Turkey

GDP $699 billion*

Population 78.1 million*

	AFFECTED BY 100-YEAR FLOOD	AFFECTED BY 250-YEAR EARTHQUAKE	CAPITAL LOSS FROM 250-YEAR EARTHQUAKE
GDP	$20 billion (3%)	$300 billion (38%)	$60 billion (8%)
Population	3 million (3%)	20 million (27%)	80,000 (<1%)

*2015 estimates

Turkey's population and economy are exposed to earthquakes and floods, with earthquakes posing the greater risk of a high impact, lower probability event. The model results for present-day risk shown in this risk profile are based on population and gross domestic product (GDP) estimates for 2015. The estimated damage caused by historical events is inflated to 2015 US dollars.

Almost 75 percent of Turkey's population lives in urban environments. The country's gross domestic product (GDP) was approximately US$699 billion in 2015, with more than 60 percent derived from services, most of the remainder generated by industry, and agriculture making a small contribution. Turkey's per capita GDP was $8,940.

This map displays GDP by province in Turkey, with greater color saturation indicating greater GDP within a province. The blue circles indicate the risk of experiencing floods and the orange circles the risk of earthquakes in terms of normalized annual average of affected GDP. The largest circles represent the greatest normalized risk. The risk is estimated using flood and earthquake risk models.

The table displays the provinces at greatest normalized risk for each peril. In relative terms, as shown in the table, the province at greatest risk of floods is Bartin, and the one at greatest risk of earthquakes is Izmir. In absolute terms, the province at greatest risk of floods is Adana, and the one at greatest risk of earthquakes is Istanbul.

Annual Average of Affected GDP (%)

8
5
1

Negligible

FLOOD
EARTHQUAKE

GDP (billions of $)

0.28 5.8 16 51 67 190

TOP AFFECTED PROVINCES

FLOOD
ANNUAL AVERAGE OF AFFECTED GDP (%)

Bartin	8
Adana	4
Amasya	4
Bayburt	3
Tokat	3
Agri	3
Karabuk	3
Igdir	2
Hatay	2
Sakarya	2

EARTHQUAKE
ANNUAL AVERAGE OF AFFECTED GDP (%)

Izmir	4
Bursa	3
Yalova	3
Istanbul	2
Canakkale	2
Manisa	2
Edirne	2
Erzurum	2
Van	2
Igdir	2

BLACK SEA
GEORGIA
ARMENIA
AZERBAIJAN
ISLAMIC REPUBLIC OF IRAN
SYRIAN ARAB REPUBLIC
CYPRUS
IRAQ
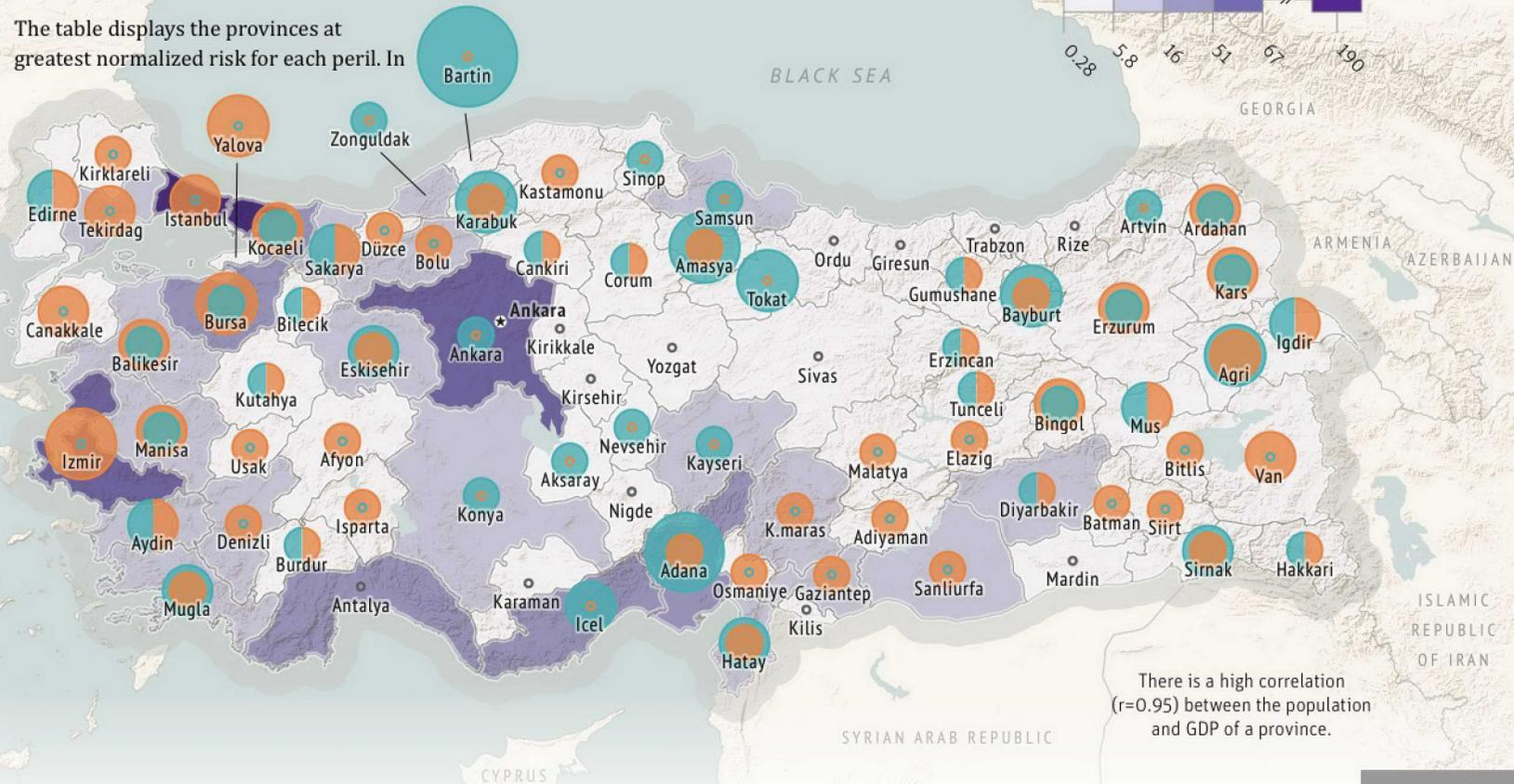
There is a high correlation (r=0.95) between the population and GDP of a province.

Map province labels: Bartin, Zonguldak, Yalova, Kastamonu, Sinop, Kirklareli, Edirne, Tekirdag, Istanbul, Kocaeli, Sakarya, Düzce, Bolu, Karabuk, Cankiri, Corum, Samsun, Amasya, Ordu, Giresun, Trabzon, Rize, Artvin, Ardahan, Canakkale, Bursa, Bilecik, Eskisehir, Ankara, Kirikkale, Yozgat, Sivas, Gumushane, Bayburt, Erzurum, Kars, Igdir, Balikesir, Kutahya, Kirsehir, Erzincan, Tunceli, Bingol, Mus, Agri, Izmir, Manisa, Usak, Afyon, Nevsehir, Aksaray, Kayseri, Malatya, Elazig, Bitlis, Van, Aydin, Denizli, Isparta, Burdur, Konya, Nigde, K.maras, Adiyaman, Diyarbakir, Batman, Siirt, Mugla, Antalya, Karaman, Adana, Osmaniye, Gaziantep, Sanliurfa, Mardin, Sirnak, Hakkari, Icel, Kilis, Hatay

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The most devastating flood in Turkey since 1900 occurred in 1998. It affected over 1 million people and caused over $1 billion in damage. Flooding in 2006 caused almost $400 million in damage, while further floods in 2009 caused about $600 million in damage.

This map depicts the impact of flooding on provinces' GDPs, represented as percentages of their annual average GDPs affected, with greater color saturation indicating higher percentages. The bar graphs represent GDP affected by floods with return periods of 10 years (white) and 100 years (black). The horizontal line across the bars also shows the annual average of GDP affected by floods.

When a flood has a 10-year return period, it means the probability of occurrence of a flood of that magnitude or greater is 10 percent per year. A 100-year flood has a probability of occurrence of 1 percent per year. This means that over a long period of time, a flood of that magnitude will, on average, occur once every 100 years. It does not mean a 100-year flood will occur exactly once every 100 years. In fact, it is possible for a flood of any return period to occur more than once in the same year, or to appear in consecutive years, or not to happen at all over a long period of time.

If the 10- and 100-year bars are the same height, then the impact of a 10-year event is as large as that of a 100-year event, and the annual average of affected GDP is dominated by events that happen relatively frequently. If the impact of a 100-year event is much greater than that of a 10-year event, then less frequent events make a larger contribution to the annual average of affected GDP. Thus, even if a province's annual affected GDP seems small, less frequent and more intense events can still have large impacts.

The annual average population affected by flooding in Turkey is about 600,000 and the annual average affected GDP about $5 billion. For most provinces, in which the impacts from 10- and 100-year floods do not differ much, relatively frequent floods have large impacts on these averages. For the few in which the 100-year impacts are much greater than the 10-year impacts, less frequent events make a significant contribution to the annual average of affected GDP.

Affected GDP (%) for
10 and 100-year return periods

One block = 5%   30
                  15
Annual average — 5
               10-year 100-year

Annual Average of Affected GDP (%)

0 1 2 4 6 8
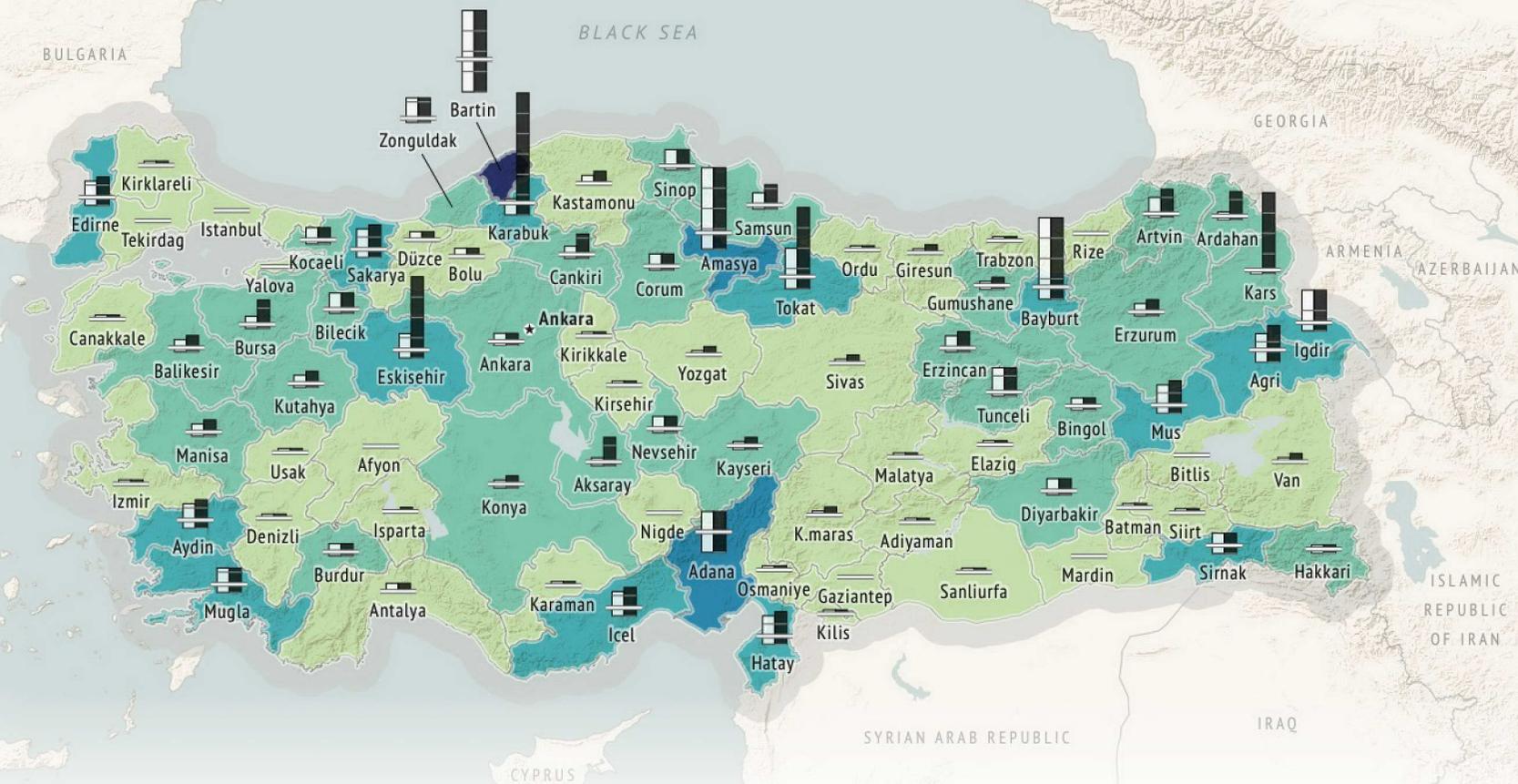
Turkey's most deadly earthquake since 1900 took place in 1939 in Erzincan, with a magnitude of 7.7. It caused more than 30,000 fatalities and over $300 million in damage. A 1999 earthquake with a magnitude of 7.6 caused nearly 18,000 deaths, affected over 1 million people, and caused close to $30 billion in damage.

This map depicts the impact of earthquakes on provinces' GDPs, represented as percentages of their annual average GDPs affected, with greater color saturation indicating higher percentages. The bar graphs represent GDP affected by earthquakes with return periods of 10 years (white) and 100 years (black). The horizontal line across the bars also shows the annual average of GDP affected by earthquakes.

When an earthquake has a 10-year return period, it means the probability of occurrence of an earthquake of that magnitude or greater is 10 percent per year. A 100-year earthquake has a probability of occurrence of 1 percent per year. This means that over a long period of time, an earthquake of that magnitude will, on average, occur once every 100 years. It does not mean a 100-year earthquake will occur exactly once every 100 years. In fact, it is possible for an earthquake of any return period to occur more than once in the same year, or to appear in consecutive years, or not to happen at all over a long period of time.

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The annual average population affected by earthquakes in Turkey is about 1 million and the annual average affected GDP $10 billion. The annual averages of fatalities and capital losses caused by earthquakes are about 1,000 and about $2 billion, respectively. The fatalities and capital losses caused by more intense, less frequent events can be substantially larger than the annual averages. For example, an earthquake with a 0.4 percent annual probability of occurrence (a 250-year return period event) could cause about 80,000 fatalities and $60 billion in capital loss (about 8 percent of GDP).
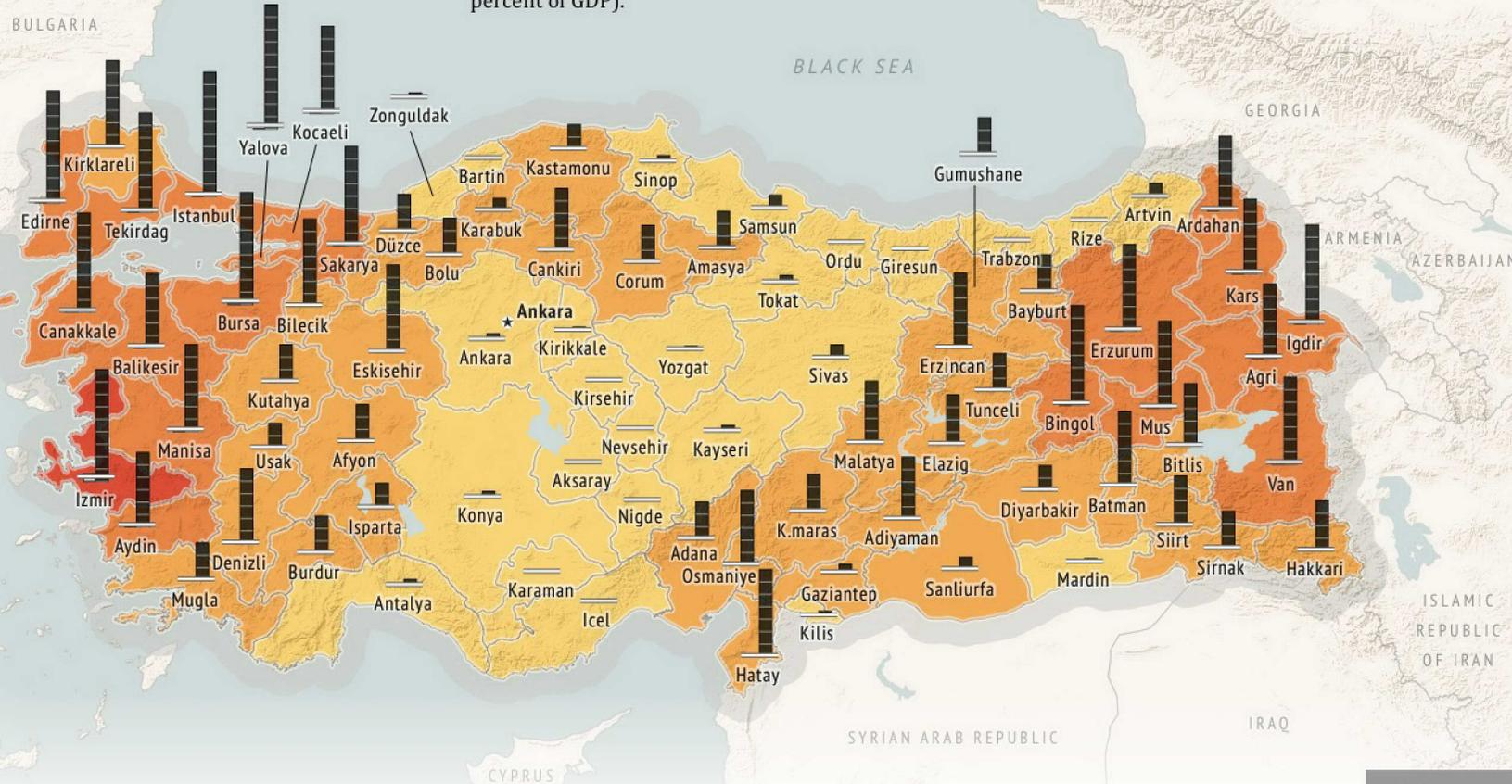
Affected GDP (%) for 10 and 100-year return periods

One block = 10%

100 / 50 / 20

Annual average

10-year   100-year

Annual Average of Affected GDP (%)

0   1   2   4   6   8

Turkey
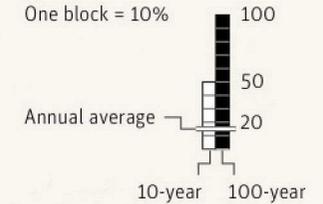
EARTHQUAKE
ANNUAL AVERAGE CAPITAL LOSS (MILLIONS $)

Istanbul 800
Izmir 300
Bursa 100
Kocaeli 100
Ankara 40
Manisa 40
Tekirdag 30
Balikesir 30
Sakarya 30
Aydin 20
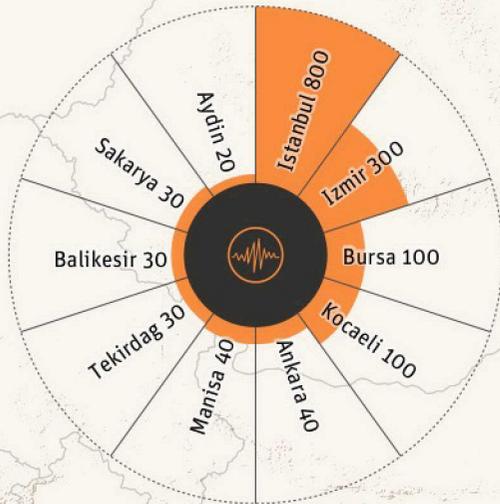
EARTHQUAKE
ANNUAL AVERAGE FATALITIES

Istanbul 400
Izmir 200
Kocaeli 100
Bursa 100
Van 50
Sakarya 50
Hatay 30
Balikesir 30
Tekirdag 30
Yalova 30
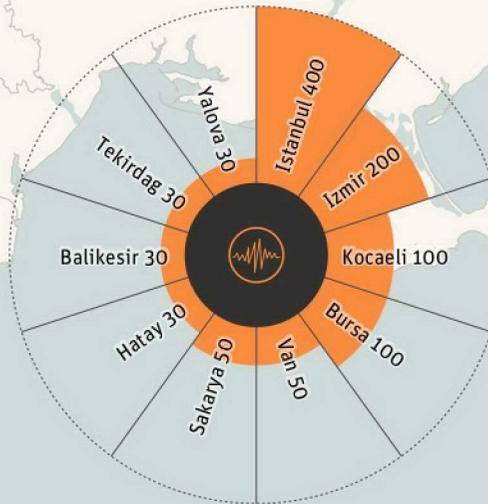
The rose diagrams show the provinces with the potential for greatest annual average capital losses and highest annual average numbers of fatalities, as determined using an earthquake risk model. The potential for greatest capital loss occurs in Istanbul, which is not surprising, given the economic importance of the province.

FLOOD
EXCEEDANCE PROBABILITY CURVE, 2015 AND 2080

2080
2015

Return period (years): 10   50   100   250
Probability (%): 10   2   1   0.4
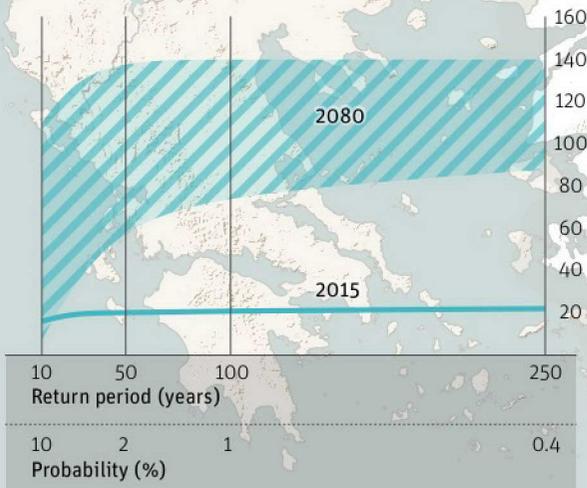
EARTHQUAKE
EXCEEDANCE PROBABILITY CURVE, 2015 AND 2080

Affected GDP (billions of $)
2,500
2,000
1,500
1,000
500

2080
2015

Return period (years): 10   50   100   250
Probability (%): 10   2   1   0.4
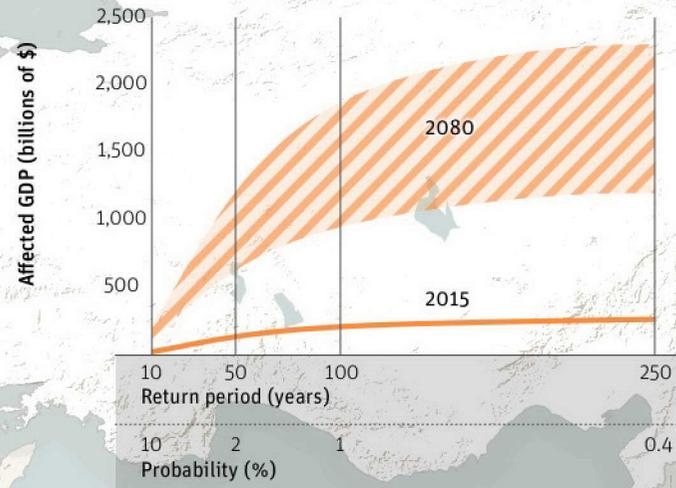
The exceedance probability curves display the GDP affected by, respectively, floods and earthquakes for varying probabilities of occurrence. Values for two different time periods are shown. A solid line depicts the affected GDP for 2015 conditions. A diagonally striped band depicts the range of affected GDP based on a selection of climate and socioeconomic scenarios for 2080. For example, if Turkey had experienced a 100-year return period flood event in 2015, the affected GDP would have been an estimated $20 billion. In 2080, however, the estimated affected GDP from the same type of event would range from about $80 billion to about $140 billion. If Turkey had experienced a 250-year earthquake event in 2015, the affected GDP would have been about $300 billion. In 2080, the affected GDP from the same type of event would range from about $1 trillion to about $2 trillion, due to population growth, urbanization, and the increase in exposed assets.