users to model exposure changes for each administrative region of a country
- Increase (or decrease) the exposure for one or more province within the country of interest.
- National level risk metrics (AEP and OEP by return period and AAL) would be displayed.

Future Developments

Exposure Risk Calculator



Exposure Risk Calculator

Based on outputs from the probabilistic flood and earthquake models, this tool allows you to model different exposures at the country level for each hazard. It presents losses as Occurrence Exceedance Probability (estimations of loss for a range of return periods based on analysis of the largest single event in each year) and the Aggregate Exceedance Probability (estimations based on all events in a year). To use the tool, either adjust the exposure by a percentage or supply an absolute value. Click "Update dashboard" to view the modelled damage that your chosen selections provide. More information on using this screen is available in the [User Guide](#) (a [Russian version](#) is also available).

Country
Mongolia

Current absolute exposure \$9,854,938,112 USD Current population exposure 3,171,860

Options to adjust exposure

Ulaanbaatar exposure change +10 %
 Khuvsgul exposure change -15 %
 Uvurkhangai exposure change +25 %

Update dashboard Download current dashboard data (CSV)

Flood

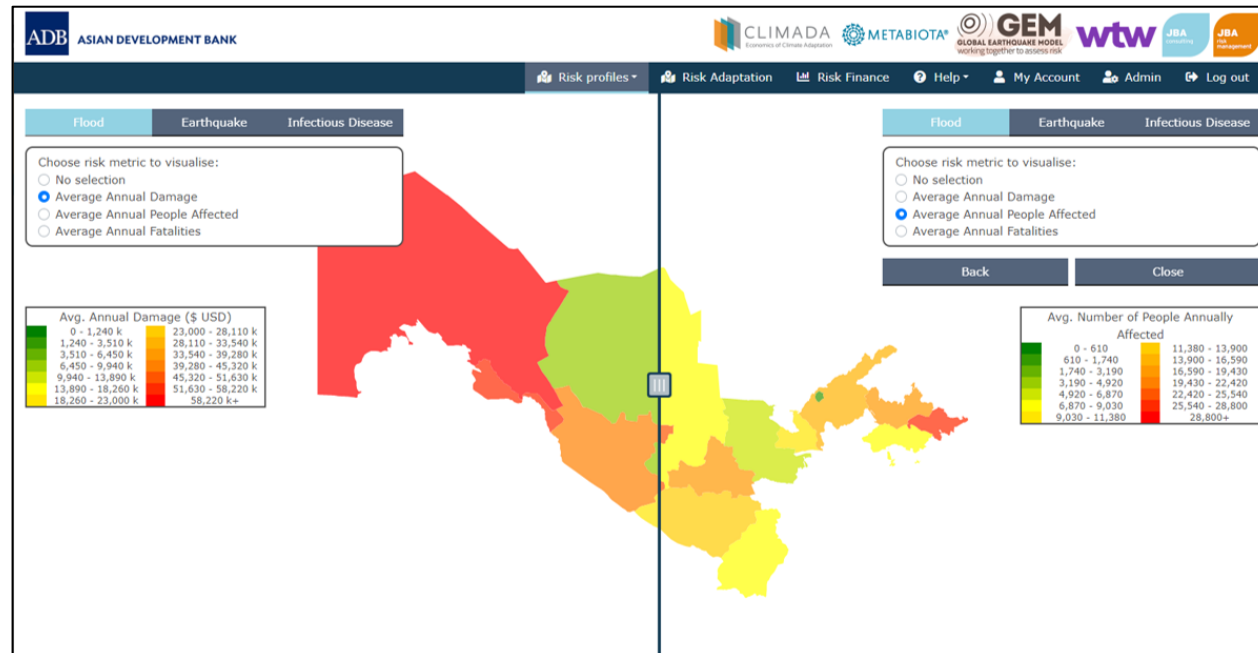
Current Average Annual Damage (USD) \$20,121,957 Adjusted Average Annual Damage (USD) \$22,134,153

Return Period	Current OEP Damage	Current AEP Damage	Adjusted OEP Damage	Adjusted AEP Damage	Current population exposure
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5	\$10,101,267	\$12,826,133	\$11,111,394	\$14,108,746	11,263
10	\$47,601,279	\$48,238,398	\$52,361,407	\$53,062,231	24,369

- Enable users to model exposure changes for each administrative region of a country
- Increase (or decrease) the exposure value for one or more province within the country of interest.
- Adjusted Population exposure for different return periods is displayed

Future Developments

Socio-economic risk metrics



- Quantification of flood and earthquake risk to population by gender and vulnerable groups and quantification of economic risk by industry sectors
- Map display allows users to compare risk metrics

Part 4 – Conclusions



Conclusions



How do you think the DRMI could be used to support decision making?

Which sections of the DRMI do you find most useful for risk management decision making?

Do you have additional datasets that could help better understand the key risks that your country faces?

What enhancements would you like to see in the tool?

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