WORLD BANK GROUP | GFDRR

EUROPE AND CENTRAL ASIA (ECA)
RISK PROFILES

# Kazakhstan

GDP $120 billion*

Population 17.7 million*

| AFFECTED BY 100-YEAR FLOOD | AFFECTED BY 250-YEAR EARTHQUAKE | CAPITAL LOSS FROM 250-YEAR EARTHQUAKE |
|---|---|---|
| $10 billion (11%) | $30 billion (22%) | $20 billion (14%) |
| 1 million (8%) | 3 million (17%) | 20,000 (<1%) |

*2015 estimates

Kazakhstan's population and economy are exposed to earthquakes and floods, with floods posing the greater risk. The model results for present-day risk presented 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 dollars.

Just over half of Kazakhstan's population lives in urban environments. The country's GDP was approximately US$120 billion in 2015, with close to 70 percent derived from services, most of the remainder generated by industry, and agriculture making a small contribution. Kazakhstan's per capita GDP was $6,770.

This map displays GDP by province in Kazakhstan, 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 both relative and absolute terms, the province at greatest risk of floods is Atyrauskaya, and the one at greatest risk of earthquakes is the Almaty City area.

## TOP AFFECTED PROVINCES

### FLOOD

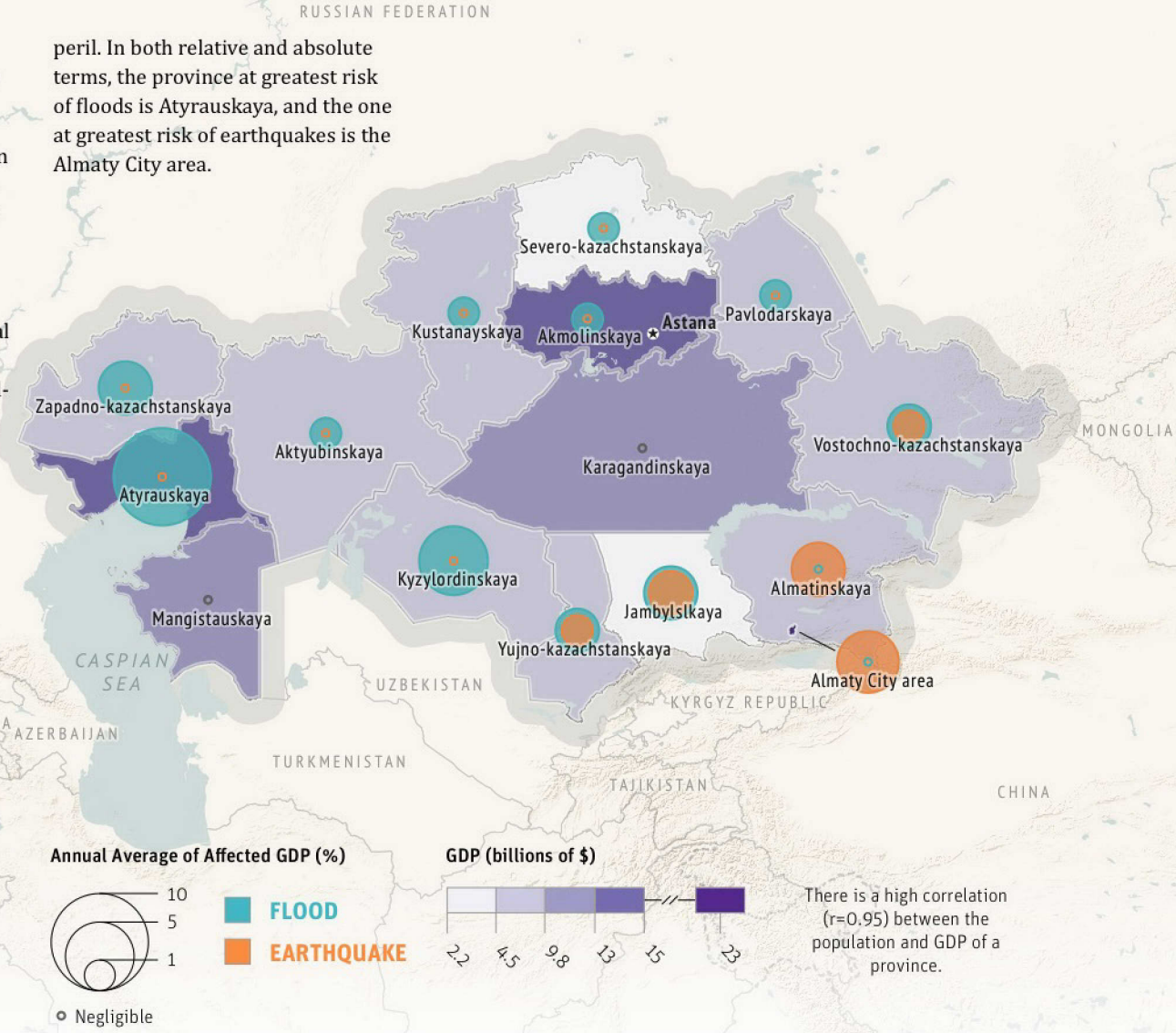
ANNUAL AVERAGE OF AFFECTED GDP (%)

| | |
|---|---|
| Atyrauskaya | 11 |
| Kyzylordinskaya | 5 |
| Zapadno-kazachstanskaya | 3 |
| Jambylslkaya | 2 |
| Yujno-kazachstanskaya | 2 |
| Vostochno-kazachstanskaya | 2 |
| Severo-kazachstanskaya | 1 |
| Akmolinskaya | 1 |
| Aktyubinskaya | 1 |
| Kustanayskaya | 1 |

### EARTHQUAKE

ANNUAL AVERAGE OF AFFECTED GDP (%)

| | |
|---|---|
| Almaty City area | 4 |
| Almatinskaya | 3 |
| Jambylslkaya | 2 |
| Yujno-kazachstanskaya | 1 |
| Vostochno-kazachstanskaya | 1 |
| Mangistauskaya | 0 |
| Pavlodarskaya | 0 |
| Kyzylordinskaya | 0 |
| Severo-kazachstanskaya | 0 |
| Akmolinskaya | 0 |




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

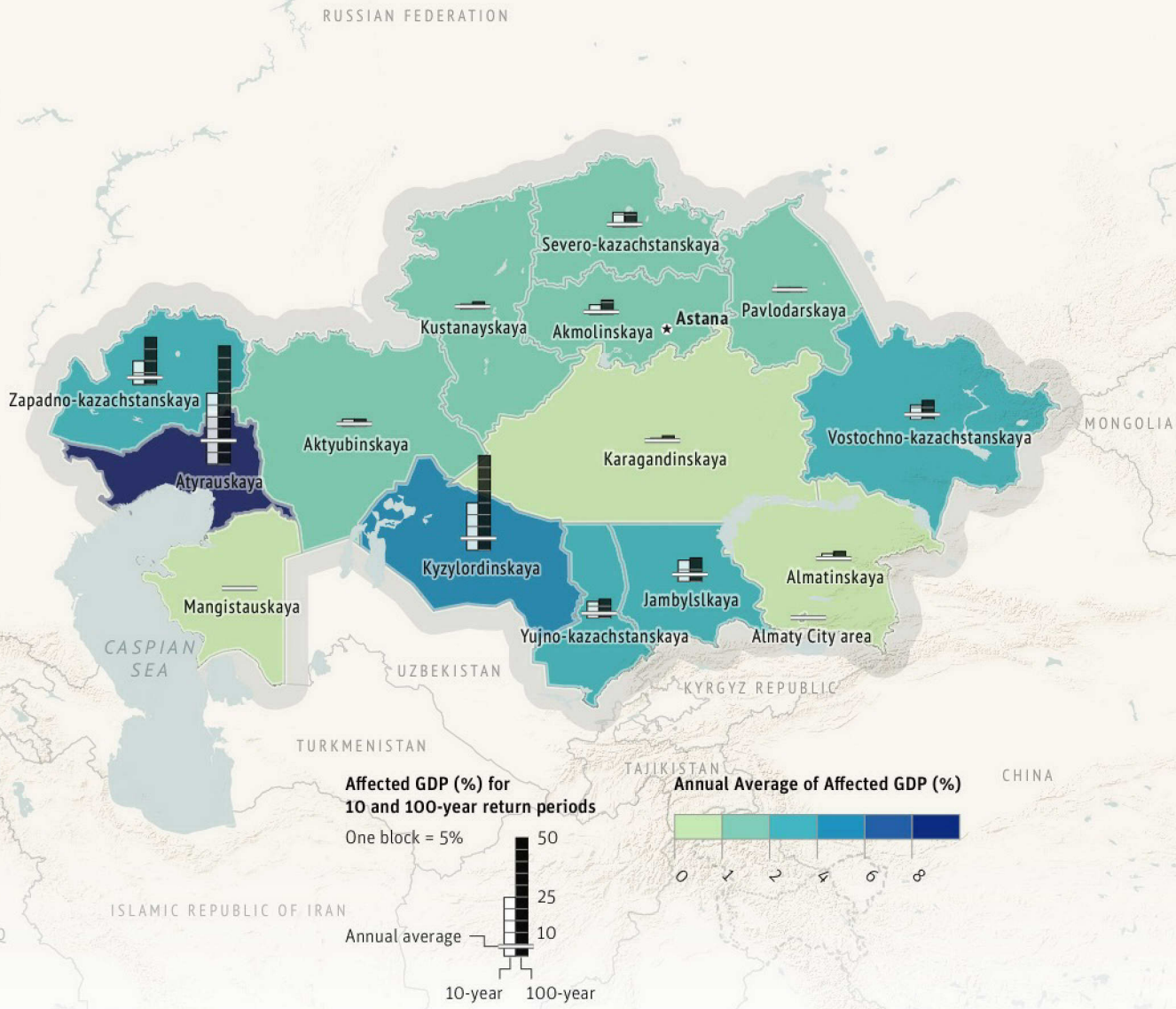
The most deadly flood since Kazakhstan gained its independence in 1991 occurred in 2010. It caused over 40 fatalities and close to $40 million in damage. The most damaging flood took place in 2008, causing one death and over $100 million in damage. A 1993 flood caused approximately 10 fatalities and close to $60 million in damage. Flooding in 2011 caused only two fatalities and damage close to $70 million.

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 Kazakhstan is about 300,000 and the annual average affected GDP about $3 billion. For most provinces, the 10- and 100-year impacts do not differ much, so 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 averages of affected GDP.



Kazakhstan's worst earthquake since 1900 took place in 1911 in Kemin, with a magnitude of 7.7. The earthquake caused over 450 fatalities and more than $20 million in damage. Other earthquakes occurred in Aksu in 1716 and Alma-Ata in 1889. More recently, in 2003, an earthquake caused three deaths and affected close to 40,000 people.

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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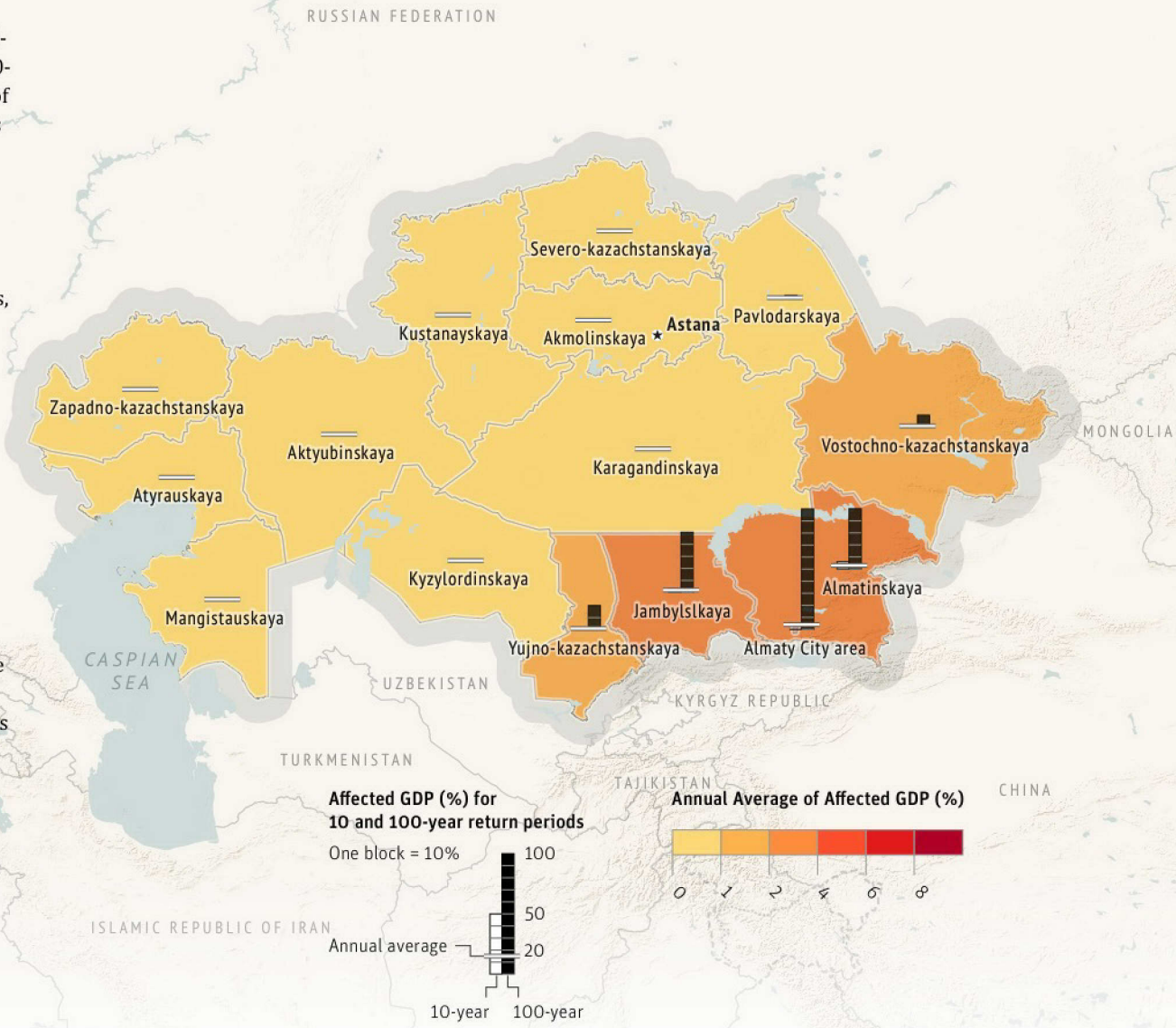
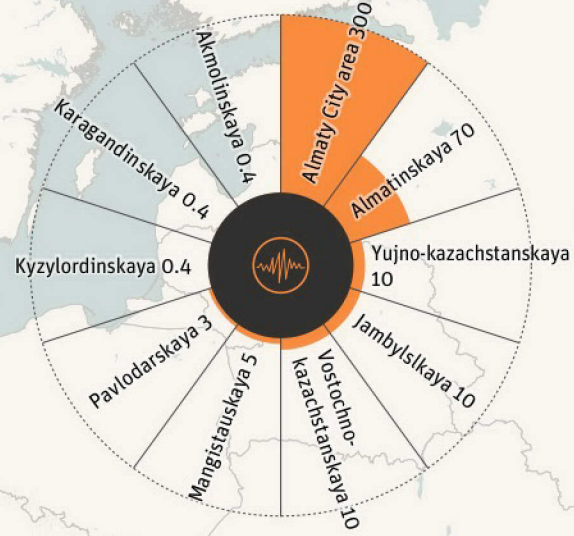
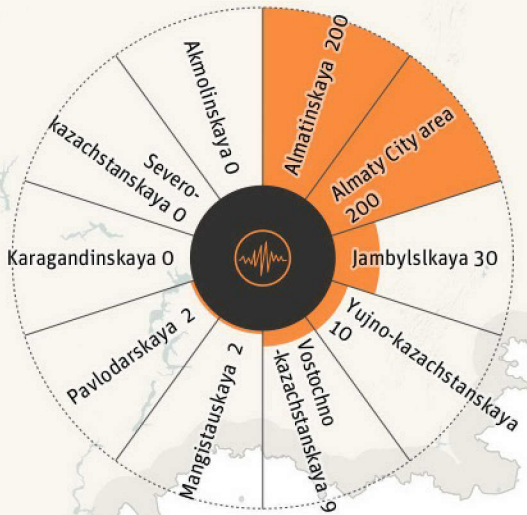
The annual average population affected by earthquakes in Kazakhstan is about 200,000 and the annual average affected GDP about $1 billion. The annual averages of fatalities and capital losses caused by earthquakes are about 500 and about $400 million, respectively. The fatalities and capital losses caused 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 nearly 20,000 fatalities and $20 billion in capital loss (about 10 percent of GDP).



## EARTHQUAKE
ANNUAL AVERAGE CAPITAL LOSS (MILLIONS $)

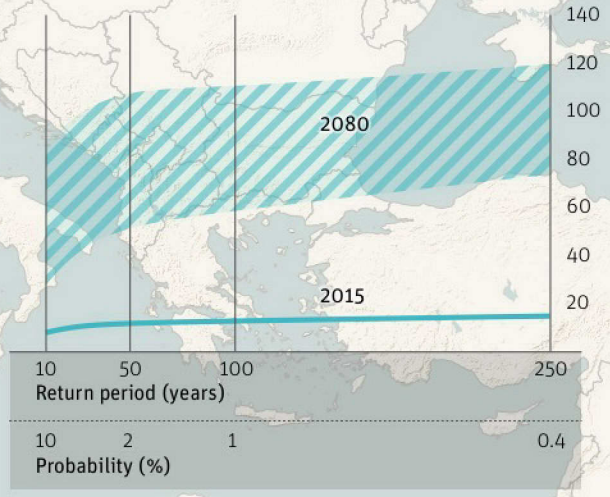



## EARTHQUAKE
ANNUAL AVERAGE FATALITIES

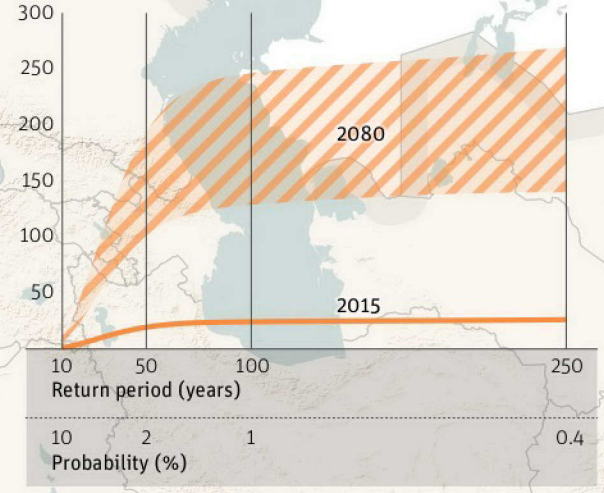



The rose diagrams show the provinces with the potential for greatest annual average capital losses and highest annual average numbers of fatalities, as determined using an earthquake risk model. The potential for greatest capital loss occurs in the Almaty City area, which is not surprising, given the economic importance of the province.

## FLOOD
EXCEEDANCE PROBABILITY CURVE, 2015 AND 2080




## EARTHQUAKE
EXCEEDANCE PROBABILITY CURVE, 2015 AND 2080




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 Kazakhstan had experienced a 100-year return period flood event in 2015, the affected GDP would have been an estimated $10 billion. In 2080, however, the affected GDP from the same type of event would range from about $60 billion to about $100 billion. If Kazakhstan had experienced a 250-year earthquake event in 2015, the affected GDP would have been about $20 billion. In 2080, the affected GDP from the same type of event would range from about $100 billion to $300 billion, due to population growth, urbanization, and the increase in exposed assets.

All historical data on floods and earthquakes are from D. Guha-Sapir, R. Below, and Ph. Hoyois, EM-DAT: International Disaster Database (Université Catholique de Louvain, Brussels, Belgium), www.emdat.be; the National Geophysical Data Center/World Data Service (NGDC/WDS), Significant Earthquake Database (National Geophysical Data Center, NOAA), doi:10.7289/V5TD9V7K; 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$.