Russian Federation

GDP $1.2 trillion*

Population 144 million*

	AFFECTED BY 100-YEAR FLOOD	AFFECTED BY 250-YEAR EARTHQUAKE	CAPITAL LOSS FROM 250-YEAR EARTHQUAKE
	$60 billion (6%)	$10 billion (1%)	$6 billion (1%)
	8 million (6%)	2 million (2%)	10,000 (<1%)

*2015 estimates

The Russian Federation's population and economy are exposed to earthquakes and floods, with floods posing the greater risk. 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.

Close to 75 percent of the Russian Federation's population lives in urban environments. The country's GDP was approximately US$1.2 trillion in 2015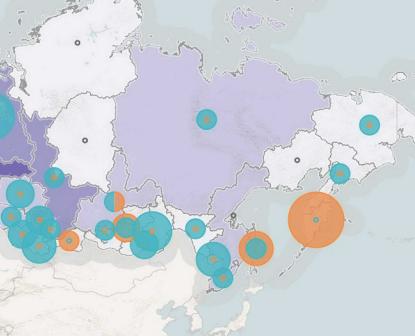, with nearly 60 percent derived from services, most of the remainder generated by industry, and agriculture making a small contribution. The Russian Federation's per capita GDP was $8,140.

This map displays GDP by province in the Russian Federation, 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 Adeygeya Republic, and the one at greatest risk of earthquakes is Kamchatskaya Oblast. In absolute terms, the province at greatest risk of floods is Moskva, and the one at greatest risk of earthquakes is Sakhalinskaya Oblast.

TOP AFFECTED PROVINCES

FLOOD
ANNUAL AVERAGE OF AFFECTED GDP (%)

Adygeya Rep.	7
Yamalo-nenetskiy Okrug	6
Severnaya Osetiya-alaniya Rep.	5
Kurganskaya Oblast	5
Tyumenskaya Oblast	5
Orlovskaya Oblast	4
Karatchayevo-cherkesiya Rep.	4
Mariy-el Rep.	4
Chitinskaya Oblast	4
Tverskaya Oblast	4

EARTHQUAKE
ANNUAL AVERAGE OF AFFECTED GDP (%)

Kamchatskaya Oblast	8
Sakhalinskaya Oblast	3
Buryatiya Rep.	2
Dagestan Rep.	2
Chechnya Rep.	1
Tyva Rep.	1
Severnaya Osetiya-alaniya Rep.	1
Karatchayevo-cherkesiya Rep.	1
Kabardino-balkariya Rep.	1
Irkutskaya Oblast	1

Annual Average of Affected GDP (%)

8
5
1

Negligible

FLOOD
EARTHQUAKE

GDP (billions of $)

0.15 7.2 17 40 57 280

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

The most devastating flood in the Russian Federation since its reconstitution in 1991 occurred in 2013, causing about $1 billion in damage. A 2012 flood caused over 150 fatalities and over $600 million in damage. Fatalities and damage caused by flooding in August 2002 were on par with those of the 2012 flood. Flooding also occurred in 1994, 1996, and 1998, with the 1996 flood affecting close to 800,000 people.
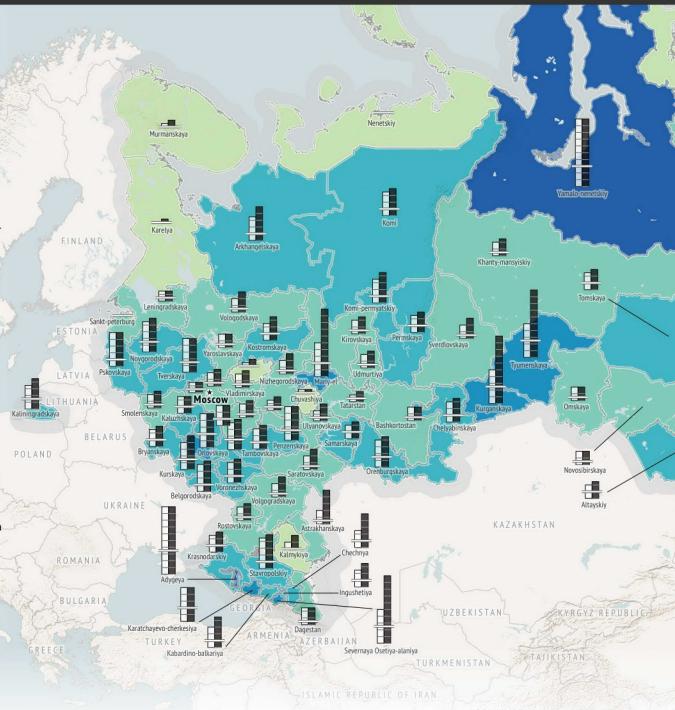
This map depicts the impact of flooding on provinces' GDPs, represented as percentages of their annual average GDPs affected, with greater color saturation indicating higher percentages. The bar graphs represent GDP affected by floods with return periods of 10 years (white) and 100 years (black). The 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.
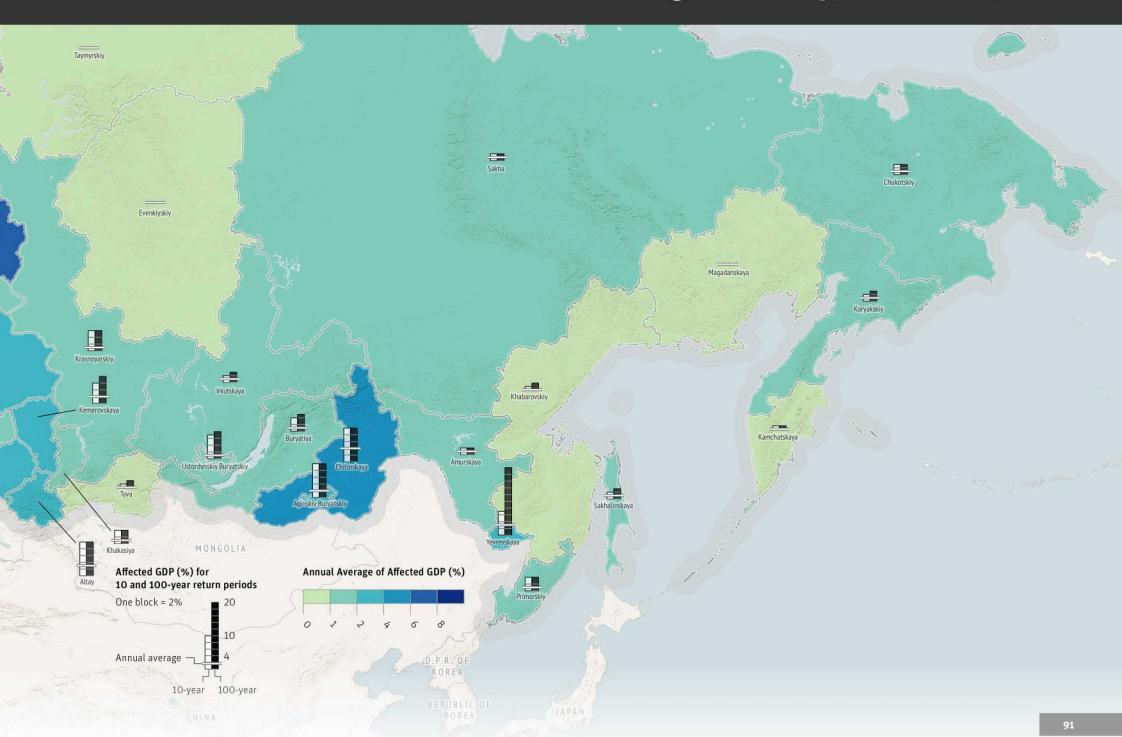
If the 10- and 100-year bars are the same height, then the impact of a 10-year event is as large as that of a 100-year event, and the annual average of affected GDP is dominated by events that happen relatively frequently. If the impact of a 100-year event is much greater than that of a 10-year event, 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 the Russian Federation is about 2 million and the annual average affected GDP about $20 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, the less frequent events make a significant contribution to the annual average of affected GDP.

Taymyrskiy

Sakha

Chukotskiy

Evenkiyskiy

Magadanskaya

Koryakskiy

Krasnoyarskiy

Irkutskaya

Khabarovskiy

Kemerovskaya

Buryatiya

Kamchatskaya

Ustordynskiy Buryatskiy

Chitinskaya

Amurskaya

Tyva

Aginskiy Buryatskiy

Sakhalinskaya

Khakasiya

MONGOLIA

Yevreyskaya

Altay

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

Annual Average of Affected GDP (%)

One block = 2%

20

0 1 2 4 6 8

10

Primorskiy

Annual average

4

10-year   100-year

CHINA

D.P.R. OF
KOREA

REPUBLIC OF
KOREA

JAPAN

The Russian Federation's worst earthquake since 1900 took place in 1995 in Neftegorsk, with a magnitude of 7.1. It destroyed the settlement of Neftegorsk and caused nearly 2,000 fatalities and over $450 million in damage. Another major earthquake, which occurred in Kamchatka in 1952 and was followed by a tsunami, killed over 2,000 people. More recently, in 2007, an earthquake in the Russian Federation caused over $450 million in damage.
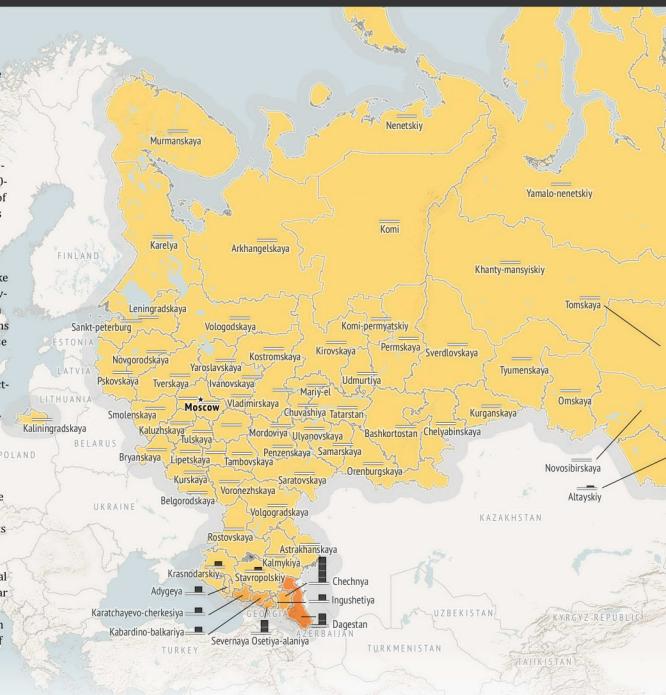
This map depicts the impact of earthquakes on provinces' GDPs, represented as percentages of their annual average GDPs affected, with greater color saturation indicating higher percentages. The bar graphs represent GDP affected by earthquakes with return periods of 10 years (white) and 100 years (black). 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
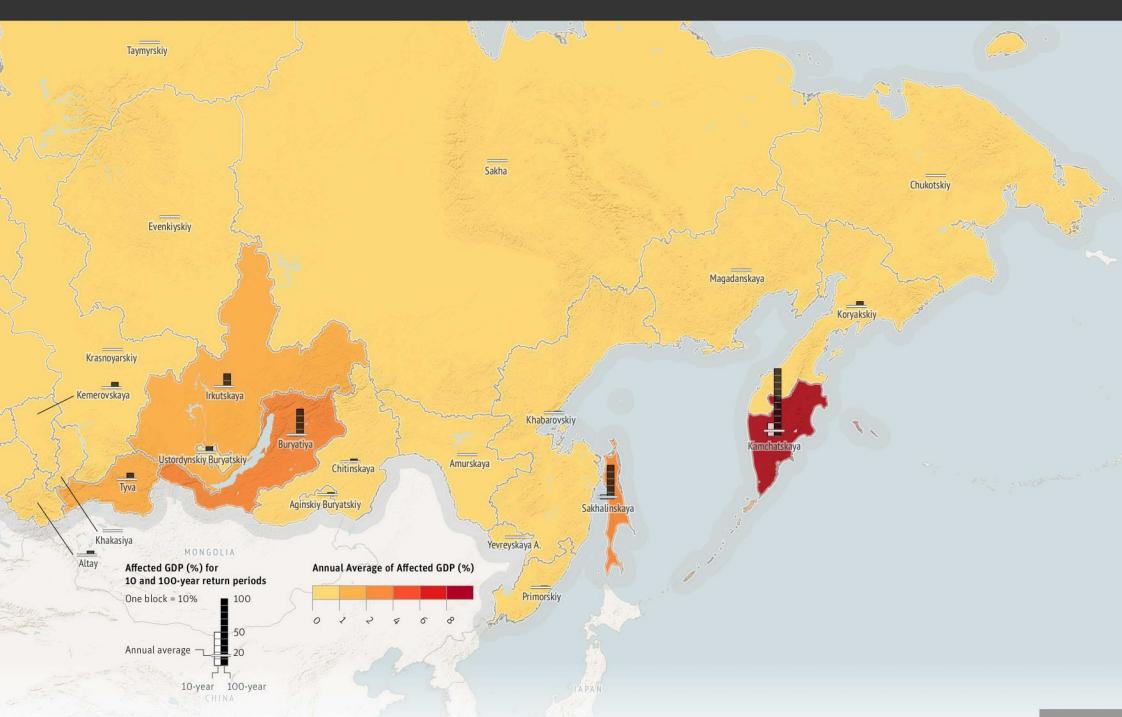
an earthquake of any return period to occur more than once in the same year, or to appear in consecutive years, or not to happen at all over a long period of time.

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 the Russian Federation 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 200 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 about 10,000 fatalities and $6 billion in capital loss (less than 1 percent of GDP).
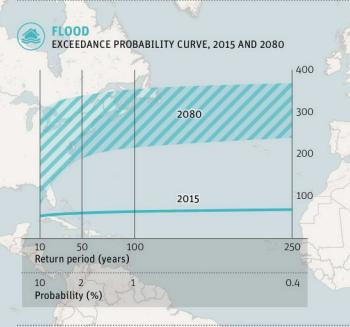
Taymyrskiy

Sakha

Chukotskiy

Evenkiyskiy

Magadanskaya

Koryakskiy

Krasnoyarskiy

Kemerovskaya

Irkutskaya

Khabarovskiy

Kamchatskaya

Buryatiya

Ustordynskiy Buryatskiy

Chitinskaya

Amurskaya

Tyva

Aginskiy Buryatskiy

Sakhalinskaya

Khakasiya

Yevreyskaya A.

MONGOLIA

Altay

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

Annual Average of Affected GDP (%)

One block = 10%

100

50

20

Annual average

10-year   100-year

CHINA

Primorskiy

0   1   2   4   6   8

JAPAN

Russian Federation

EARTHQUAKE
ANNUAL AVERAGE CAPITAL LOSS (MILLIONS $)

- Stavropolskiy Kray 6
- Severnaya Osetiya-alaniya Rep. 6
- Chechnya Rep. 7
- Kemerovskaya Oblast 9
- Buryatiya Rep. 20
- Irkutskaya Oblast 20
- Krasnodarskiy Kray 30
- Dagestan Rep. 40
- Kamchatskaya Oblast 50
- Sakhalinskaya Oblast 100

EARTHQUAKE
ANNUAL AVERAGE FATALITIES

- Omskaya Oblast 7
- Chechnya Rep. 8
- Severnaya Osetiya-alaniya Rep. 9
- Kabardino-balkariya Rep. 10
- Kamchatskaya Oblast 10
- Krasnodarskiy Kray 20
- Irkutskaya Oblast 20
- Dagestan Rep. 30
- Buryatiya Rep. 30
- Sakhalinskaya Oblast 30
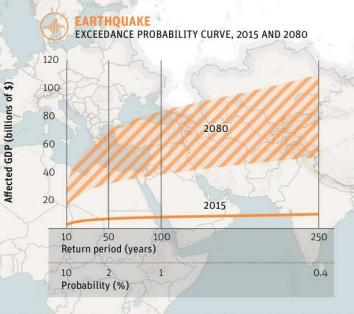
The rose diagrams show the provinces with the potential for greatest annual average capital losses and highest annual average numbers of fatalities, as determined using an earthquake risk model. The potential for greatest capital loss occurs in Sakhalinskaya Oblast, which is not surprising, given the economic importance of the province.

FLOOD
EXCEEDANCE PROBABILITY CURVE, 2015 AND 2080

Return period (years)

Probability (%)

EARTHQUAKE
EXCEEDANCE PROBABILITY CURVE, 2015 AND 2080

Affected GDP (billions of $)

Return period (years)

Probability (%)

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 the Russian Federation had experienced a 100-year return period flood event in 2015, the affected GDP would have been an estimated $60 billion. In 2080, however, the affected GDP from the same type of event would range from about $200 billion to about $400 billion. If the Russian Federation had experienced a 250-year earthquake event in 2015, the affected GDP would have been an estimated $20 billion. In 2080, however, the affected GDP from the same type of event would range from about $50 billion to about $100 billion, due to population growth, urbanization, and the increase in exposed assets.