Turkmenistan

GDP $50.0 billion*

Population 5.4 million*

|	AFFECTED BY 100-YEAR FLOOD	AFFECTED BY 250-YEAR EARTHQUAKE	CAPITAL LOSS FROM 250-YEAR EARTHQUAKE
GDP	$3 billion (7%)	$30 billion (52%)	$5 billion (10%)
Population	400,000 (7%)	3 million (50%)	10,000 (<1%)

*2015 estimates

Turkmenistan'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.

Just over half of Turkmenistan's population lives in rural environments. The country's GDP was approximately US$50.0 billion in 2015, with close to 50 percent derived from industry, most of the remainder generated by services, and agriculture making a small contribution. Turkmenistan's per capita GDP was $9,230.

This map displays GDP by province in Turkmenistan, 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 Charzhou, and the one at greatest risk of earthquakes is Turkmenistan Territories. In absolute terms, it is Turkmenistan Territories.
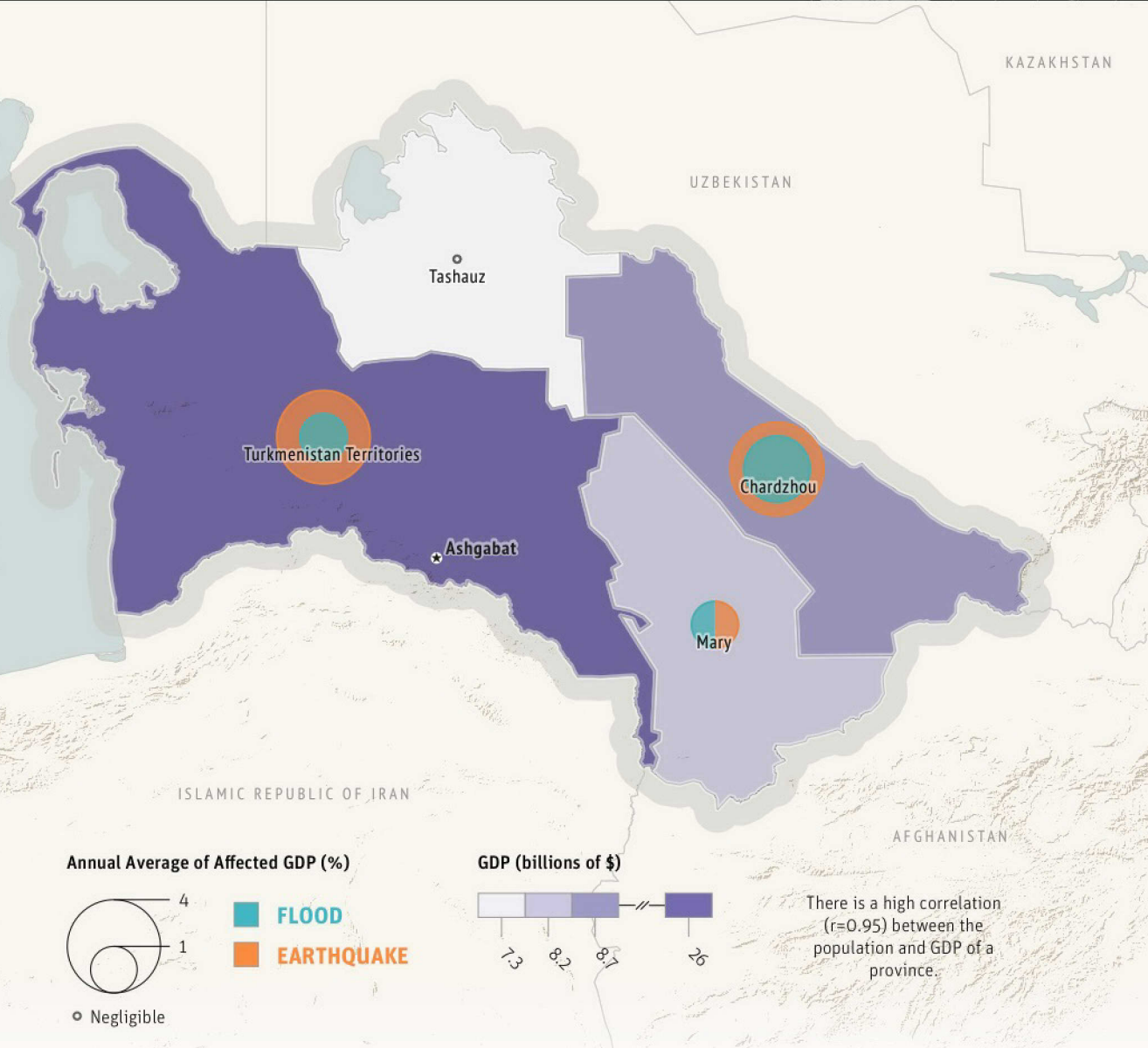
TOP AFFECTED PROVINCES

FLOOD ANNUAL AVERAGE OF AFFECTED GDP (%)		EARTHQUAKE ANNUAL AVERAGE OF AFFECTED GDP (%)	
Chardzhou	2	Turkmenistan Territories	4
Turkmenistan Territories	1	Chardzhou	4
Mary	1	Mary	1
Tashauz	0	Tashauz	0

KAZAKHSTAN

UZBEKISTAN

Tashauz

Turkmenistan Territories

Ashgabat

Chardzhou

Mary

ISLAMIC REPUBLIC OF IRAN

AFGHANISTAN

Annual Average of Affected GDP (%)

4
1

Negligible
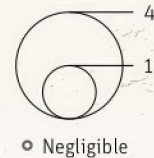
FLOOD
EARTHQUAKE

GDP (billions of $)

13   8.2   8.7   26
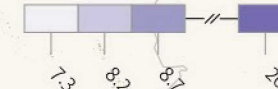
There is a high correlation (r=0.95) between the population and GDP of a province.

The worst flood in Turkmenistan since it gained its independence in 1991 occurred in 1993 and caused about $200 million in damage.
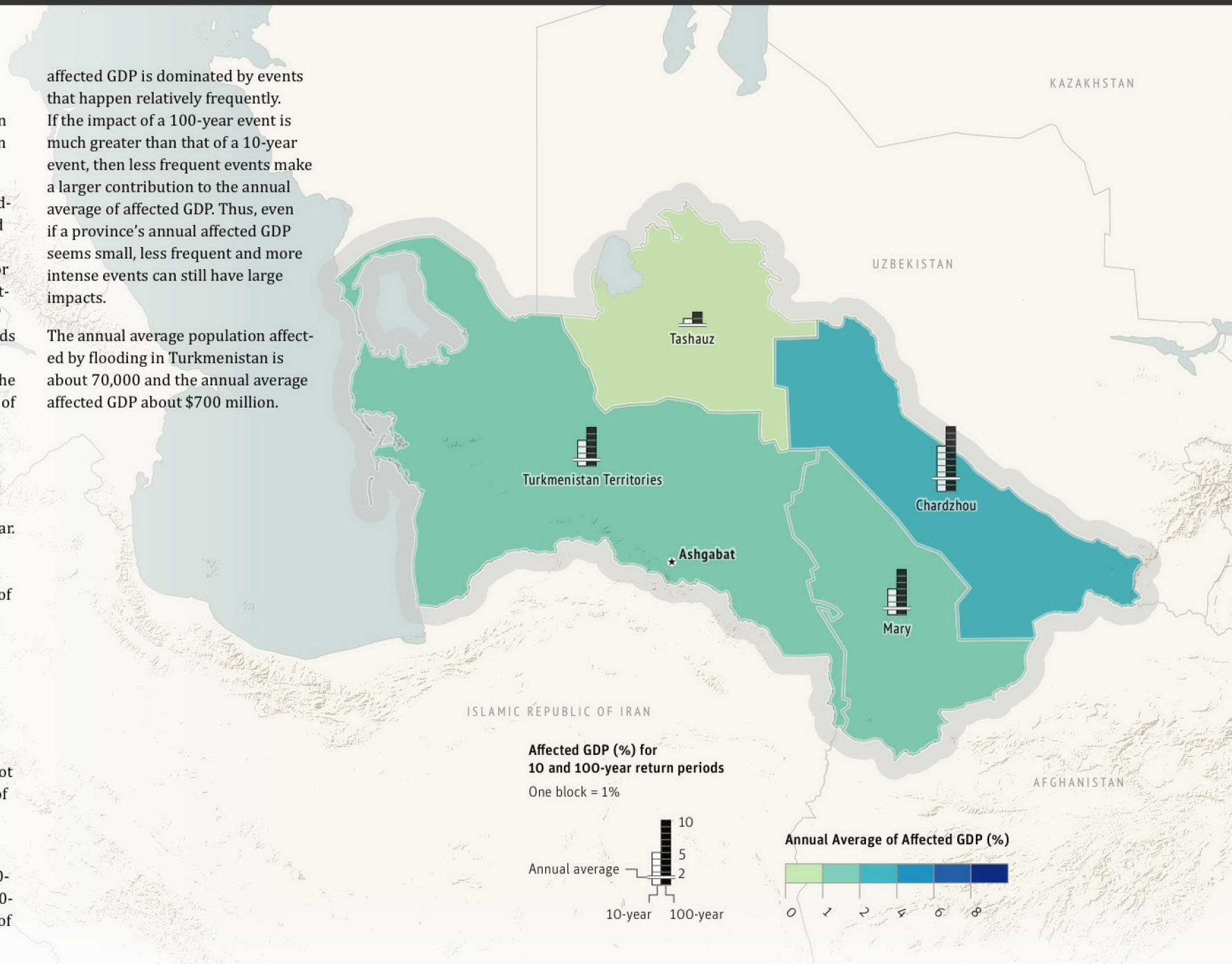
This map depicts the impact of flooding on provinces' GDPs, represented as percentages of their annual average GDPs affected, with greater color saturation indicating higher percentages. The bar graphs represent GDP affected by floods with return periods of 10 years (white) and 100 years (black). The 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 Turkmenistan is about 70,000 and the annual average affected GDP about $700 million.

KAZAKHSTAN

UZBEKISTAN

Tashauz

Turkmenistan Territories

Chardzhou

★ Ashgabat

Mary

ISLAMIC REPUBLIC OF IRAN

AFGHANISTAN

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

One block = 1%

10
5
Annual average — 2

10-year   100-year

Annual Average of Affected GDP (%)

0   1   2   4   6   8

Turkmenistan's worst earthquake since 1900 took place in 1948 in Aschgabad, with a magnitude of 7.3. It caused anywhere from 50,000 to over 100,000 fatalities and almost $4 billion in damage. Other significant earthquakes affecting Turkmenistan occurred in 1895, 1929, and 1946.
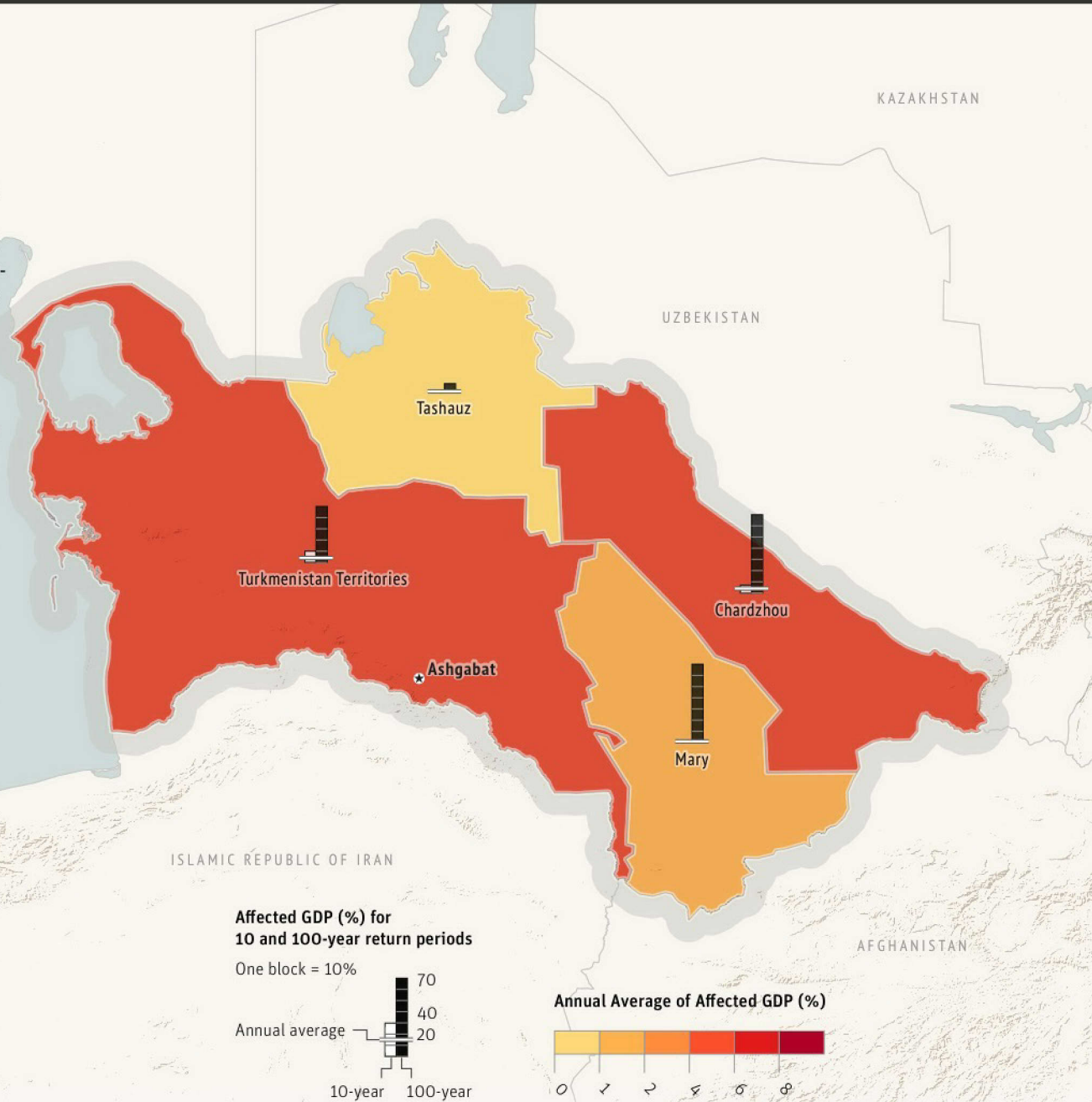
This map depicts the impact of earthquakes on provinces' GDPs, represented as percentages of their annual average GDPs affected, with greater color saturation indicating higher percentages. The bar graphs represent GDP affected by earthquakes with return periods of 10 years (white) and 100 years (black). 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
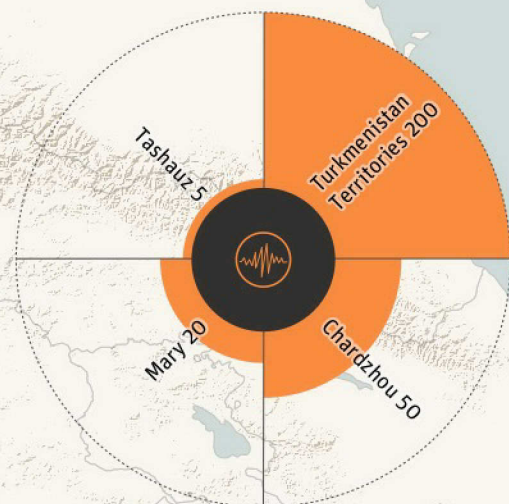
appear in consecutive years, or not to happen at all over a long period of time.

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 larger contributions 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.
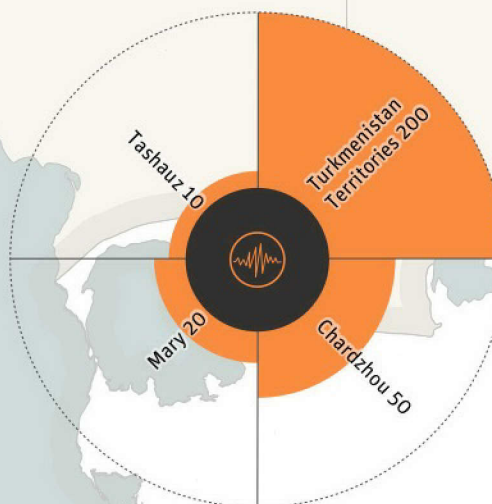
The annual average population affected by earthquakes in Turkmenistan is about 100,000 and the annual average affected GDP about $2 billion. The annual averages of fatalities and capital losses caused by earthquakes are about 300 and about $200 million, respectively. The fatalities and capital losses 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 10,000 fatalities and $5 billion in capital loss (about 10 percent of GDP).

KAZAKHSTAN

UZBEKISTAN

Tashauz

Turkmenistan Territories

Chardzhou

★ Ashgabat

Mary

ISLAMIC REPUBLIC OF IRAN

AFGHANISTAN

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

One block = 10%

70
40
Annual average
20

10-year   100-year

Annual Average of Affected GDP (%)

0 1 2 4 6 8

Turkmenistan

EARTHQUAKE
ANNUAL AVERAGE CAPITAL LOSS (MILLIONS $)

Tashauz 5
Turkmenistan Territories 200
Mary 20
Chardzhou 50

EARTHQUAKE
ANNUAL AVERAGE FATALITIES

Tashauz 10
Turkmenistan Territories 200
Mary 20
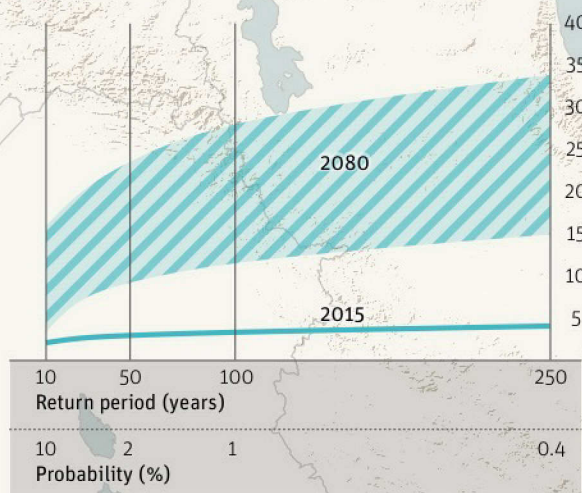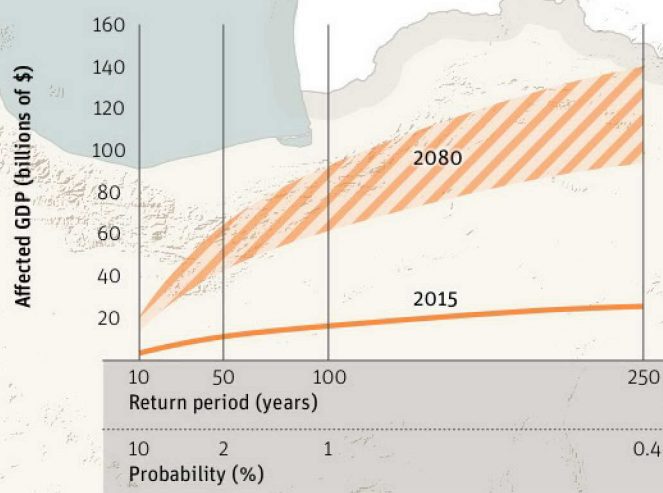Chardzhou 50

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 Turkmenistan Territories, 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 $)

160
140
120
100
80
60
40
20

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 Turkmenistan had experienced a 100-year return period flood event in 2015, the affected GDP would have been an estimated $3 billion. In 2080, however, the affected GDP from the same type of event would range from about $10 billion to about $30 billion. If Turkmenistan had experienced a 250-year earthquake event in 2015, the affected GDP would have been about $30 billion. In 2080, the affected GDP from the same type of event would range from about $90 billion to about $140 billion, due to population growth, urbanization, and the increase in exposed assets.

All historical data on floods and earthquakes are from, respectively, D. Guha-Sapir, R. Below, and Ph. Hoyois, EM-DAT: International Disaster Database (Université Catholique de Louvain, Brussels, Belgium), www.emdat.be, and J. Daniell and A. Schaefer, "Eastern Europe and Central Asia Region Earthquake Risk Assessment Country and Province Profiling," final report to GFDRR, 2014. Damage estimates for all historical events have been inflated to 2015 US$.