Japan's Insurance Market 2021

The Toa Reinsurance Company, Limited

Japan's Insurance Market 2021

Contents **Page**

To Our Clients

It gives me great pleasure to have the opportunity to welcome you to our brochure, 'Japan's Insurance Market 2021.' It is encouraging to know that over the years our brochures have been well received even beyond our own industry's boundaries as a source of useful, up-to-date information about Japan's insurance market, as well as contributing to a wider interest in and understanding of our domestic market.

During fiscal 2020, the year ended March 31, 2021 the insurance and reinsurance industries have been encountering a substantially changing business environment. For instance, insurance needs and risks have been rapidly diversifying and changing amid developments that include evolution and growing prevalence of digital technologies, frequent occurrences of natural disasters associated with climate change, and demographic trends in the form of a decreasing birthrate and an aging population. Meanwhile, the COVID-19 pandemic has greatly affected our world in a variety of ways, having weighed on the global economy as well as people's work and lifestyles.

Amid these circumstances, the Toa Re Group has drawn up TEAM TOA 2023, our new medium-term management plan, which launched in April 2021. Under TEAM TOA 2023, we aim to achieve sustainable growth in step with our clients and society by providing optimal solutions and services to our clients amid an increasingly changing environment. The respective entities and sections of the Group will rally together in carrying out various initiatives to achieve such targets.

Everyone at the Toa Re Group will do their utmost to ensure that the Group consistently fulfills its mission as a reinsurance company "Providing Peace of Mind," as articulated in the Toa Re Mission Statement. We look forward to your ongoing support going forward.

In conclusion, I hope that our brochure will provide a greater insight into the Japanese insurance market and I would like to express my gratitude to all who kindly contributed so much time and effort towards its making.

Masaaki Matsunaga
President and Chief Executive
The Toa Reinsurance Company, Limited

1. Trends in Solvency Regulations in Japan and the Response among Insurance Companies

Nobuyasu Uemura, Ph.D.
Professor, Faculty of Commerce, Fukuoka University

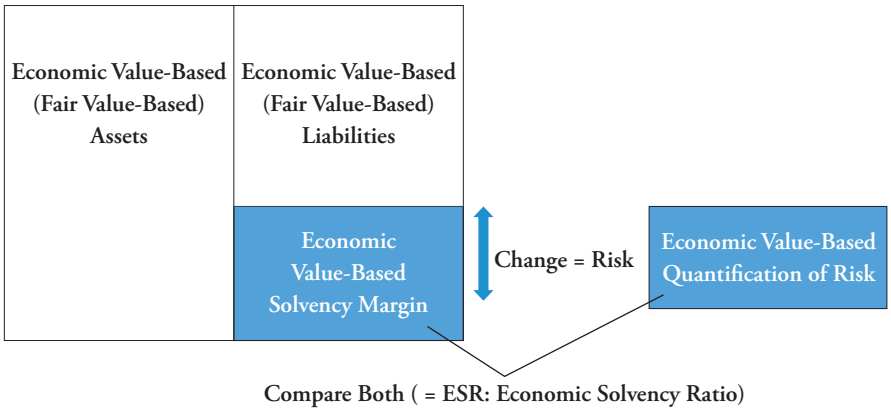
1. Economic Value-Based Solvency Regulations in Japan

Japan's Financial Services Agency (FSA) is currently preparing for the introduction of economic value-based solvency regulations. Although these regulations are for Japan-based insurers, the FSA plans to implement new regulations for all Japan-based insurers in 2025 in line with the schedule for the introduction of the Insurance Capital Standard (ICS).

Economic value-based solvency regulations are designed to accurately elucidate the financial status of insurance companies through the integrated assessment of assets and liabilities on an economic value basis (fair value basis). In many countries, including Japan, current insurance accounting uses acquisition cost or a similar metric to value reserves, which account for the majority of insurance company liabilities. However, regulations based on current accounting are unable to accurately reflect the soundness of insurance companies.

In Japan, an FSA panel composed of knowledgeable members of the insurance industry started investigation into the introduction of economic value-based solvency regulations in 2006. The panel published its recommendations in 2007. Subsequently, the economic environment changed as a result of the global financial crisis of 2008 and the negative interest rate policy of the Bank of Japan. In June 2020, the FSA Council of Experts (with different participants to the earlier one that published recommendations in 2007) proposed the direction of the introduction of regulations.

Figure 1: Economic Value-Based Solvency Regulations



Source: Chart created by the author

While Japan was considering the introduction of economic value-based solvency regulations, the International Association of Insurance Supervisors (IAIS) was developing the Insurance Capital Standard (ICS) for internationally active insurance groups. The ICS also uses the market-adjusted valuation approach based on economic value. As a key member of the IAIS, the FSA is also considering the introduction of criteria similar to the ICS for domestic regulations.

In addition, IFRS 17 "Insurance Contracts," an international accounting standard for insurance contracts, is finally about to come into force after more than 20 years of consideration. IFRS 17 is similar to economic value-based solvency regulations in that it measures insurance liabilities on an economic value basis.

However, IFRS is voluntary rather than compulsory in Japan, and the FSA does not plan to review the insurance accounting standards used for supervision. Therefore, even after the introduction of economic value-based solvency regulations in 2025, insurers will continue to report their financial results based on current accounting standards, except for companies that have voluntarily applied IFRS.

2. Features of Japan's Insurance Market

A brief overview of Japan's insurance market is helpful in understanding trends in solvency regulations in Japan.

Traditional products are still the core of the Japanese life insurance market. Here, "traditional" means that future cash flow is determined at the effective date of contract. Due in part to the impact of low interest rates, sales of yen-denominated savings products have been low in recent years, and many life insurance companies mainly offer protection-type insurance products with a term of about 10 years. However, when interest rates were relatively high (until the mid-1990s), insurance companies aggressively pushed ultra-long-term, high-interest-rate products that offered advantageous returns to policyholders, such as whole life insurance and individual annuity insurance, in addition to fixed-term protection-type insurance products. Consequently, many policies with high interest rates from that time are still included in insurance company liabilities. Life insurance companies have been lengthening the maturities of assets by purchasing ultra-long-term government bonds since the 2000s, but the mismatch between assets and liabilities still remains, and the decline in interest rates is putting pressure on the soundness of life insurance companies.

Table 1: Balance of Policy Reserves by Policy Year (Dai-Ichi Life Insurance)

(Million yen; %)

Policy Year	End of Fiscal 2019	Proportion	Expected Interest Rate
Until Fiscal 1980	565,820	2.5%	2.75% - 5.50%
Fiscal 1981 - Fiscal 1985	1,098,107	4.8%	2.75% - 5.50%
Fiscal 1986 - Fiscal 1990	4,331,989	18.9%	2.75% - 5.50%
Fiscal 1991 - Fiscal 1995	4,018,926	17.5%	2.75% - 5.50%
Fiscal 1996 - Fiscal 2000	1,431,383	6.2%	2.00% - 2.75%
Fiscal 2001 - Fiscal 2005	1,498,915	6.5%	1.50%
Fiscal 2006 - Fiscal 2010	2,675,261	11.7%	1.50%
Fiscal 2011 - Fiscal 2015	4,700,871	20.5%	1.00% - 1.50%
Fiscal 2016 - Fiscal 2019	2,638,437	11.5%	0.25% - 1.00%
Total	22,959,709	100.0%	

Table created using data from Dai-Ichi Life Insurance Annual Report 2020

Around 2000, medium-sized life insurance companies went bankrupt one after another. These bankruptcies were a result of a sharp fall in asset prices and interest rate levels due to the collapse of the bubble economy; these companies had aggressively sold products featuring advantageous returns with high interest rates during the bubble economy. Improper management also increased the risk of bankruptcy. Regulators may not have been able to prevent the companies from going bankrupt even if economic value-based solvency regulations had been in place, but at least they would have been able to identify unsound companies early on.

The Japanese non-life insurance market generates more than 50% of premium income from automobile insurance, which is renewed annually. This makes non-life insurance companies less susceptible to interest rate fluctuations than life insurance companies. However, Japanese non-life insurance companies are exposed to the risk of large-scale natural disasters such as earthquakes and typhoons. They also hold many equities of large companies for the purpose of maintaining insurance contracts, not for investment purposes, so fluctuations in share prices can easily cause significant changes in the solvency margin ratio.

In addition, major non-life insurance companies have become international comprehensive insurance groups through mergers and acquisitions. Japan's three major insurance groups have a 90% share of Japan's non-life insurance market. Further, the risk profiles of all groups are becoming more diverse and complex because they are exposed to many kinds of risk, such as interest rate risk in the life insurance business and the operational risk of overseas insurance companies due to their diversification.

The three major insurance groups – Tokio Marine Holdings, Inc., MS&AD Insurance Group Holdings, Inc., and Sompo Holdings, Inc. – and the Dai-ichi Life Insurance Group are designated as "Internationally Active Insurance Groups" subject to ICS.

3. Features of the New Solvency Regulations

The new solvency regulations presented by the 2020 Council of Experts do more than just embrace economic value-based thinking. Their three-pillar approach is another feature.

The first pillar is solvency regulation in a narrow sense based on quantitative criteria, the second pillar is risk management and supervisory review, and the third pillar is disclosure. This approach is not novel, as it is already incorporated in the Basel regulations for banks and Solvency II, the EU's insurance supervision regulations. The elements that make up these three pillars are also already incorporated in current Japanese insurance administration.

However, the content of solvency regulations differs greatly depending on the design of the relationship between the first pillar and the second and third pillars. At present, no decision has been made about the extent to which the first pillar will employ the insurer's own internal model, so companies will adhere to the criteria of the standard model. If the first pillar is made very strict, the second and third pillars

will become less important. It will make adhering to the criteria set by the authorities based on the standard model an effective risk management tool for insurance companies. That said, one criterion alone cannot control all of an insurer's management risks, and that kind of regulatory design can even undermine the soundness of insurers.

The Council of Experts believes that encouraging insurers to manage their own risk is important, and proposes that the first pillar should be the one with the greatest common denominator, so to speak. As a result, the standard model criteria are less sensitive to risk and may sacrifice some of the benefits of incorporating economic value-based assessment. For the second pillar, however, the Own Risk and Solvency Assessment (ORSA) report and other data the authorities already request from insurance companies every year can be used to confirm insurer soundness. Dialogue between authorities and insurance companies based on such data will encourage companies to voluntarily improve their own risk management. Furthermore, the third pillar, which centers on insurers' disclosure, involves discipline from market participants. The new solvency regulations do not simply require insurers to adhere to quantitative standards, but ensure soundness with proper regulatory design built on multiple pillars.

Prudential Policy Based on the Three Pillars

- Pillar 1 (solvency regulation): establishes a common standard of a solvency ratio and a framework of supervisory interventions, which functions as a backstop to protect policyholders.
- Pillar 2 (risk management and supervisory review): covers risks that are not fully captured in Pillar 1 and establishes a supervisory review on insurers' risk management frameworks that facilitate enhancement of their risk management practices.
- Pillar 3 (disclosure): facilitates dialogue between insurers and external stakeholders that improves corporate governance and enhances discipline in insurance companies through external scrutiny.

Source: FSA Council of Experts announcement, June 2020

4. Response among Insurance Companies

In closing, here is a brief overview of the response among Japan's insurance companies.

Published material indicates that many Japanese insurers have already adopted some form of internal control based on economic value. The listed insurance groups define their economic solvency ratio (ESR), a key indicator that compares the economic value-based solvency margin to risk quantified based on economic value, and publish their ESR and its numerator and denominator for use in their dialogue with analysts and investors.

The extent to which ESR is important to management is not necessarily clear, with the exception of some listed companies. The commitment to ESR seems to vary from company to company. However, companies are certainly struggling with the gap between profit indicators and current solvency criteria, which are based on current accounting standards, and economic value-based internal control in managing risks, especially interest rate risk. The introduction of economic value-based solvency criteria that are consistent with their internal control will facilitate risk management.

ESR is considered more variable than current solvency criteria due to changes in the economic environment and financial markets. It will take on a greater role as a regulatory indicator rather than as an insurer-related internal control indicator. In particular, authorities will use ESR as the basis for intervening in management when an insurer's ESR fails to meet an adequate solvency level as defined by authorities, so insurers are likely to suppress risk and increase solvency even more than they do now. This fact reflects the trend over the last few years for insurers to fully satisfy the current solvency margin regulation at a high level, but still continue to borrow externally using subordinated debt, etc. Some insurers are also suppressing interest rate risk.

However, as mentioned above, the new solvency criteria will not overly rely on the first pillar, but will also emphasize the second and third pillars. Insurers will therefore need to communicate their risk-taking strategies to the authorities and external stakeholders more clearly.

Soundness is not a license to take risk freely. Insurers must take risks to generate returns, but only risks they are reasonably capable of taking on. Mutual insurance companies must fully consider what their members, who are policyholders, want of management with regard to how a company takes on risk.

For example, a company with extensive equity holdings must demonstrate its capabilities as an investor and the ability to generate returns that outperform the market. This would also clarify management responsibilities. I believe the new solvency regulations will likely require greater risk-based management among insurers.

2. Climate Change: The Situation in Japan and Impact on Non-Life Insurance

Toshio Koshiba
Manager, Senior Consultant, Risk Assessment Section, Corporate Planning Department
MS&AD InterRisk Research & Consulting, Inc.

1. Introduction: Article Thesis and Structure

Alarms have been going off about global climate change for many years. In Japan, major disasters resulting from massive typhoons and heavy rains in 2018 and 2019 and record-high temperatures over the past several years have made the Japanese public increasingly concerned about and aware of the realities of climate change.

Various studies have investigated climate change, and the Intergovernmental Panel on Climate Change (IPCC – created by the United Nations Environment Programme and the World Meteorological Organization) and other organizations have predicted the increase in temperature. The general view in the non-life insurance industry is that claims paid will increase if climate change intensifies.

This article examines climate change circumstances based on various meteorological data, with a focus on the past and present rather than forecasts for the future, and considers the impact on non-life insurance. Due to timing issues, this article mainly covers circumstances up to 2020.

2. The Relationship between Climate Change and Non-Life Insurance

First, I would like to summarize the relationship between the damage caused by ongoing climate change and the expected increase in the risk of non-life insurance claim payments. The general view is that climate change will more likely lead to an increase in natural disasters due to intensified weather.

(1) Flooding

Precipitation increases when the amount of water vapor in the atmosphere rises due to higher temperatures, which causes river flooding and inland flooding and may increase the risk of flooding damage.

(2) Wind damage

Higher air and seawater temperatures may mean that a higher number of typhoons will approach the coast of Japan and make landfall without losing intensity, which increases the risk of damage caused by powerful winds.

(3) Storm surge

Increased risk of coastal storm surge can be put down to two factors. The first is rising sea levels related to the higher temperatures that are causing Arctic and Antarctic ice to melt. The second factor is rising sea levels related to the drop in atmospheric pressure and the strong wind that blows the sea surface, both of which are associated with increased likelihood of strong typhoons, as mentioned in (2) above.

In fact, as shown in Table 1, seven of the ten highest claims paid totals from wind and flooding damage in Japan have occurred in the past 10 years, which underscores the social mission of non-life insurance companies.

Table 1: Major Claims Paid Due to Wind and Flooding Damage[1]

Rank	Disaster Name	Region	Date	Claims Paid (Billion yen)			
				Fire	Motor	Marine	Total
1	Typhoon No. 21, 2018 (Typhoon Jebi)	Osaka, Kyoto, Hyogo and elsewhere	September 3-5, 2018	936.3	78.0	53.5	1,067.8
2	Typhoon No. 19, 2019 (Typhoon Hagibis)	East Japan	October 6-13, 2019	518.1	64.5	–	582.6
3	Typhoon No. 19, 1991 (Typhoon Mireille)	Nationwide	September 26-28, 1991	522.5	26.9	18.5	568.0
4	Typhoon No. 15, 2019 (Typhoon Faxai)	Kanto	September 5-10, 2019	439.8	25.8	–	465.6
5	Typhoon No. 18, 2004 (Typhoon Songda)	Nationwide	September 4-8, 2004	356.4	25.9	5.1	387.4
6	Heavy Snowfall, February 2014	Mainly Kanto	February, 2014	298.4	24.1	–	322.4
7	Typhoon No. 18, 1999 (Typhoon Bart)	Kumamoto, Yamaguchi, Fukuoka and elsewhere	September 21-25, 1999	284.7	21.2	8.8	314.7
8	Typhoon No. 24, 2018 (Typhoon Trami)	Tokyo, Kanagawa, Shizuoka and elsewhere	September 28-October 1, 2018	294.6	11.5	–	306.1
9	Heavy Rain, July 2018	Okayama, Hiroshima, Ehime and elsewhere	June 28-July 8, 2018	167.3	28.3	–	195.6
10	Typhoon No.15, 2015 (Typhoon Goni)	Nationwide	August 24-26, 2015	156.1	8.1	–	164.2

Source: General Insurance Association of Japan: *Fact Book 2019-2020 - General Insurance in Japan* P. 78. The figure of "total" does not equal the total of individual items due to rounding.

3. Historical Climate Comparison and Natural Disaster Scale in Japan

The following uses recorded meteorological data and insurance claims paid data for an historical climate comparison from various perspectives to consider the impact of climate change and the scale of natural disasters.

(1) Is Climate Change Occurring?

Following is an historical comparison for seven perspectives on whether climate change is occurring.

A. Comparison of Temperatures 100 Years Ago (1920) and Temperatures Now (2020)

Past records are available on the Japan Meteorological Agency website. Table 2 is a comparative summary of Tokyo temperatures for 1920 (100 years ago) and 2020 using a number of familiar data points rather than just the historical annual averages used for many articles on climate change.

Table 2: Comparison of Tokyo Temperatures for 1920 and 2020 (Degrees Celsius)

	1920	2020	Comments
Average temperature	14.2	16.5	
Single-day high (highest)	32.5	37.3	The lowest single-day high in the last 10 years was 36.1°C
Single-day high (lowest)	1.3	6.5	
Single-day low (highest)	25.0	28.0	
Single-day low (lowest)	-4.3	-2.1	
Days with a lowest temperature below 0°C	60	6	The largest number of days with a lowest temperature below 0°C in the last 10 years was 22
Days with a lowest temperature at or above 25°C	1	27	The fewest number of days with a lowest temperature at or above 25°C in the last 10 years was 10
Days with a highest temperature at or above 30°C	38	54	
Days with a highest temperature at or above 35°C	0	12	While the fewest days with a highest temperature at or above 35°C in the last 10 years was 2, the figure for each of the past three years was 12 days.

Note: Table uses data from the Japan Meteorological Agency website.

The table simply compares a single year in the past with a single year in the present. However, items in red highlight major differences, not just in 2020 but also over the past 10 years. The figures may be something of a shock for Tokyo residents, and underscore the significant differences in weather between 1920 and 2020.

At this point, many readers presumably are thinking that urbanization has an impact as well as climate change. Data from the Japan Meteorological Agency's website indicate that the average temperature in Japan increased 1.24°C over the 100 years through 2019.[2] The figure is calculated using data from 15 locations where the influence of urbanization is small. Table 3 is a comparison between 1920 and 2020 in Hikone,* one of the fifteen locations referred to above, using the same data points as Table 2. Hikone is in Shiga Prefecture, which is located far from the sea and is close to the central part of Japan.

* The comparison uses Hikone instead of Iida, Nagano Prefecture, which is in a similar location far from the sea and close to the central part of Japan, because the measurement location in Iida changed sometime between 1920 and 2020.

Table 3: Comparison of Hikone Temperatures for 1920 and 2020 (Degrees Celsius)

	1920	2020	Comments
Average temperature	14.0	15.8	
Single-day high (highest)	34.1	36.3	
Single-day high (lowest)	1.7	2.6	
Single-day low (highest)	25.3	28.2	
Single-day low (lowest)	-4.5	-1.4	
Days with a lowest temperature below 0°C	50	7	The largest number of days with a lowest temperature below 0°C in the last 10 years was 37
Days with a lowest temperature at or above 25°C	1	27	The fewest number of days with a lowest temperature at or above 25°C in the last 10 years was 13
Days with a highest temperature at or above 30°C	57	53	
Days with a highest temperature at or above 35°C	0	12	While the fewest days with a highest temperature at or above 35°C in the last 10 years was 1, the figure for each of the past three years was 11 days.

Note: Table uses data from the Japan Meteorological Agency website.

Overall, the differences in Hikone seem to be smaller compared to Tokyo, but the items in red highlight large differences.

Therefore, the data suggest that the rise in temperature is just as pronounced in Hikone, where the effect of urbanization is comparatively smaller, than it is in Tokyo, which is affected by urbanization.

B. Years with Extremely High and Low Temperatures

Table 4 summarizes highest temperatures in Japan by year and location.[3]

Table 4: Ranking of Highest Temperatures in Japan (through 2020)

Rank	Prefecture	Location	Recorded Temperature	
			°C	Date
1	Shizuoka	Hamamatsu	41.1	August 17, 2020
1	Saitama	Kumagaya	41.1	July 23, 2018
3	Gifu	Mino	41.0	August 8, 2018
3	Gifu	Kanayama	41.0	August 6, 2018
3	Kochi	Ekawasaki	41.0	August 12, 2013
6	Shizuoka	Tenryu	40.9	August 16, 2020
6	Gifu	Tajimi	40.9	August 16, 2007
8	Niigata	Nakajo	40.8	August 23, 2018
8	Tokyo	Ome	40.8	July 23, 2018
8	Yamagata	Yamagata	40.8	July 25, 1933

Note: Table uses data from the Japan Meteorological Agency website.

The data indicate that seven of the top ten highest temperatures were in the past three years, underscoring the striking upward trend in temperature in recent years.

Next, Table 5 summarizes lowest temperatures in Japan by year and location.

Table 5: Ranking of Lowest Temperatures in Japan (through 2020)

Rank	Prefecture	Location	Recorded Temperature	
			°C	Date
1	Kamikawa region, Hokkaido	Asahikawa	-41.0	January 25, 1902
2	Tokachi region, Hokkaido	Obihiro	-38.2	January 26, 1902
3	Kamikawa region, Hokkaido	Etanbetsu	-38.1	February 17, 1978
4	Shizuoka	Mount Fuji	-38.0	February 27, 1981
5	Souya region, Hokkaido	Utanobori	-37.9	February 17, 1978
6	Kamikawa region, Hokkaido	Horokanai	-37.6	February 17, 1978
7	Kamikawa region, Hokkaido	Bifuka	-37.0	February 17, 1978
8	Kamikawa region, Hokkaido	Wassamu	-36.8	January 25, 1985
9	Kamikawa region, Hokkaido	Shimokawa	-36.1	February 17, 1978
10	Souya region, Hokkaido	Nakatonbetsu	-35.9	January 24, 1985

The data indicate that lowest temperatures ranked 3 to 10 have occurred since 1970. Of note, observation began in 1976 or later for most locations. Lowest temperatures for these locations do not appear from the 1990s onward in Table 5, which also suggests a rise in temperature in recent years. To illustrate this trend, Table 6 summarizes lowest temperature rankings for Tokyo and Hikone, with observations going back before 1900.

Table 6: Ranking of Lowest Temperatures in Tokyo and Hikone (Degrees Celsius and Year)

Rank	Tokyo (from 1875)		Hikone (from 1893)	
1	-9.2	January 13, 1876	-11.3	January 27, 1904
2	-9.1	January 14, 1885	-10.0	January 6, 1923
3	-8.6	January 24, 1927	-9.3	January 6, 1938
4	-8.6	January 12, 1876	-9.2	January 13, 1907
5	-8.4	January 13, 1881	-9.1	January 29, 1933
6	-8.2	January 9, 1918	-8.9	February 17, 1896
7	-8.2	January 21, 1885	-8.8	February 8, 1966
8	-8.1	January 22, 1922	-8.7	December 21, 1947
9	-8.1	January 8, 1918	-8.7	February 5, 1901
10	-8.1	January 20, 1889	-8.6	January 11, 1939

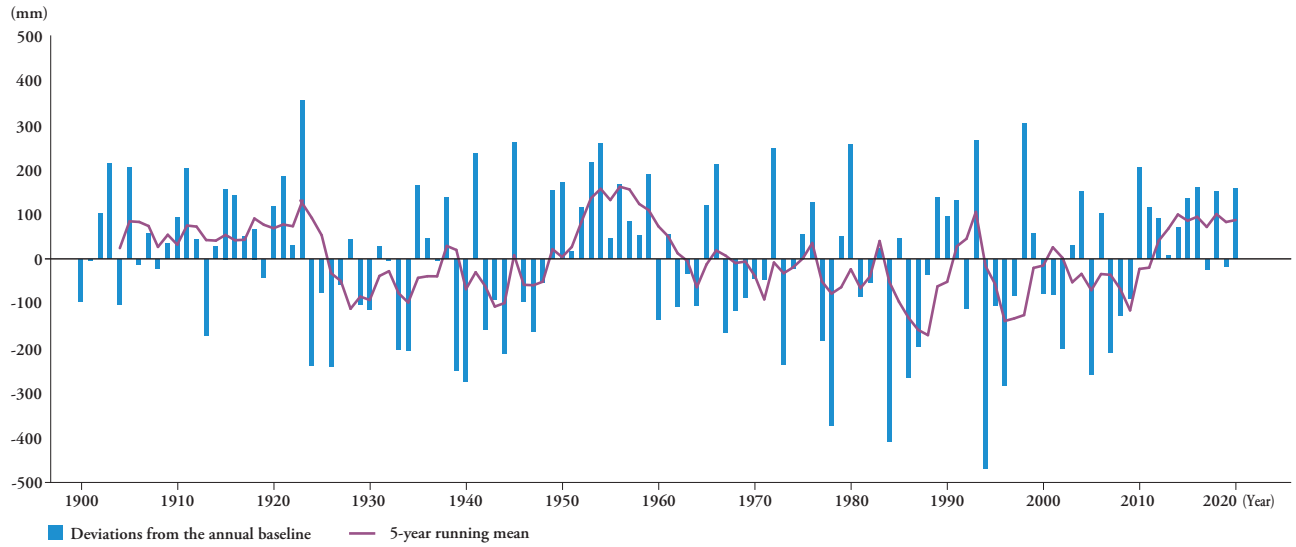
The data indicate that all of the top ten record-low temperatures are in 1927 or earlier in Tokyo, which underwent urbanization, while nine of the top ten record-low temperatures are before 1950 in Hikone, which is comparatively less affected by urbanization. Recent record lows are also rare at other locations where observation began just as far back as Tokyo and Hikone, which suggests a long-term increase in temperature.

Notably, some locations have observed record lows in recent years. For example, during an intense cold wave in western Japan from January 25 to 26, 2016, Hitoyoshi in Kumamoto Prefecture observed the record low of -9.8°C since observation began in 1943. Using a different indicator, locations including Okayama and Hiroshima Prefecture recorded the lowest single-day high temperature since observation began in 1900 during a nationwide cold wave from February 26 to 27, 1981.

C. Long-Term Changes in Precipitation

The Japan Meteorological Agency's time-series data for annual deviations in precipitation in Japan (1898-2020)[4] indicate no long-term change trend (Figure 1). Although precipitation has trended upward over the last 10 years, it is low compared to the 1950s. In addition, time-series data for annual deviations in precipitation worldwide indicate that the number of years with high precipitation has increased since 2004.

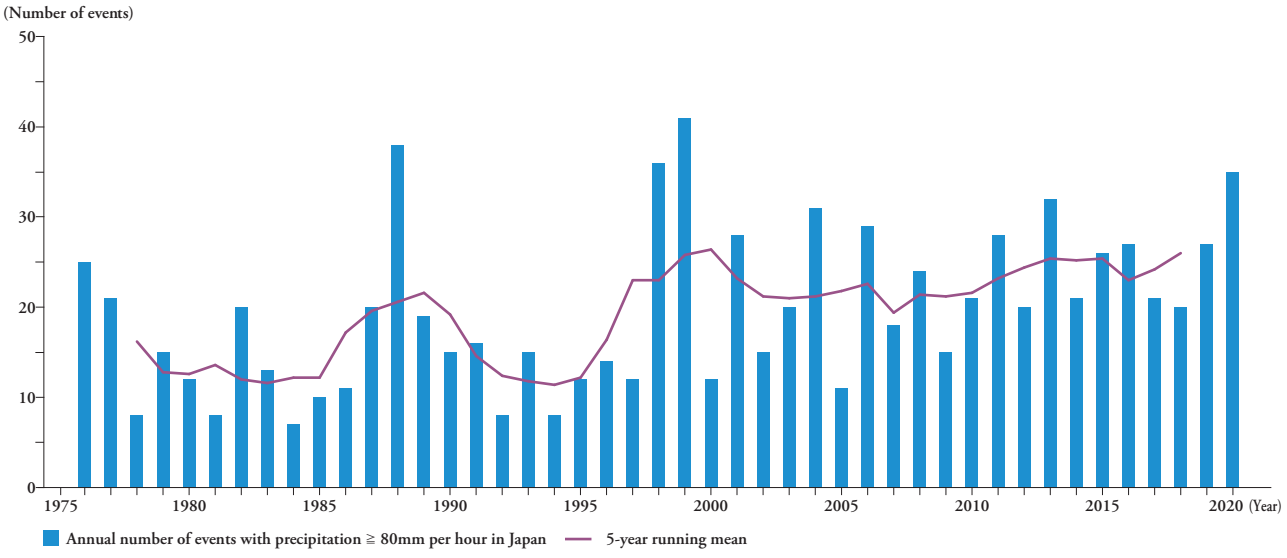
Figure 1: Annual Deviations in Precipitation in Japan



Note: Created from time-series data for annual deviations in precipitation in Japan (1898–2020) as reported on the Japan Meteorological Agency website. The baseline is the 30-year average value from 1991 to 2020.

Precipitation in short intervals such as 10 minutes or 1 hour is of greatest interest. Using data from the Japan Meteorological Agency website,[5] Figure 2 shows the annual number of events observed by the Automated Meteorological Data Acquisition System (AMeDAS) nationwide with precipitation of 80 mm or more in one hour, and the number of events has been trending upward since 1998. Flooding damage has tended to occur more easily in recent years.

Figure 2: Annual Number of Events with Precipitation ≧ 80mm in One Hour in Japan (1976-2020)



D. Wind Record Trends

Table 7 shows the top 10 record events for maximum instantaneous wind speed in Japan.

The data show three record events since 2000, and no tendency toward higher wind speed in recent years. Further, only two of the top ten record events for maximum wind speed have occurred since 2000, again showing no tendency toward higher wind speed.

Moreover, with regard to location-related trends, the second, third and fourth ranked record events for maximum instantaneous wind speed in Tokyo occurred within the last 20 years, but none of the top ten ranked record events for maximum wind speed occurred in that time. In Hikone, the first and ninth ranked record events for maximum instantaneous wind speed occurred within the last 20 years, but only the fourth ranked record event ranked among maximum wind speed events in that time. These data suggest no increased likelihood of strong winds in recent years.

Table 7: Top 10 Record Events for Maximum Instantaneous Wind Speed in Japan

Rank	Prefecture	Location	Recorded Wind Speed		
			m/s	Direction	Date
1	Shizuoka	Mount Fuji	91.0	SSW	September 25, 1966
2	Okinawa	Miyakojima	85.3	NE	September 5, 1966
3	Kochi	Murotomisaki	84.5	WSW	September 16, 1961
4	Okinawa	Yonagunijima	81.1	SE	September 28, 2015
5	Kagoshima	Naze	78.9	ESE	August 13, 1970
6	Okinawa	Naha	73.6	S	September 8, 1956
7	Ehime	Uwajima	72.3	W	September 25, 1964
8	Okinawa	Ishigakijima	71.0	SSW	August 23, 2015
9	Okinawa	Iriomotejima	69.9	NE	September 16, 2006
10	Tokushima	Tsurugisan	69.0	SSE	August 21, 1970

E. Trends in Cherry Blossom Dates

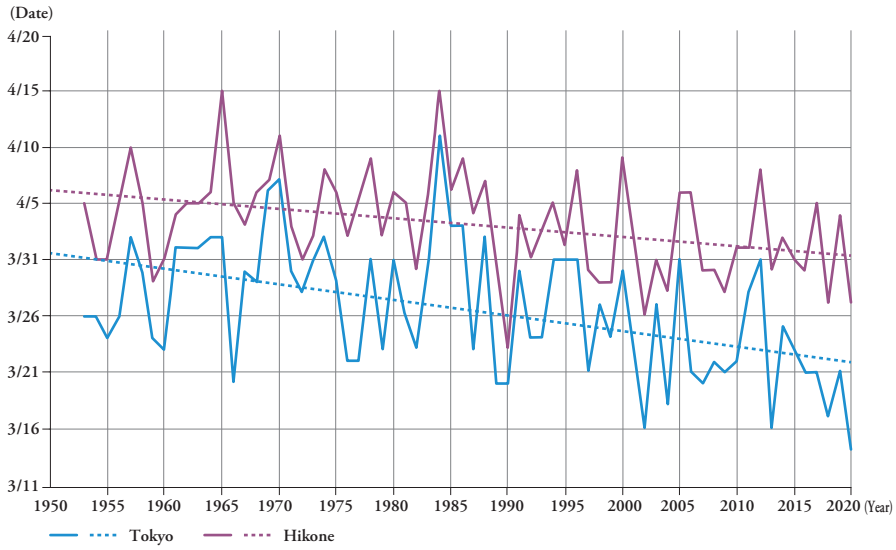
Figure 3 shows the dates when cherry trees began blossoming in Tokyo and Hikone.

Statistical records begin in 1953, and clearly show that cherry trees have been blossoming earlier in both Tokyo and Hikone in recent years. Acceleration began in the 1990s and the trend has been pronounced in the years since 2000.

The anomaly of the very late bloom in both Tokyo and Hikone in 1984 is due to the fact that it was a very cold year; the average temperature in Tokyo was 4.4°C

lower in January, 5.3°C lower in February, and 4.8°C lower in March compared with the same months in 2020. Incidentally, the average monthly temperature in Tokyo in January 1984 was 61st lowest among all years since records began in 1876, February ranked 22nd, and March ranked 14th, so these temperatures were not particularly low compared with a less urbanized Tokyo. However, the average monthly temperature in Tokyo in January 1984 was 5th lowest among all years since 1953, the year in which cherry blossom statistics were first recorded, February was the lowest, and March ranked 2nd. It underscores the fact that Tokyo in 1984 was particularly cold among recent years.

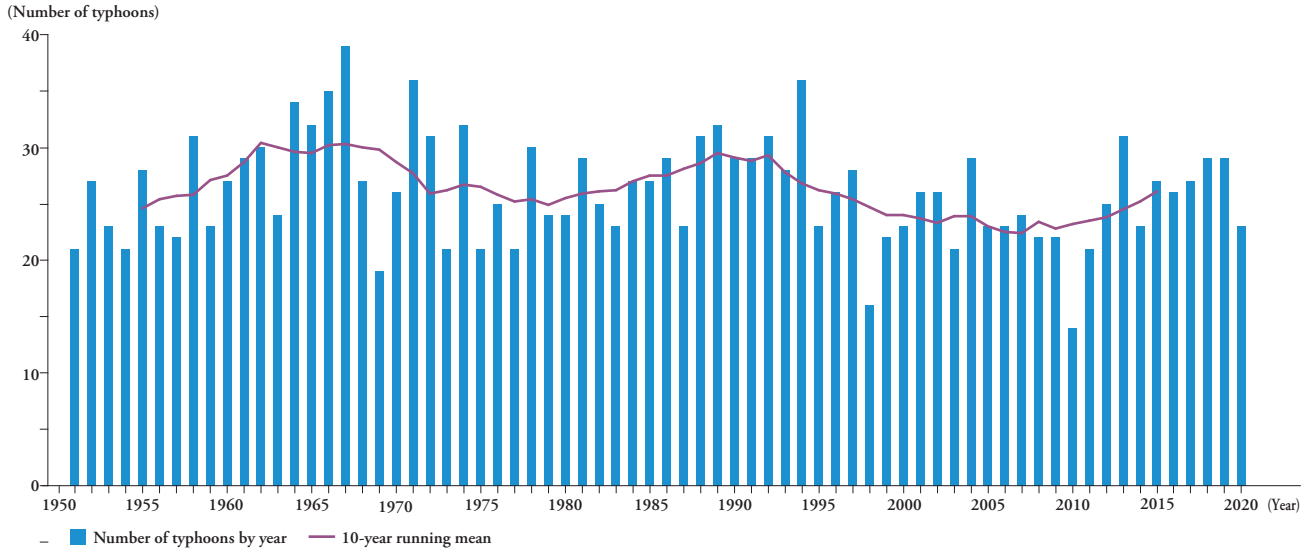
Figure 3: Cherry Blossom Dates in Tokyo and Hikone



F. Number of Typhoons and Typhoon Landfalls

Figure 4 shows the results of an investigation into the number of typhoons by year[6] to see if typhoons have become more frequent in recent years. The data indicate that the number of typhoons is not trending upward. Few typhoons occurred from 2000 to 2010. While typhoons have increased since 2010, the number is still lower than in the 1960s and around 1990, when the number of typhoons was high.

Figure 4: Number of Typhoons by Year



In addition, typhoons making landfall in Japan[7] were most frequent in 2004 during a period when the number of typhoons was otherwise low. Table 8 shows the years when typhoons made landfall frequently, but shows the number has not been trending upward in recent years.

Table 8: Ranking of Typhoon Landfalls in Japan by Year

Rank	Landfalls	Year
1	10	2004
2	6	1990, 1993, 2016
5	5	1954, 1962, 1965, 1966, 1989, 2018, 2019

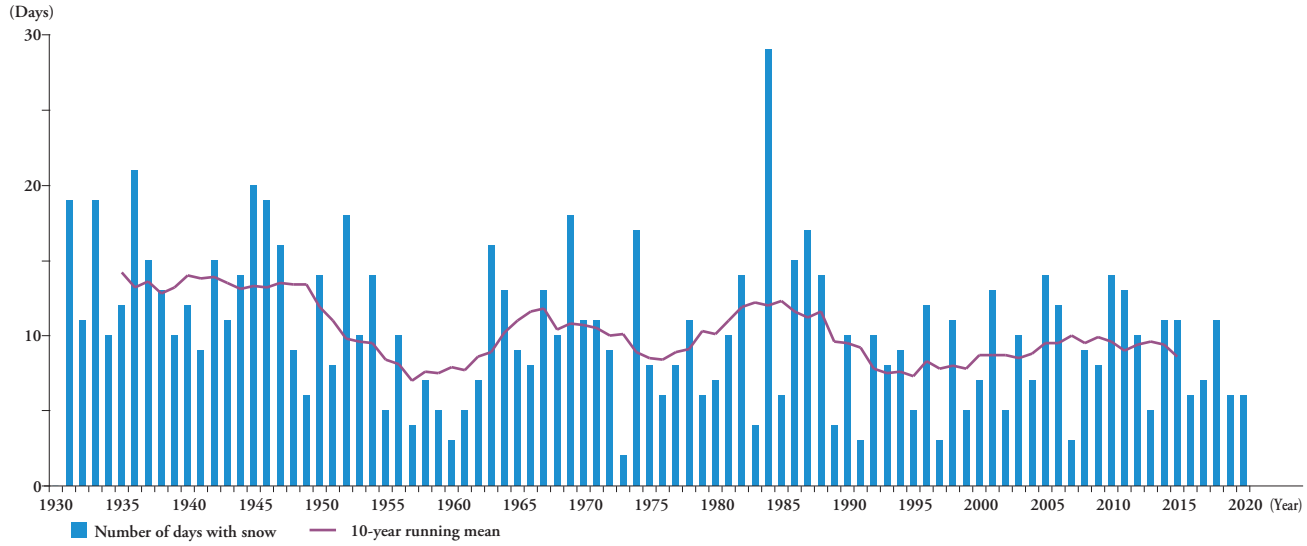
Typhoons with the strength of Typhoon Nancy (1961) and Typhoon Vera (the Isewan Typhoon, 1959) have not struck in recent years. As I mentioned at the beginning of this paper, Typhoon Jebi in 2018 caused the highest claims paid of any typhoon in Japan, but it was not nearly as powerful as Typhoon Nancy or the Isewan Typhoon – their central pressure at landfall was more than 20 hPa lower than that of Typhoon Jebi.

However, the widely accepted view is that global warming will cause fewer but more powerful typhoons to approach Japan. Future global warming and typhoon-related developments require continued attention.

G. Heavy Snowfall

In 2014, heavy snowfall mainly in inland areas of the Kanto region, including Tokyo, set significantly higher records for snow depth, and incurred claims paid of over 300 billion yen.[1] According to statistics, heavy snowfall trends seem to differ from temperature trends.

Figure 5: Days with Snow in Tokyo by Year



Note: Table uses data from the Japan Meteorological Agency website.

Figure 5 shows the number of days with snow in Tokyo.

Days with snow have decreased in recent years compared to before 1950, but have not decreased significantly when compared to around 1960 and 1995. By the way, in 1984, the year in which the cherry blossoms were significantly later as I mentioned above, the number of days with snow was 29. It was a particularly large number, reflecting the cold winter.

Table 9 shows major locations where the deepest snow was observed during the heavy snowfall in February 2014. These points are located along the Pacific coast.

Table 9: Major Locations Where Deepest Snow in Month Was Observed during Heavy Snowfall in February 2014

Observation Point (Year observation began)	Deepest Snow in Month (cm)	Observation Date
Kofu (1894)	114	February 15, 2014
Kawaguchiko (1933)	143	February 15, 2014
Kumagaya (1896)	62	February 15, 2014

Supplementing the above table, the second-ranked snowfall in Kofu was in 1998 and five out of the top ten snowfalls in Kawaguchiko were in the past 30 years. This seems contrary to the trend toward the decrease in heavy snowfalls in

recent years. In Tokyo, however, only one of the top ten snowfalls was in the past 30 years, so the snowfall trend varies by region.

Also, record snowfalls in the heavy snow belt along the Sea of Japan have tended to be less frequent in recent years compared with the observation points along the Pacific coast mentioned above. However, in Hijiori, Yamagata Prefecture, six of the top-ten records for monthly snow depth occurred during the 20 years since 2001. Hijiori is located along the Sea of Japan and holds the record for Japan's fourth-highest snow depth at 445 cm, with record snowfalls for the 40-odd years since 1982.

Supplement: The deepest snow depth during a given month is used for the snow depth record at each observation point.

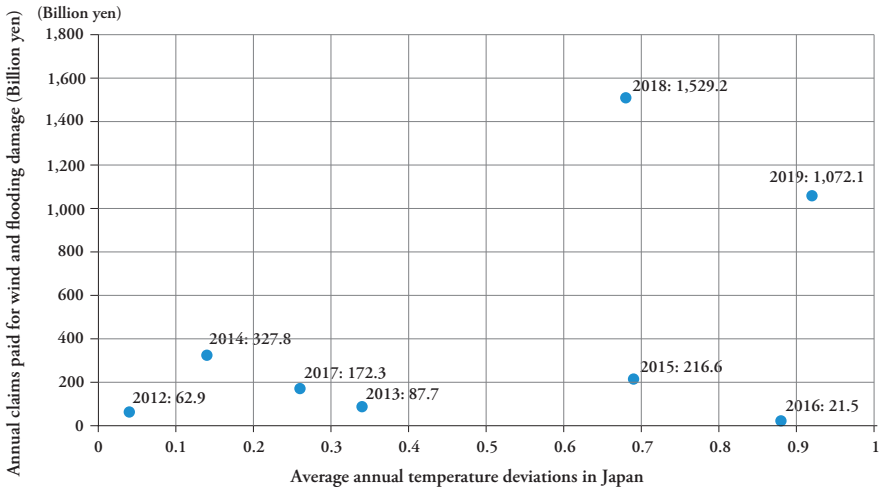
(2) Relationship between Climate Change and the Scale of Wind, Flooding and Other Natural Disasters

Has the risk of wind and flooding damage increased due to the rise in average annual temperatures in Japan? To answer this question, I investigated the relationship between average annual temperatures in Japan and claims paid annually due to wind and flooding damage. Wind and flooding damage includes damage from wind, flooding, large-scale fires, and snow.

Average annual temperature deviations in Japan are the figures announced by the Japan Meteorological Agency.[8] At the same time, claims paid information for wind and flooding damage is data published by the General Insurance Association of Japan. Information on claims paid annually for wind and flooding is not available, so the figures used are actually the figures from total claims paid for large-scale natural disasters[9] announced since 2012. This is a good proxy given the availability of information because wind and flooding damage accounts for a large proportion of claims paid for large-scale natural disasters.

Figure 6 shows average annual temperature deviations in Japan and annual claims paid for wind and flooding damage as defined above.

Figure 6: Average Annual Temperature Deviations in Japan and Annual Claims Paid for Wind and Flooding Damage



* The baseline for average annual temperature deviations in Japan is the 30-year average from 1991 through 2020.

In conclusion, the correlation coefficient between average annual temperature deviations and total claims paid for wind and flooding damage is 0.45, which is positive but not particularly compelling for several reasons. The statistical period is short at eight years, and typhoons come from the sea in the south and are not only affected by the temperature near Japan. Moreover, the pressure pattern at the time of individual events such as typhoons and the Baiu front (rainy season front) determines their strength, so the correlation with average annual temperature is not considered high in the first place.

4. Conclusion

Section 3 above considered climate change and trends from the past to the present from various perspectives. Meteorological phenomena occur due to interrelationships among extremely complex factors and any conclusions would require more detailed investigation. However, the following tendencies are apparent.

Items	Climate Change and Trends from the Past to the Present
Temperature	An upward trend is clear. A strong upward trend in temperature is particularly pronounced in recent years.
Precipitation	Although annual precipitation is not trending upward, precipitation in short intervals is trending upward and contributing to flooding damage.
Wind speed	A trend toward stronger wind is not apparent.
Cherry blossoms	Cherry trees have been blossoming earlier.
Typhoons	No particular change is apparent in number or landfalls.
Heavy snowfall	New records have been set for heavy snowfall in recent years, so heavy snow seems no less likely.

The above conditions only show the impact of climate change to date. The actual impact of climate change does not live up to the clamor surrounding it, but that may not be the case going forward. Fortunately, the present influence of climate change is as per the table above.

Non-life insurance companies are required to help reduce the social impact of natural disasters by providing stable non-life insurance coverage. They also must aggressively implement measures to both mitigate climate change in ways such as reducing greenhouse gas emissions and adapt to climate change by preparing for adverse effects, while proactively participating in global initiatives such as the SDGs.

Selected Bibliography

1. General Insurance Association of Japan: *Fact Book 2019-2020 – General Insurance in Japan*, page 78.
2. Japan Meteorological Agency website: Method for calculating annual temperature deviation in Japan.
https://www.data.jma.go.jp/cpdinfo/temp/clc_jpn.html
3. Japan Meteorological Agency website: National ranking over time.
https://www.data.jma.go.jp/obd/stats/etrn/view/rankall.php?prec_no=&block_no=&year=&month=&day=&view=a2
4. Japan Meteorological Agency website: Deviations over time in annual precipitation in Japan (1898-2020).
https://www.data.jma.go.jp/cpdinfo/temp/an_jpn_r.html
5. AMeDAS: Annual number of events with precipitation ≧ 80mm per hour in Japan.
https://www.data.jma.go.jp/cpdinfo/extreme/extreme_p.html
6. Japan Meteorological Agency website: Number of typhoons.
https://www.data.jma.go.jp/fcd/yoho/typhoon/statistics/generation/generation.html
7. Japan Meteorological Agency website: Number of typhoon landfalls.
https://www.data.jma.go.jp/fcd/yoho/typhoon/statistics/landing/landing.html
8. Japan Meteorological Agency website: Annual average temperature deviations in Japan over time (1898-2020).
https://www.data.jma.go.jp/cpdinfo/temp/an_jpn.html
9. General Insurance Association of Japan website: Claims paid due to wind and flooding damage, etc.
https://www.sonpo.or.jp/report/statistics/disaster/index.html

3. Influence of Short-Term Climate Variability on Climate Change and its Possible Implications for Risk Quantification

Kazuhiro Tsubono, MSc., Hongyuan Li, Ph.D., Oriol Gaspa Rebull
Aon Japan Reinsurance Solutions Analytics

1. Introduction

There has been a fair amount of discussion in the (re)insurance industry about the recent typhoon activity in Japan and its relationship with climate change.

In this article we will explore the available academic literature and meteorological data for Japan and how the interaction between Climate Variability and Climate Change is potentially affecting the present and future typhoon activity. We will also explore some climate change related trends observed in the data and what it could mean for the future of typhoon risk quantification.

To guarantee a mutual understanding between the authors and the reader, it is necessary to define two very important concepts that will follow through the whole article:

- We refer to Climate Variability as the variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all spatial and temporal scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability) as defined by the IPCC [1].
- We refer to Climate Change as the change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods as defined in the Framework Convention on Climate Change (UNFCCC) in its Article 1 [2].

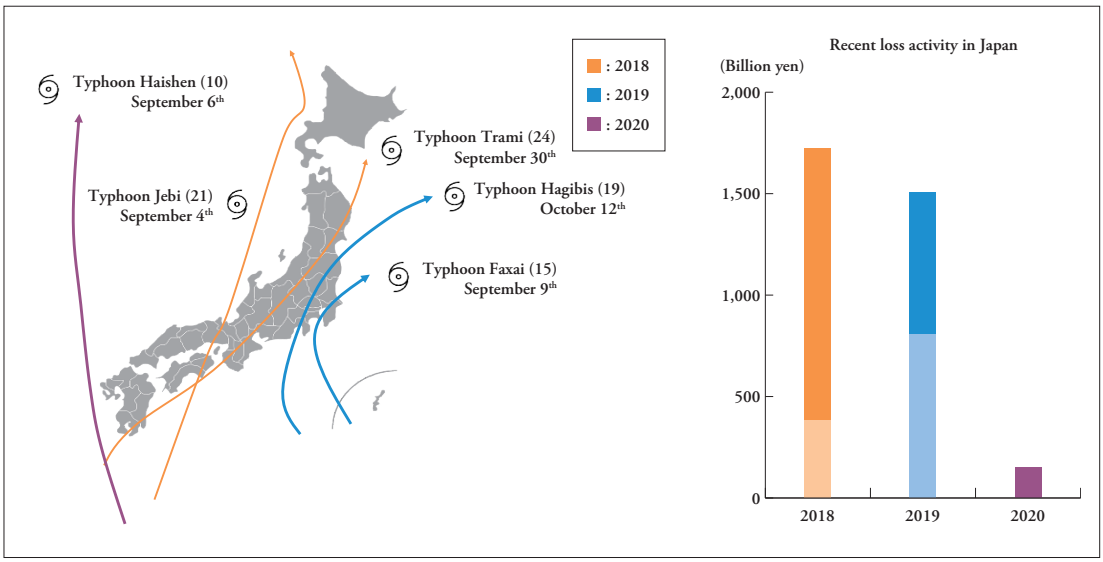
In other words, Climate Variability consists of high frequency climate oscillations, some of which account for short term (1 to 5 years) phenomena like El Niño Southern Oscillation (ENSO) or the Atlantic Multidecadal Oscillation (AMO), while Climate Change represents patterns of change in a longer time scale (i.e. 30 years).

Regardless of the definition, there is overwhelming evidence that climate change will have an impact on meteorological conditions in the longer term and at a global scale. However, it is difficult to assess the near-term impact of climate change as other short-term phenomena included under the climate variability also influence near-term climatological trends.

(1) The recent typhoon activity in Japan

The recent years have seen high typhoon landfall activity in the Northwest Pacific: 2018 and 2019 in Japan. In 2018 and 2019 Japan suffered 3 of the top 5 weather related insured losses in history, the most material of them Typhoon Jebi, estimated at $13 billion by Impact Forecasting [3].

Figure 1: Best typhoon track provided by JTWC (Joint Typhoon Warning Center) and loss estimates by Impact Forecasting across Japan in 2018, 2019 and 2020



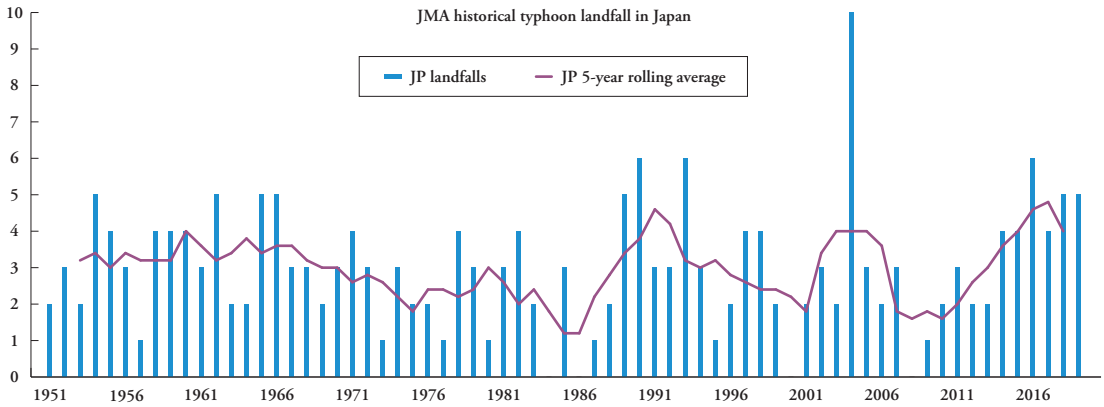
If we compare the 30-year long-term average (as defined by JMA) and the last 3 years of typhoon landfalls, we can see that each of the last 3 years' landfall activity has been outside the one standard deviation, which shows a big contrast between short and long-term activity. In other words, a large climate variability.

Year	JMA Landfalls
2018	5
2019	5
2020	0
Long-term average	2.7 ± 2.1

While the long-term average used in this article is defined by JMA as the 30-year average from 1981 to 2010, JMA is soon to release a new long-term average from 1991 to 2020. Under this new metric the long-term average is 3.0 ± 2.1 and technically only 2019 falls outside the 1 standard deviation, but the contrast between long- and short-term activity remains significant.

High typhoon landfall activity might not have been seen in Japan in the recent 15 years, but climate variability is certainly not new as seen in the last 70 years of JMA landfall data, especially since the mid-1980s (Figure 2).

Figure 2: Typhoon landfall in Japan as provided by the JMA since 1951 [reference 4]



* The line shows the 5-year rolling average.

We introduced the 5-year rolling average to better represent some of the short-term phenomena that drive climate variability like El Niño and reduce the noise brought by the very short-term activity. Periods of ENSO cycle range from 2 to 7 years, so its impact can be narrowed to specific years, but it will not be seen in the long-term.

(2) What does climate change research tell us?

Climate change is a very complex issue that is not fully understood. Hundreds of scientists have spent years studying the anthropogenic and non-anthropogenic factors driving the rise in global temperatures and other phenomena.

The best way to start getting a sensible picture of the potential effects of climate change in Japan is to revise available scientific literature in a comprehensive way.

Rather than looking for specific changes to typhoon, we have selected three wide-ranging reports which review the latest studies regarding potential impact of Climate Change and summarize a level of consensus among the scientific community. This guided our decision-making process.

1	**The Japan Climate Change 2020 by MEXT, JMA** [4] *Region: Japan*	The Ministry of Education, Culture, Sports, Science and Technology (MEXT) and the Japan Meteorological Agency (JMA) have compiled the facts about climate change observed so far, and the future projections of the global average temperature under the 2°C increase scenario (RCP2.6) and the 4°C increase scenario (RCP8.5)
2	**Cha et al., 2020** [5] *Region: Northwest Pacific Scope*	Additional inputs with more focus on the Northwest Pacific Basin have been gathered from the assessment requested by the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) and the World Meteorological Organization (WMO) Typhoon Committee
3	**Knutson et al., 2019** [6] *Region: Global*	We have also used the report from the World Meteorological Organization Task Team on Tropical Cyclones and Climate Change where 11 authors provide their opinion on proposed projections of a 2°C global warming scenario relative to 1986-2005 conditions

Looking into the future, the most up to date scientific reports seem to have clear agreement on the increase of typhoon intensity although specifics about basins are still unclear. Beyond that, there is no real consensus on how frequency of typhoons will change between now and 2050.

The areas where the scientific community appears to have relatively higher agreement on climate change regarding typhoon occurrence are seen in the table below:

Risk Factor	Risk Change	Confidence Level	Impact on Flood Risk
Typhoon intensity	Increase	Medium to High	The academic community agrees that with higher temperatures typhoons are likely to become more intense
TC induced precipitation	Increase	Medium to High	There is a similar level of agreement that higher level of moisture in the air will increase the level of induced precipitation, thus increasing the contribution of flooding to potentially larger wind losses due to more intense typhoons

Looking into the past, in their 2020 report, the JMA did not find significant long-term trends in typhoon formations, strong typhoon landfalls or clear differences between climate change and the natural 10-20 year variability.

So, if there are no clear patterns observed in the past data nor clear agreement on future trends, what else can be said about the recent typhoon activity?

2. The Correlation between Anomalies

Japanese typhoon landfall activity oscillations are starting to be understood although there is still no clear scientific consensus. Findings based on studies by Professor Fudeyasu of YNU [7] suggest El Niño brings a higher number of landfalls in early summer and an increase in typhoon intensity in late summer.

So, while there are indications of the influence of ENSO phases in the Japan landfall activity, there is not enough evidence to directly link it to the 2018/19 seasons.

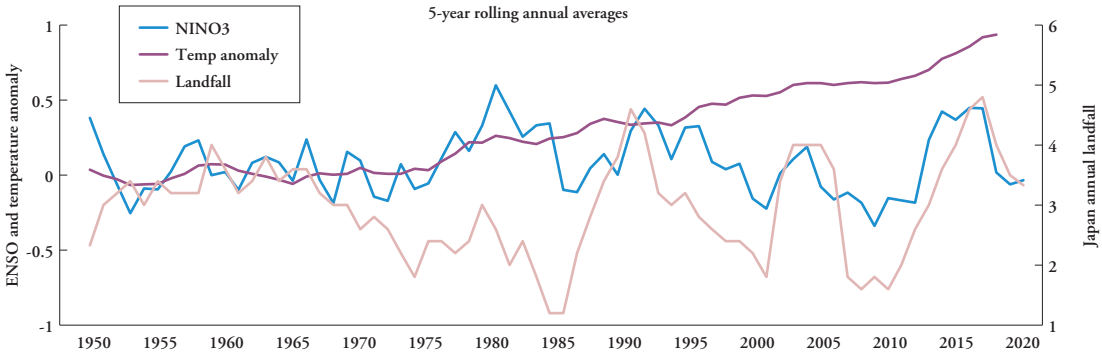
While there are no clear frequency patterns in the long-term typhoon activity (30-year average), the JMA landfall data shows 3 peaks and 2 cycles of high and low typhoon activity (1990-95, 2003-07 and 2016-19) with an average transition period of 13 years since the 1970s (Figure 2).

If we introduce the ENSO anomaly to the mix (Figure 3), we can also see a substantial change in the variability with longer term ENSO cycles since the 1970s. Even more interesting maybe is the strong correlation between the ENSO anomaly cycles and the typhoon activity.

There are many factors that could drive such changes in climate variability. We could be simply looking at a phase of cyclical climate variability within the longer climatology, but things turn very interesting when we include global trends linked to climate change.

Once we overlay the global temperature anomaly to the landfall activity and ENSO, we can match the emergence of the initial stages of the ENSO and landfalls long activity cycle with the late 1970s decade, the same decade when global temperatures started a strong deviation from the long term average.

Figure 3: Time series of NOAA's annual global temperature anomaly [reference 8], 5-year rolling average of JMA's typhoon landfall in Japan and the 5-year rolling average of JMA's annual ENSO anomaly [reference 9].

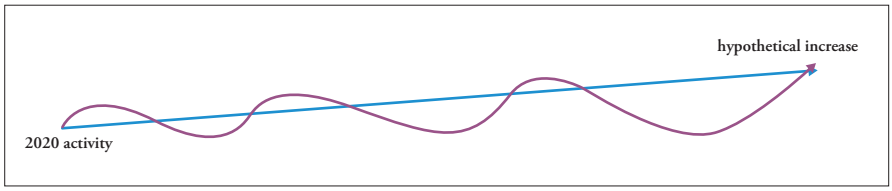


The relationship between global warming and ENSO is not new and it has been addressed in scientific articles before [10].

What we see here though, is a first regional attempt at correlation between climate variability (ENSO anomaly) and climate change (global temperature anomaly) and how it potentially affects typhoon activity in Japan (JMA typhoon landfall) and by default the probability of having more or less typhoon losses in the future.

What is most interesting is the possibility of climate change influencing (or amplifying) the natural climate variability oscillations rather than just causing an incremental change of typhoon activity. In other words, could the climate change impact on typhoon frequency be a non-linear (cyclical) phenomenon (Figure 4)?

Figure 4: Schematic of the changes in frequency of typhoons due to climate change



* The straight line represents a linear increase where each year there is a marginal frequency increase compared to the previous one. This is the most common approach taken in the present climate change conditioning of catastrophe models. The wave line represents a non-linear change where the overall increase of typhoons is subject to periods of low and high activity.

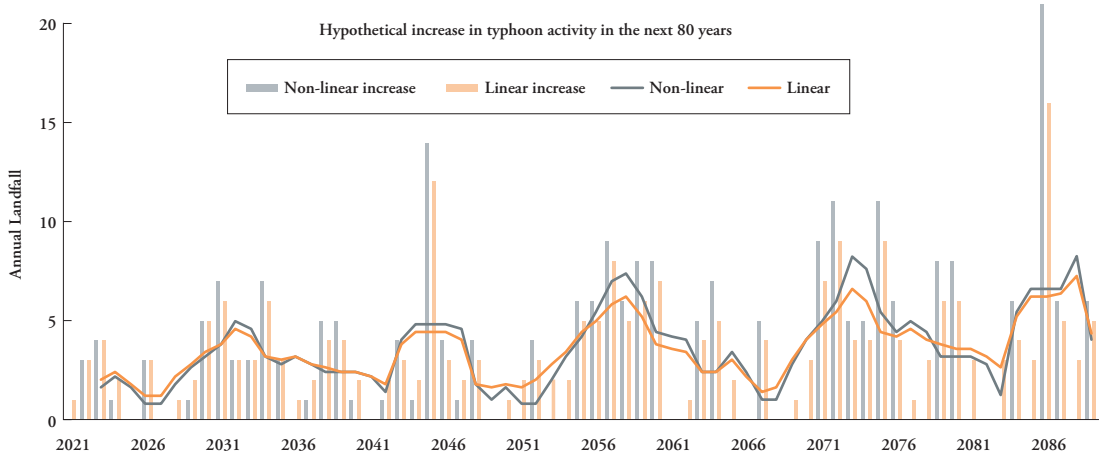
If such correlation is confirmed in the future, the implications are wide-ranging and important, but for now we would like to highlight two: Changes in typhoon landfall and Changes in risk quantification.

(3) Changes in typhoon landfall

Depending on what trend the future holds we could see a very different type of landfall activity to what we have been experiencing so far.

- If we follow a linear trend, we expect to see an overall and gradual increase of typhoon landfall in Japan overarching the on-going climate variability. Basically, each year would have a marginal frequency increase compared to the previous one (Figure 5 in orange).
- If we follow a non-linear trend, periods of high and low typhoon activity could become longer, more and/or less active depending on what part of the cycle we are in (Figure 5 in grey).

Figure 5: Frequency changes under a linear and non-linear change of typhoon activity



* The linear increase (orange) shows similar cycles of climate variability but with a marginal increase of annual landfall events by 2060/80. The non-linear increase (grey) shows periods of higher activity compared to the linear increase (grey line higher than orange), but crucially also periods of lower activity compared to the linear 5-year rolling average (longer periods of time with no grey bars).

The outcomes of these two scenarios are very different.

- The linear approach represents a general increase of typhoon activity in the future, where basically typhoons would make landfall in Japan more often, hence increasing the probability of small or larger losses, depending on the individual typhoon characteristics and exposure affected.
- The non-linear approach would increase the already large variability linked to typhoon landfall. Periods of higher activity compared to now would mix with short period of no activity or longer periods of lower activity, thus increasing volatility of typhoon losses and making typhoon losses less predictable with the present modelling tools.

(4) Changes in risk quantification

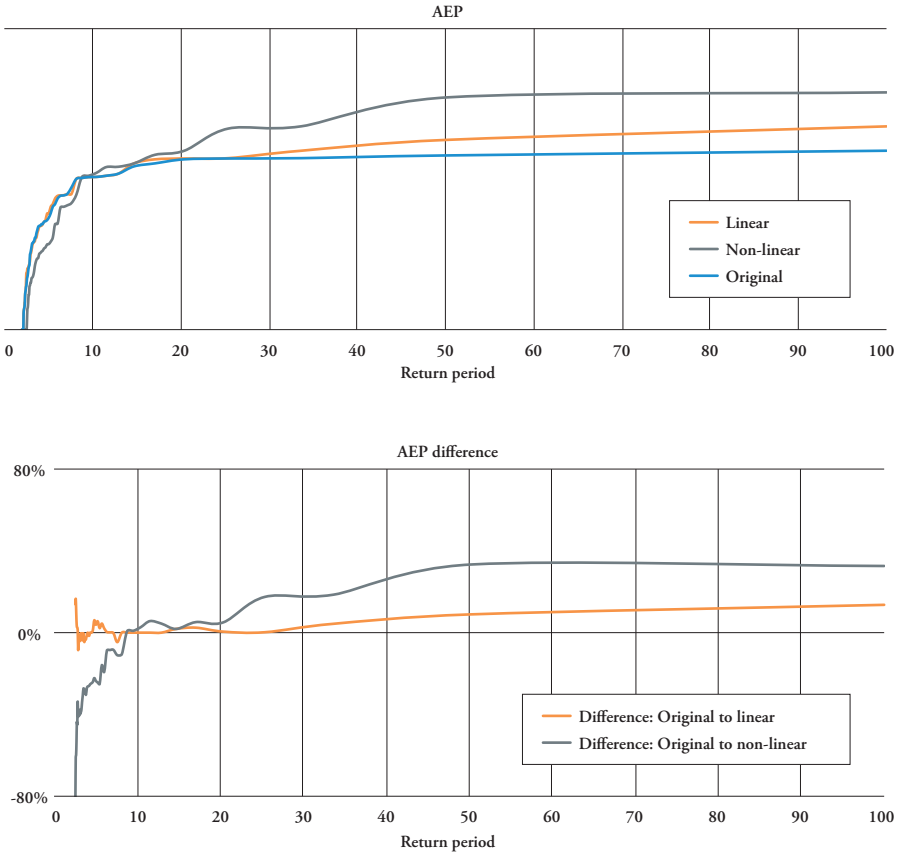
The implications of a linear versus a non-linear change in typhoon activity are also important in the development of climate change-based catastrophe models.

Occurrence and Aggregated Exceedance Probability (OEP and AEP) curves would look very different depending on what methodology is followed. In a non-linear approach the number of typhoons in the YLT would change dramatically. YLTs would have to include some periods of time with a higher number of typhoons and other periods with a lower number of events.

To exemplify the impact of the linear and non-linear changes, we have used the same hypothetical changes in frequency shown in Figure 5 to calculate the resulting AEP of a linear and non-linear typhoon activity compared to the present (Figure 6).

While the linear approach basically shows a gradual increase compared to the original curve, the non-linear one shows differences ranging between -80% at lower return periods to +30% in the tail.

Figure 6: Top: Original sample AEP (Blue), AEP under a linear increase of frequency (Orange) and AEP under a non-linear increase of frequency (Grey).
Bottom: Differences between approaches by return period.
Differences range between 80% at the lower return periods to 40% in the tail.



These different behaviours are a representation of the stochastic nature of EP curves. Even though the physical impact of climate change on typhoon is not expected to be seen until 2050, the stochastic nature of catastrophe models will change the shape of the EP curve across all return periods as seen in Figure 6.

This means that on average, if we were to experience a non-linear change of typhoon frequency under climate change influence, the level of losses at high frequency events (RP < 10 years) would reduce, but losses at higher return periods (RP > 30) would increase.

A non-linear approach brings a different concept of climate change impact compared to current assumptions and essentially challenges the underlying assumptions of Poisson frequency adopted by many cat models. The confirmation of a non-linear trend would force modelling companies to consider some kind of time-dependency approach to the frequency component of the hazard.

Apart from the inherent complexity of creating a time-dependent hazard component with such limited historical data, the implications on risk quantification will also be highly dependent on the degree of frequency and severity changes to be implemented in the models. It is clear the level of uncertainty linked to climate change is very large and the modelling implementation of it can feel slightly overwhelming.

3. Implications for Japanese Insurers

In April 2021, the Financial Services Agency (FSA) and the Tokyo Stock Exchange (TSE) shared initial ideas regarding the update of corporate governance codes [11]. Though there are no concrete requirements, there are some basic principles in the code related to climate change.

Within the 2nd basic principle there is some consideration for global environmental issues mostly related to the physical aspect of climate. The 3rd basic principle encourages listed companies to appropriately disclose financial information.

In particular, the guidelines suggest "*that companies should collect and analyze the necessary data on the impact of climate change risks and profit opportunities on their business activities and profits. These companies should also promote the enhancement of the quality and quantity of disclosure based on TCFD (Task Force on Climate-related Financial Disclosures), which is an internationally established disclosure framework, or an equivalent framework.*"

The corporate governance code requires the companies listed in the first section of the TSE (東証一部) to disclose the above information but without being forced by the law. Nevertheless, explaining the reason why companies will not disclose the information will be required.

The relevance of climate change on financial disclosures is increasing and it will be important for companies to be able to clearly articulate to regulators the impact of climate change risks and profit opportunities on their business activities and how reinsurance can mitigate any negative impact.

Climate models and academics suggest a noticeable, alas not fully quantified,

increase in frequency of typhoons as soon as 2050. Being able to understand and model the inner dynamics of frequency changes, regional patterns, intensity variations and other relevant parameters will be strongly linked with companies' capability of disclosing the financial implications of climate change.

By exploring a wide range of parameters linked to climate change, climate variability and the uncertainties around their relationship now, stakeholders can establish a robust framework relevant to their portfolio and be ready to address future regulatory requirements and make informed decisions on underwriting, capital adequacy, risk management and reinsurance.

4. Conclusions

The most up to date scientific reports show no real consensus on how frequency of typhoons will change between now and 2050; past data do not show any clear patterns either. The only clear agreement across the scientific community is on the increase of typhoon intensity in the longer term although specifics about basins are still unclear.

Climatological data points towards a strong component of climate variability in the recent 2018/19 typhoon seasons in Japan (similar to 2004) and the possibility of this climate oscillation to remain the same or even increase in the future depending on the global and/or regional climate change impact.

Volatility of cat losses could increase in the future, especially if we add the potential changes in other perils like rain, drought, snow and other atmospheric related phenomena due to climate change.

The development of frameworks to achieve the most comprehensive quantification of the changes in all atmospheric risks due to climate change possible, will provide insurers with a more informed degree of risk management as well as an established and sound forum for discussion with all stakeholder to achieve a sustainable market in the future.

It is widely accepted that catastrophe models are the best available tools to tackle some of these quantification issues, but it is also very important to understand their underlying data, limitations and strengths to be able to develop credible alternatives that better align with companies' views of risk.

Disciplines like model development, model evaluation, calibration and validation will become more and more relevant as modelling tools increase their complexity, in order to reduce the uncertainty around climate change impact.

The world is getting more volatile, more uncertain and more extreme, leading investors and regulators towards increasing their requirements for more disclosure of the impact on businesses (insurance or otherwise) of climate change.

The (re)insurance sector with its deep knowledge of catastrophe risk has the possibility of tackling this challenging topic from an angle of growth and opportunity, increasing transparency with customers and developing products on the primary side to leverage new reinsurance solutions to hedge some of that risk. These are only some of the possibilities open to the industry.

5. References

1. IPCC, 2012: Glossary of terms. In: "Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation" [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)]. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change (IPCC). Cambridge University Press, Cambridge, UK, and New York, NY, USA, pp. 555-564.
2. United Nations, 1992, "United Nations Framework Convention on Climate Change":
https://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf
3. Aon, Aon Catastrophe Insight
http://catastropheinsight.aon.com/Pages/Home.aspx
4. The Ministry of Education, Culture, Sports, Science and Technology (MEXT) and the Japan Meteorological Agency (JMA), "Japan Climate Change 2020":
https://www.data.jma.go.jp/cpdinfo/ccj/index.html
5. Eun Jeong Cha, Thomas R. Knutson, Tsz-Cheung Lee, MingYing, Toshiyuki Nakaegawa. "Third assessment on impacts of climate change on tropical cyclones in the Typhoon Committee Region – Part II: Future projections." *Tropical Cyclone Research and Review*. Volume 9, Issue 2, June 2020, Pages 75-86
6. Thomas Knutson, Suzana J. Camargo, Johnny C. L. Chan, Kerry Emanuel, Chang-Hoi Ho, James Kossin, Mrutyunjay Mohapatra, Masaki Satoh, Masato Sugi, Kevin Walsh and Liguang Wu. "Tropical Cyclones and Climate Change Assessment: Part I: Detection and Attribution" *American Meteorological Society*. October 2019. DOI: https://doi.org/10.1175/BAMS-D-18-0189.1
7. H. Fudeyasu, S. Iizuka and T. Matsuura. "Impact of ENSO on landfall characteristics of tropical cyclones over the western North Pacific during the summer monsoon season," *Geophysical Research Letters* Vol. 33, L21815, doi:10.1029/2006GL027449, 2006. (Prof. Fudeyasu El Niño Japan article)
8. National Oceanic and Atmospheric Administration, Climate Monitoring section:
https://www.ncdc.noaa.gov/cag/time-series/global/globe/land_ocean/1/12/1880-2016
9. The Japan Meteorological Agency, Global Environment and Climate section:
https://www.data.jma.go.jp/gmd/cpd/db/elnino/index/nino3idx.html
10. Cai, W., Wang, G., Dewitte, B. et al. "Increased variability of eastern Pacific El Niño under greenhouse warming." *Nature* 564, 201–206 (2018). DOI: https://doi.org/10.1038/s41586-018-0776-9
11. Revisions of Japan's Corporate Governance Code and Guidelines for Investor and Company Engagement, "Council of Experts Concerning the Follow-up of Japan's Stewardship Code and Japan's Corporate Governance Code," Financial Services Agency (FSA): https://www.fsa.go.jp/en/news/2021/20210407.html

4. Trends in Japan's Non-Life Insurance Industry

Non-Life Planning Department
The Toa Reinsurance Company, Limited

1. The Operating Environment of the Non-Life Insurance Industry

The GDP of Japan ranks third in the world and its economy has continued to grow moderately in recent years. However, Japan's population has been declining since 2008, and its low birthrate and aging population are expected to continue.

Looking at the Japanese non-life insurance market, automobile insurance currently accounts for about half of net premium income of direct non-life insurance companies. Factors including new advances in automated driving technology are projected to change the structure of the non-life insurance industry. In fact, conditions in the non-life insurance industry have been changing rapidly over the past several years. In addition to having to cover frequent natural disasters such as earthquakes and typhoons, the industry has had to deal with changing risks related to COVID-19 and silent cyber risks, which involve the risk of cyber loss on existing business classes such as property insurance and casualty insurance.

Non-life insurance companies in Japan are targeting further growth by doing business overseas, developing new markets by providing new products and services, and implementing initiatives to increase operating efficiency.

2. Overview of the Non-Life Insurance Industry

(1) Status of Non-Life Insurance Companies, Cooperatives and SASTI

Japan's non-life insurance industry comprises 28 Japanese non-life insurance companies that are members of the General Insurance Association of Japan (GIAJ) and 18 companies that are members of the Foreign Non-Life Insurance Association of Japan, Inc. (FNLIA). Japan's non-life insurance market is an oligopoly in which the three largest non-life insurance groups (in alphabetical order; MS&AD Insurance Group Holdings, Inc., Sompo Holdings, Inc. and Tokio Marine Holdings, Inc.) account for more than 86% of the 8,692 billion yen in net premium income written by the 28 GIAJ members as a whole.

Japan's non-life insurance companies have increased operating efficiency since liberalization of the insurance industry in 1996, and have conducted mergers and business integrations since 2000. As a result, for all non-life companies, the underwriting expense ratio (other than commission and brokerage) in fiscal 2020 decreased to 14%, compared with 21% for all non-life insurance companies in the industry for fiscal 1995, prior to liberalization.

The cooperative mutual insurance market also has considerable premium volume. Even if we look only at the main cooperatives that make up the Japan Cooperative Insurance Association Incorporated, they alone had premium income of 2,535 billion yen in fiscal 2019 (excluding life cooperatives and pension cooperatives).

Furthermore, Small Amount Short Term Insurance ("SASTI") business was introduced in Japan following an amendment to the Insurance Business Act in April 2006, and it is also providing customers with non-life insurance cover. As the name implies, this business is limited to selling insurance in small amounts with limited terms. On the other hand, regulations make it possible for companies that are not insurance companies to enter this business much more easily than in the case of

establishing a new insurance company. For example, companies need only register and need not be licensed by the Financial Services Agency (FSA) to operate, the minimum capital required is 10 million yen compared to 1 billion yen for an insurance company, and participants may sell both life and non-life insurance. The number of member companies of The Small Amount & Short Term Insurance Association of Japan continues to grow and the scale of the market continues to expand. Non-life insurance products sold in this market are mainly renters insurance, including fire insurance for the home contents of renters and rental housing liability insurance sold through the real estate agent channel, recent strong-seller pet insurance, and pecuniary insurance.

The Small Amount & Short Term Insurance Market Data

Figure 1: Member Companies

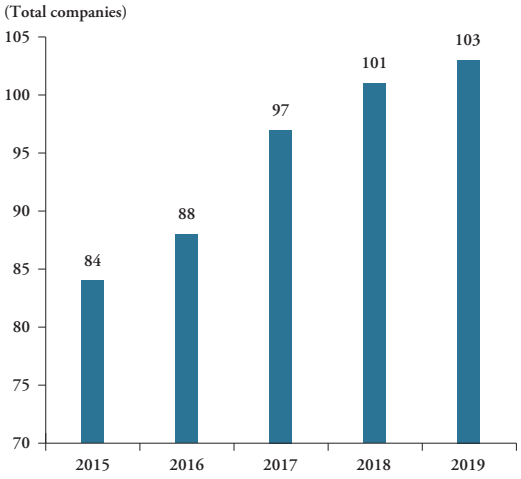
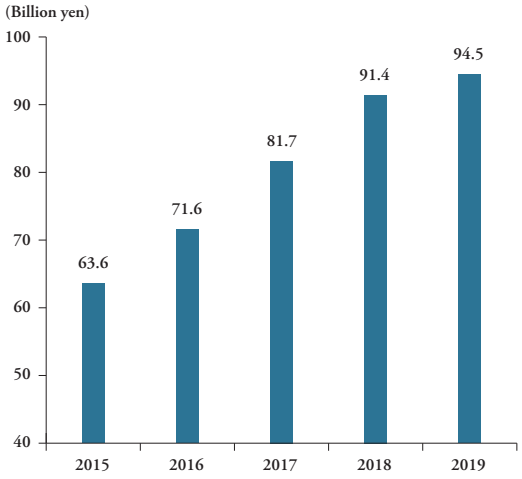


Figure 2: Premium Income (excl. Life and Medical Insurance)



Source: The Small Amount & Short Term Insurance Association of Japan

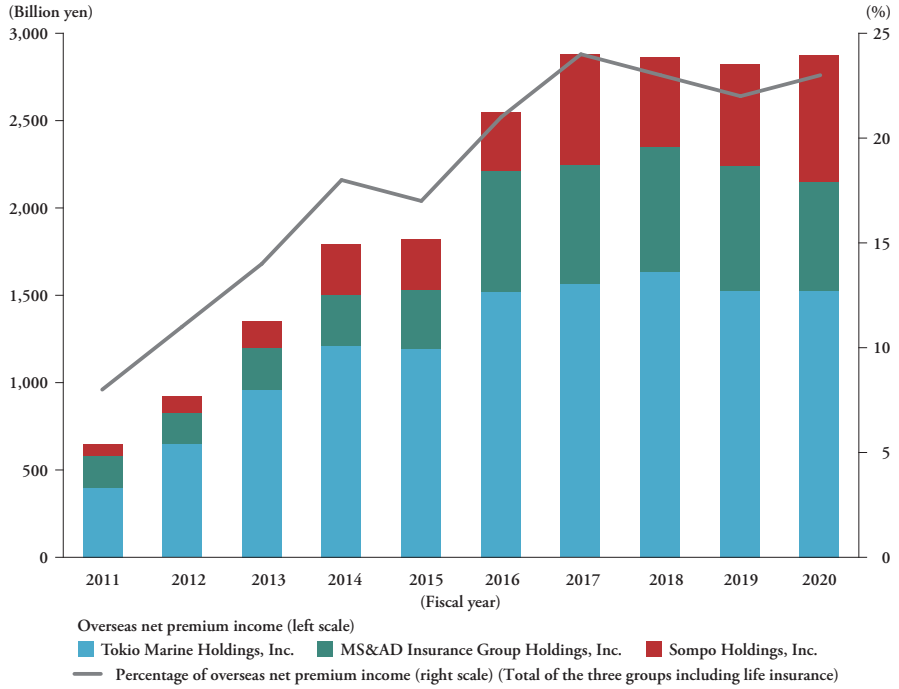
(2) Overseas Business Trends

The three largest non-life insurance groups have all positioned overseas business as a growth driver, and have aggressively implemented initiatives such as forming business alliances with local insurance companies and engaging in M&A.

Figure 3 shows overseas net premium income* for the three largest non-life insurance groups. It increased slightly year on year in fiscal 2020, and has been stable over the past several years. Overseas net premium income for these insurance groups in fiscal 2020 was about 4.5 times that of fiscal 2010, and overseas business accounted for approximately 23% of net premium income for the three largest non-life insurance groups.

* In this section, "overseas net premium income" shows the total of net premium income from non-life insurance and life insurance premiums.

Figure 3: Trends in Overseas Net Premium Income for the Three Largest Non-Life Insurance Groups



The three largest non-life insurance groups have adopted similar strategies in targeting growth opportunities in emerging markets and expanding specialty lines in developed markets. Key overseas business developments of the three largest non-life insurance groups and recent trends are as follows:

MS&AD Holdings group company Mitsui Sumitomo Insurance acquired the general insurance operations of U.K. company Aviva plc in 2004, and is using its non-life insurance businesses in Asia as its base for advancing into the ASEAN region. It enhanced its presence by acquiring Singapore insurer First Capital Insurance Limited in December 2017, and U.S. managing general agent International Transportation and Marine Office, LLC in April 2021. In other markets, it strengthened its reinsurance business and specialty lines by completing the acquisition of Amlin plc of the United Kingdom in 2016.

Sompo Holdings acquired leading U.K. specialty (re)insurer Canopius Group Limited in 2014. In addition, it significantly expanded its overseas business in 2017 by completing the acquisition of Endurance Specialty Holdings Ltd. (now called Sompo International). Also in 2017, Sompo Holdings restructured its overseas business, making Sompo International the core overseas insurance business of the group, and selling all Canopius shares to a private equity investor.

Tokio Marine Holdings has pursued growth opportunities in its overseas business by acquiring businesses in emerging countries, as well as insurance companies with strong specialty lines in developed countries, particularly in Europe and the United States, such as Kiln Ltd. of Lloyd's in the U.K. and Philadelphia

Consolidated Holding Corp. of the U.S. in 2008, Delphi Financial Group, Inc. of the U.S. in 2012 and specialty insurance group HCC Insurance Holdings, Inc. of the U.S. in October 2015. Further, in February 2020 it completed the acquisition of Privilege Underwriters, Inc., which specializes in the U.S. market for personal insurance and risk management services for high net worth individuals and families. At the same time, Tokio Marine Holdings sold its reinsurance subsidiary, Tokio Millennium Re AG and Tokio Millennium Re (UK) Limited in 2018 and reviewed its business portfolio.

(3) Trends in Business Results of Non-Life Insurance Companies for Fiscal 2020

The following is a summary of the main financial results (total) of 28 non-life GIAJ members in fiscal 2020.

Net premium income in all lines of business increased by 83 billion yen from the previous fiscal year to 8,692 billion yen.

Net claims paid (paid basis) decreased by 463 billion yen to 4,563 billion yen because the number of typhoons and other natural disasters in Japan decreased substantially compared to the previous fiscal year. As a result, the loss ratio for fiscal 2020 decreased by 5.9 percentage points to 58.0%.

Expenses increased by 31 billion yen to 2,838 billion yen. The net expense ratio was unchanged from the previous fiscal year at 32.6%.

Underwriting profit (earned/incurred basis) decreased by 1 billion yen to 92 billion yen year on year because of additional provision for catastrophe loss reserves despite the positive factors above.

Ordinary profit, calculated as the sum of underwriting profit and investment profit, increased by 500 million yen to 597 billion yen. After deducting tax expense, net income decreased by 20 billion yen to 437 billion yen.

3. Recent Non-Life Insurance Industry Trends

(1) Fiscal 2020 Trends in the Fire Insurance Market

Multiple large typhoons caused damage in fiscal 2018 and fiscal 2019, but no typhoons made landfall on the mainland in fiscal 2020. The impact of wind and flooding disaster losses on the non-life insurance market was therefore relatively minor. Non-life insurance companies estimated a certain amount of damage for the earthquake that occurred in February 2021 offshore of Fukushima Prefecture, but the impact of natural disaster losses was generally limited.

Table 1: Statistics for Recent Major Earthquakes

	Date	Magnitude	Number of Claims Paid (Personal)	Insurance Claims Paid (Million yen)
Fukushima Earthquake	2021/2/13	7.3	95,258	148,948*
Kumamoto Earthquake	2016/4/14,16	6.5, 7.3	212,316	388,308

*For the Fukushima Earthquake, as of March 31, 2021, including loss reserves
(Source: General Insurance Association of Japan website, "Key figures related to the insurance claims paid for earthquakes in fiscal 2020 as of March 31, 2021," No. 21-01)

However, fire insurance is expected to remain unprofitable in fiscal 2020 for the eleventh consecutive fiscal year. Even though there were fewer natural disasters, issues such as rising reinsurance premiums and more accidents resulting from aging factories made it clear that there have been latent structural profitability-related problems in the fire insurance market.

The reference loss cost rate of residential fire insurance (as calculated by the General Insurance Rating Organization of Japan) was raised in Japan in October 2019 by 4.9% on a national average because of the major natural disasters in 2018. Direct non-life insurance companies then revised their premium rates in January 2021. The following table presents the fire insurance premium rate increases for reference.

Table 2: Recent Rate Increase Revisions

Dare of Revision	Rate Increase*	Comments
October 2019	+7% to +10%	Reflected the revision of the reference loss cost rate in May 2018 (5.5%: in consideration of the impact of natural disasters before 2017)
January 2021	+8% to +10%	Reflected the revision of the reference loss cost rate in October 2019 (4.9%: in consideration of the impact of Typhoon Jebi and Typhoon Trami in 2018)
2022	N/A	Reflected the revision of the reference loss cost rate in May 2021 (Approximately 10%: claims paid due to successive typhoons in 2019)

* The average rate increase for residential, general, and factory properties by the three largest non-life insurance companies, based on interviews by Toa Re

The reference loss cost rate will likely be reviewed in light of huge claims related to a series of natural disasters since 2019, the maximum policy period for fire insurance will shorten to five years from ten years, and direct non-life insurance companies will likely revise their rates. Results in Japan's fire insurance business are therefore expected to improve in the future. Direct non-life insurance companies have considered business conditions for policyholders during the COVID-19 pandemic and have not uniformly requested increases in fire insurance premiums,

but instead have tightened other conditions for the insured, such as increasing deductibles and setting limits on claims payable.

In addition, several large-scale industrial fire losses occurred in fiscal 2020. Notably, the fire at an Asahi Kasei Microsystems Co., Ltd. semiconductor factory in October 2020 was estimated to become Japan's largest fire-related insured loss. Furthermore, at the end of the fiscal year, a fire occurred at a Renesas Electronics Corporation semiconductor factory. These fires are expected to incur losses from property damage, business interruption and contingent business interruption. These repeated large-scale fires have the potential to affect the performance of direct non-life insurance companies, and also to have a considerable impact on the reinsurance market.

(2) COVID-19- and Silent Cyber-Related Risks

Reinsurance renewals in 2021 focused on heightened consciousness of the risk of infectious diseases, mainly due to the COVID-19 situation, and the underwriting conditions for silent cyber risks. Reinsurer positions differed depending on various issues including the characteristics of each business line, the insurance product and related conditions to be covered, and the reinsurance structure. In general, however, cedents such as direct non-life insurance companies that opened renewal negotiations at an early stage did well. Eventually, overseas reinsurers seemed to understand the renewal conditions sought by direct non-life insurance companies, while the markets generally accepted them.

In property lines, some reinsurers requested exclusion clauses for infectious diseases and silent cyber risks even for January 1 renewals, resulting in calls at an early stage of renewal from major direct non-life insurance companies for a modified version of the Lloyd's Market Association (LMA) standard exclusion clause. In most cases, cedents gained the understanding of reinsurers largely by effectively explaining the collateral of direct policies with policyholders and the exposures to be ceded.

In accident lines, deals were done according to total exposed amount and probable maximum loss (PML) scenarios. Non-proportional treaty reinsurance, for which excess point is higher compared to exposure, was renewed without any limitations on infectious diseases. In liability lines, the majority of reinsurers are concerned about the impact of COVID-19, and under some treaties an exclusion clause was introduced based on the potential exposure in relation to the level of the attachment points and the details of the underlying exposure.

In marine lines, although standard exclusion clauses have been introduced for silent cyber risks and infectious diseases, in some cases direct non-life insurance companies achieved cyber exclusion write-backs of fire/explosion, etc. by gaining reinsurers' understanding through their detailed demonstration of exposure.

(3) Industrywide SDGs Initiatives

Individual companies and entire industries, including the non-life insurance industry, have been implementing sustainability initiatives for several years in response to the Sustainable Development Goals (SDGs) adopted by the United

Nations General Assembly in September 2015.

The non-life insurance industry is working to become more resilient to fluctuations in external factors by promoting new solutions and innovations that offer society greater security, safety and health. Examples include changes in underwriting policy to encourage decarbonization backed by the notion that global warming and climate change are key factors in the frequent natural disasters of recent years.

Initiatives within the industry are not limited to products and services in the insurance segment. Initiatives also extend to asset management, various systems related to employees and employment, improved governance and compliance, and added value such as community contribution programs. Further initiatives to improve corporate and industry value may be undertaken in the future.

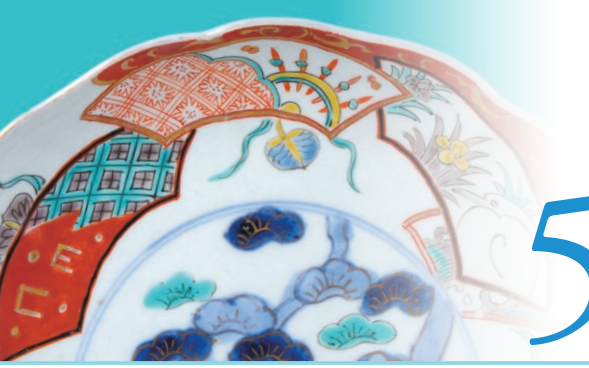
(4) Trends in Regulation by Regulatory Agencies

Given changes in the financial environment, over the past several years the FSA has recognized the importance of broadening its view of financial administration from "the Form" to "the Substance," from "the Past" to "the Future," and from "Element by element analysis" to "Holistic analysis" to achieve the goals of financial administration. Moreover, the FSA is making this a reality by inculcating principle-based inspection and supervision that emphasizes dialogue with financial institutions that has the requisite quality and depth.

A key priority for insurance companies is to meet customer needs as a means to prepare for various risks in the future given environmental changes such as frequent and intensifying natural disasters and the COVID-19 pandemic. Therefore, the FSA has indicated that insurance companies must reexamine their current business models from perspectives including product and service design, group governance, and risk management. With this mindset, the FSA has announced that it will hold in-depth dialogues with insurance companies concerning their issues, programs and progress in creating sound and sustainable business models.

In Japan, the FSA is examining evaluation and supervisory methods based on economic value in parallel with the introduction of the Insurance Capital Standard (ICS) by the International Association of Insurance Supervisors (IAIS). Solvency assessment based on economic value is central to this regime, and will likely come into force in line with the ICS application schedule (to be introduced in fiscal 2025 as a full-fledged regulation after a five-year monitoring period).

The FSA has noted that introducing the economic value-based solvency ratio into the regulatory regime may bring unexpected consequences, such as excessively risk-averse behavior among insurance companies. Therefore, it is investigating unintended consequences and international trends while continuing its examination with emphasis on dialogue with relevant parties.



5. Trends in Japan's Life Insurance Industry

Life Planning Department
The Toa Reinsurance Company, Limited

1. Overview of Business Results for Fiscal 2020

The fiscal 2020 business results for 42 life insurance companies are as follows:

(1) Total Amount of New Business

During the fiscal year ended March 31, 2021 (fiscal 2020), the total insured amount of new business for individual life decreased by 11.2% to 44.1 trillion yen, due to sales personnel refraining from face-to-face marketing to prevent the spread of COVID-19. The total insured amount of new business for individual annuity insurance decreased by 24.3% to 4 trillion yen. The total insured amount of new business for group insurance decreased by 2.2% to 4.5 trillion yen.

(2) Total Amount of In-force Business

The total insured amount of in-force business for individual life decreased by 1.7% year-on-year to 815.8 trillion yen, which was essentially unchanged from the previous fiscal year despite a decrease in the total insured amount of new business. Similar to the trend of total insured amount of new business for individual insurance, the total insured amount of in-force business for individual annuity insurance decreased by 0.7% to 101.8 trillion yen. On the other hand, the total insured amount of in-force business for group insurance increased by 1.7% to 404.8 trillion yen.

(3) Premium Revenues and Total Assets

Total premium revenues decreased by 6.3% year-on-year to 31 trillion yen. Total assets increased by 5.0% to 412.4 trillion yen due to the increase in foreign securities.

2. Trends in the Life Insurance Market Due to COVID-19

Japan confirmed its first case of COVID-19 infection in January 2020. Since then, the impact has been extensive and protracted. Under these circumstances, Japanese life insurance companies have implemented various initiatives to address COVID-19.

Many life insurance companies have expanded benefits to cover COVID-19. Conventional accidental death benefit riders do not cover death due to COVID-19, but many life insurance companies have introduced special benefit payments given societal needs. In addition, doctors have frequently advised isolation at home or in hotels for patients with mild symptoms when the number of cases outstripped the availability of hospital beds, and life insurance companies have also paid hospital benefits for those people if a medical certificate is supplied. Moreover, one company doubled benefits paid for hospitalization due to infectious diseases such as COVID-19. Other companies have started supporting the growing use of online healthcare to reduce interpersonal contact by paying outpatient benefits for online examinations.

A number of companies have been selling insurance products for infectious diseases to address the outbreak of COVID-19. In May 2020, small-amount, short-term insurer justInCase, Inc. launched Corona Tasukeai Hoken (insurance for

mutual aid under COVID-19), a product that covers hospitalization for injuries and illnesses including COVID-19, and treatment at home and temporary medical facilities due to COVID-19. Subsequently, Taiyo Life Insurance Company launched Kansensho Plus Nyuin Ichiji-kin Hoken (an additional lump-sum benefit for infectious diseases) that covers designated infectious diseases including COVID-19, and Daiichi Smart Small-amount and Short-term Insurance Co., Ltd., a subsidiary of Daiichi Life Insurance Co., Ltd., began offering a product called Corona Mini Support Hoken (small support insurance for COVID-19) with premiums that vary according to COVID-19 infection status.

In addition, COVID-19 has had a major impact on life insurance sales activities. Although life insurance sales channels in Japan are becoming more diverse, insurance company sales personnel remain the largest channel. However, life insurance companies have had to refrain from face-to-face marketing by sales personnel to prevent the spread of COVID-19. As a result, the number of new policies decreased significantly at the beginning of the COVID-19 pandemic, and the impact was pronounced. The number of new policies has been recovering since then, but the outbreak of COVID-19 has led to broad recognition that diversification of sales channels is more essential than ever, and companies are now accelerating initiatives to add sales channels that are not face-to-face.

The extensive and protracted effects of the COVID-19 pandemic require life insurance companies to contribute to the stability of society by responding flexibly and promptly based on societal needs, and to evolve business models according to circumstances.

3. Impact of COVID-19 on Life Insurance Company Results

As of May 10, 2021, the cumulative number of cases in Japan stood at over 640,000 and the cumulative number of deaths was over 10,000. Suffering has been widespread, but the number of COVID-19 cases and deaths is low compared to Europe and the United States.

According to official statistics, 1.3 million to 1.4 million people die annually in Japan, but the death toll from COVID-19 is currently just over 10,000, which is only about 0.8% of total annual deaths. While COVID-19 cases may increase in the future and the situation requires careful attention, COVID-19 has not had a major impact on Japan's mortality rate. Currently, therefore, the impact on life insurance companies from the increase in death and hospitalization benefits due to COVID-19 is limited.

However, the mortality rate may worsen in the future due to indirect effects rather than direct deaths from COVID-19. The COVID-19 pandemic has led people to avoid going to hospitals for medical exams. According to the Tokyo Medical Association, the cancer screening rate from May to July 2020 decreased compared to the same period a year earlier, with lung cancer, stomach cancer, and breast cancer screenings down significantly by more than 40% compared to the previous year. The Tokyo Medical Association is concerned that the delayed discovery of illnesses that were previously detected and treated at an early stage will

make the illnesses more serious or even fatal, and is therefore calling attention to illnesses aggravated by the excessive avoidance of medical examinations.

To date, the impact of COVID-19 on the results of life insurance companies has not been significant, but the indirect impact may worsen the mortality rate. The effects of COVID-19 require careful, long-term attention now and in the future.

4. General Trends in the Life Insurance Industry

Progress in Digital Transformation

Digital transformation (DX) initiatives are moving forward in Japan. The Ministry of Economy, Trade and Industry (METI) has issued guidelines for the promotion of DX, and under the guidelines DX is defined as innovations and creations in which "Companies address major changes in the business environment using data and digital technology to innovate their products, services, and business models based on the needs of customers and society. They also create a competitive advantage by transforming their business, organization, processes, and corporate culture." However, issues such as delayed digitalization in Japan's response to COVID-19 have highlighted the delay in digitalization in society as a whole and the need to promote DX. The government has acted to improve the situation by establishing the Digital Agency on September 1, 2021.

These initiatives are progressing throughout society, and several life insurance companies have formulated DX strategies. For example, Aflac Life Insurance Japan Ltd. formulated a DX strategy in September 2020. With the ongoing digitalization of society, diversification of values, and rapid lifestyle changes, Aflac Life plans to generate sustainable growth by collaborating with fintech companies to use digital technology such as open innovation. Another initiative involves applying data analysis and predictive models that use artificial intelligence (AI). In addition, Meiji Yasuda Life Insurance Company launched a DX strategy in April 2021 to address the impact on the life insurance business from the acceleration of society's digital shift and changes in values brought about by the increased severity of the COVID-19 situation. The strategy involves structuring sales and service models that integrate face-to-face and non-face-to-face, and automating and improving the efficiency of operations.

An operational efficiency improvement service using AI and optical character recognition (OCR) that Nippon Life Insurance Company and Nissay Information Technology Co., Ltd. offer is a specific example of DX. This service is designed to raise administrative efficiency by using AI-OCR to automatically digitalize each hospital's non-standard documents such as receipts and medical statements, which had been technologically challenging to read accurately. The system was patented in Japan in August 2020.

Until now, digitalization was mainly for simple and repetitive operations, but now DX is rapidly being adopted for a wider range of uses. Future trends such as how the ongoing implementation of DX will change insurance companies and their use of big data are now of great interest.

5. Life Insurance Product Trends Disability Insurance

The risk of death has decreased in Japan due to heightened health awareness and advances in medical technology that provide effective treatments for serious illnesses, making Japan a global leader in longevity. However, life-saving medical treatment and recuperation can take a long time, so today the risk of reduced income due to a lengthy disability period is higher than the risk of dying. Over the past several years, this has resulted in greater interest in disability insurance, which pays benefits under certain conditions when disability due to illness or injury continues for a certain period.

Japan has public systems to address disability, including injury and disease allowances and disability pensions. The injury and disease allowance system provides benefits to company employees, public employees, and other people with public health insurance when they are absent from work due to illness or injury and are unable to receive adequate compensation from their employer. The disability pension system is available when illness or injury limits life or work. However, the maximum term for payment of injury and disease allowances is one year and six months, the allowance is about two-thirds of the recipient's salary, and self-employed people are ineligible for injury and disease allowances. On the other hand, disability pensions are not universally available because the system pays pensions when people are in a state of disability corresponding to disability grade one or two as stipulated by law. Thus, the public systems have limits on payments to recipients.

Under these circumstances, the need for compensation that addresses disability risk is increasing. The public system for injury and disease allowances paid benefits in 1.61 million cases in fiscal 2009, but this figure increased to 2.02 million cases in fiscal 2018. In recent years, several life insurance companies have started selling disability insurance to address growing needs and the shortfalls in public systems, and a wide variety of products have been developed.

In December 2019, SBI Life Insurance Co., Ltd. launched the industry's first disability insurance product that allows policyholders to choose from three types of risk coverage. One is a comprehensive illness type, which also covers mental illness such as depression, and policyholders can use mental health consultation services free of charge. The deductible period for benefits is 60 days, and another feature is that policyholders are able to select a type with reduced premiums if they choose to receive 50% less in benefits during the injury and disease benefit payment period. In April 2020, Fukoku Mutual Life Insurance Company launched a disability insurance rider that pays benefits for 12 months after 30 consecutive days of hospitalization and home care. If care continues for another year beyond that, benefits can continue even after the end of the disability status until a maximum age of 70. Tokio Marine & Nichido Life Insurance Co., Ltd. launched a disability insurance product in January 2021 that is linked to the public system. It pays benefits after 60 consecutive days of hospitalization and home care for designated illnesses, and also pays benefits should the policyholder's disability correspond to a prescribed disability grade.

Disability insurance products are becoming more diverse given the growing need to cover the risk of unemployment, and emerging trends will remain a focus of interest.

6. Regulatory Trends

Trends in Introducing Economic Value-based Solvency Regulations

On June 26, 2020, the Financial Services Agency (FSA) of Japan published a report from The Advisory Council on the Economic Value-based Solvency Framework. The report covered the introduction of economic value-based solvency regulations, and outlined a timeline for moving forward with introduction of the framework – a tentative decision about the fundamentals of the framework to be made around 2022, finalization of standards around spring 2024, and enforcement from April 2025. With this timeline in place, the Advisory Council recommended that study should move forward, so progress toward introduction is likely to accelerate.

The Advisory Council discussed the overall structure of its prudential policy framework, relying on the concept of three pillars, an approach also adopted in Solvency II in the EU. Pillar 1 (solvency regulation) establishes a common standard of a solvency ratio and a framework of supervisory interventions, which functions as a backstop to protect policyholders. Pillar 2 (risk management and supervisory review) covers risks that are not fully captured in Pillar 1 and establishes a supervisory review on insurers' risk management frameworks that facilitate enhancement of their risk management practices. Pillar 3 (disclosure) facilitates dialogue between insurers and external stakeholders that improves corporate governance and enhances discipline in insurance companies through external scrutiny. In addition, the Advisory Council indicated that the standardized model for domestic regulation could be designed based on the Insurance Capital Standard (ICS), but will need to be adjusted as necessary to take into account issues unique to domestic regulations.

As things currently stand, the solvency margin ratio regulation introduced in 1996 is used as a regulation to secure insurers' financial soundness in Japan. However, the valuation of liabilities based on locked-in assumptions and factor-based risk measurement are recognized as major challenges under the current regulation. In the former, liabilities are valued using assumptions such as a discount rate and an occurrence rate that are fixed at the inception of an insurance contract. In the latter, the amount of risk (required capital) is calculated by multiplying the exposure value by a prescribed factor for each type of risk. As a result, the value of liabilities is not affected even if an event such as a fall of interest rates causes fluctuation in the fair value of assets. This is not consistent with trends in international methods for measuring soundness that involve appropriate management of fluctuations in net assets, which is essentially the difference between asset valuation and liability valuation on an economic value basis. Transitioning to economic value-based solvency regulation will resolve this issue, with the expectation that it will establish a regulatory and competitive environment that enables insurers to sustainably meet various insurance needs while protecting policyholders by ensuring soundness over the medium and long term.

The introduction of this regulation will require insurers to enhance the sophistication of their enterprise risk management (ERM) framework to incorporate an economic value-based approach. Anticipating the introduction of this regulation,

major Japanese life insurance companies are notably increasing ultra-long-term government bonds in their 2021 asset management plans. In addition, the new regulation will likely affect the management behavior of insurance companies and the insurance products they provide.

Several issues will continue to require attention. These include international capital regulations, which are the basis for the standardized model for domestic regulation; developments in the introduction of economic value-based solvency regulation in Japan; and the response of insurance companies.

Company Overview

Profile

The Toa Reinsurance Company, Limited (Toa Re), was established in 1940. With the reinsurance market evolving and clients' needs expanding, we have recognized the importance of being able to provide a diverse line of life and non-life reinsurance products to lead the market as Japan's primary professional reinsurer. Toa Re is based in Tokyo with subsidiaries in New Jersey (U.S.A.) and Zürich (Switzerland). Increasing demand for reinsurance products in Asian countries prompted us to expand our operations in those regions and establish branch offices in Singapore, Kuala Lumpur and Hong Kong.

In acknowledgment of Toa Re's outstanding financial profile, credit rating agencies, Standard & Poor's Financial Services LLC, A.M. Best Company, Inc. and Japan Credit Rating Agency, Ltd., have assigned Toa Re ratings of A+, A and AA+, respectively. As of March 31, 2021, the Toa Re Group boasted total assets of 772.1 billion yen. Net premiums written during the fiscal year ended March 31, 2021 totaled 287.5 billion yen.

Mission Statement

ToaRe Mission Statement

Providing Peace of Mind

Toa Re aims to realize its mission by

working with society and applying the principles of fairness and integrity to all aspects of our business

offering long-term, solid support to our clients by supplying reinsurance products and services that enable them to maintain stable operations

striving to further the interests of our shareholders and keeping them fully informed at all times

respecting the creativity of our employees and valuing their contributions

conserving the environment and contributing to the community

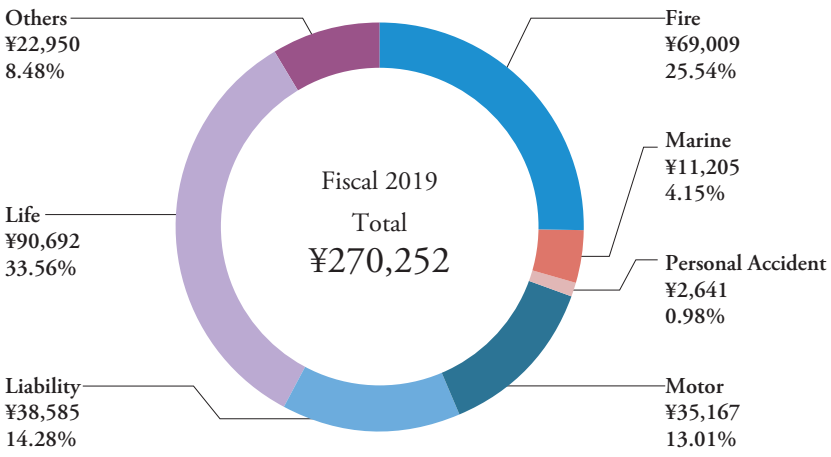
Consolidated Financial Highlights

	Million yen					Thousand U.S. dollars
	2021	2020	2019	2018	2017	**2021**
For the year ended March 31						
Ordinary income	**¥312,101**	¥297,757	¥266,625	¥254,934	¥251,462	**$2,819,085**
Net premiums written	**287,547**	270,252	248,288	237,911	223,749	**2,597,299**
Ordinary profit (loss)	**2,164**	88	(7,390)	9,857	14,022	**19,546**
Net income (loss) attributable to owners of the parent	**2,745**	(2,141)	(7,150)	9,191	10,512	24,794
As of March 31						
Total net assets	**182,257**	167,141	179,944	200,550	191,907	**1,646,255**
Total assets	**772,108**	711,690	694,088	687,950	698,418	**6,974,148**

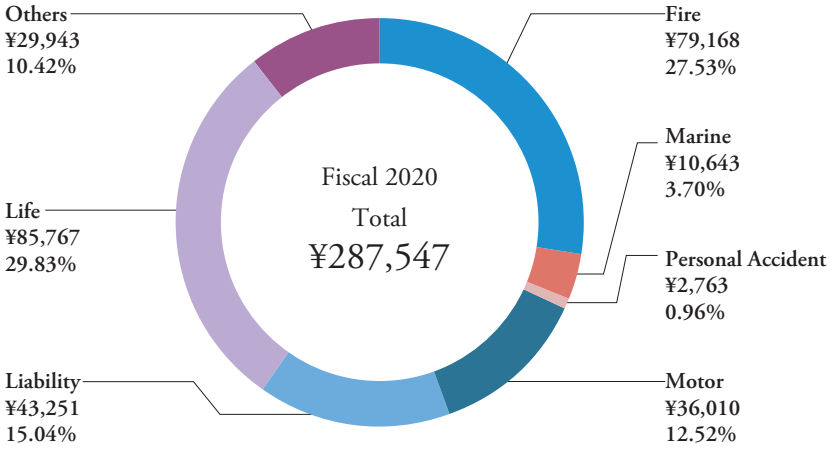
(Rate: ¥110.71 = US$1)

Net Premiums Written by Class (Consolidated Basis)

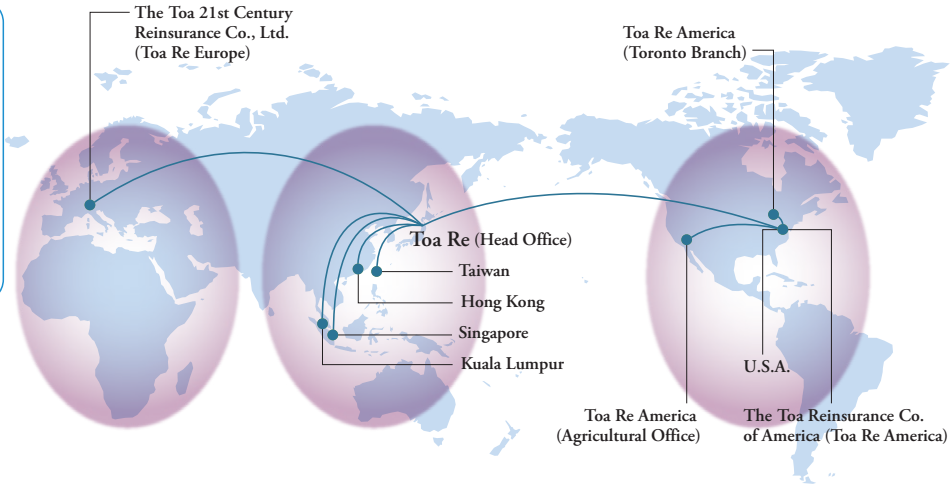
(Million yen)



(Million yen)



Overseas Network



Locations

Branches

Singapore	50 Raffles Place #26-01, Singapore Land Tower, Singapore 048623 Telephone: +65-6220-0123
Kuala Lumpur	28th Floor, UBN Tower, 10 Jalan P. Ramlee, 50250 Kuala Lumpur, Malaysia Telephone: +60-3-2732-5911
Hong Kong	Room 801, 8th Floor, Tower 1, Admiralty Centre, 18 Harcourt Road, Hong Kong Telephone: +852-2865-7581

Subsidiaries

U.S.A.	The Toa Reinsurance Co. of America 177 Madison Avenue, P.O. Box 1930, Morristown, NJ 07962-1930, U.S.A. Telephone: +1-973-898-9480
	The Toa Reinsurance Co. of America (Agricultural Office) 18301 Von Karman Avenue, Suite 400, Irvine, CA 92612, U.S.A. Telephone: +1-949-474-1420
Canada	The Toa Reinsurance Co. of America (Toronto branch) 55 University Avenue, P.O. Box 53, Suite 1700, Toronto, Ontario, M5J 2H7, Canada Telephone: +1-416-366-5888
Switzerland	The Toa 21st Century Reinsurance Co., Ltd. (Toa Re Europe) Kreuzplatz 16, 8008 Zürich, Zürich, Schweiz

Representative Offices

U.S.A.	177 Madison Avenue, P.O. Box 1930, Morristown, NJ 07962-1930, U.S.A. Telephone: +1-973-898-9816
Taiwan	4F-2, No. 128, Section 3, Min Sheng East Road, Taipei 10596, Taiwan, R.O.C. Telephone: +886-2-2715-1015

Supplemental Data: Results of Japanese Major Non-Life Insurance Companies for Fiscal 2020, Ended March 31, 2021 (Non-Consolidated Basis)

(Unit: Million yen, %)

		MS&AD Holdings		Tokio Marine Holdings		Sompo Holdings	Toa Re
		Mitsui Sumitomo	Aioi Nissay Dowa	Tokio Marine & Nichido	Nisshin	Sompo Japan	
Net Premiums Written	**Fiscal 2020**	**1,559,567**	**1,281,426**	**2,261,313**	**147,750**	**2,141,433**	**209,821**
	Fiscal 2019	1,547,930	1,276,770	2,247,508	148,850	2,184,750	208,029
Net Claims Paid	**Fiscal 2020**	**835,374**	**679,990**	**1,185,264**	**75,971**	**1,189,878**	**137,809**
	Fiscal 2019	888,652	724,662	1,353,232	86,704	1,301,872	150,083
Underwriting Profit (Loss)	**Fiscal 2020**	**23,918**	**(12,485)**	**(16,965)**	**6,811**	**66,368**	**(5,853)**
	Fiscal 2019	7,351	1,126	38,490	2,789	43,113	(4,320)
Ordinary Profit (Loss)	**Fiscal 2020**	**131,604**	**32,476**	**157,272**	**23,557**	**197,432**	**3,931**
	Fiscal 2019	89,113	58,615	223,945	5,785	182,387	4,486
Net Profit (Loss) for the Year	**Fiscal 2020**	**92,215**	**21,610**	**109,379**	**17,077**	**146,994**	**3,253**
	Fiscal 2019	94,079	44,784	169,966	3,757	130,579	1,466
Total Assets	**Fiscal 2020**	**7,098,116**	**3,745,278**	**9,562,449**	**403,135**	**7,389,677**	**543,280**
	Fiscal 2019	6,686,089	3,420,733	9,192,693	381,758	7,166,057	492,360
Ratio 1 Loss Ratio (%)	**Fiscal 2020**	**59.8**	**58.6**	**57.4**	**57.9**	**60.8**	**65.7**
	Fiscal 2019	63.3	62.0	65.2	64.8	64.9	72.1
Ratio 2 Expense Ratio (%)	**Fiscal 2020**	**32.7**	**34.9**	**30.8**	**33.1**	**33.6**	**26.2**
	Fiscal 2019	32.0	34.5	30.8	33.4	32.4	24.8
Ratio 3 Yield on Investments (Income) (%)	**Fiscal 2020**	**1.95**	**2.15**	**2.37**	**1.32**	**2.35**	**1.66**
	Fiscal 2019	1.94	2.36	2.78	1.57	2.50	1.89
Ratio 4 Yield on Investments (Realized Gains/Losses) (%)	**Fiscal 2020**	**3.05**	**2.70**	**3.45**	**6.17**	**3.30**	**3.02**
	Fiscal 2019	2.53	3.06	3.81	1.89	3.39	2.84
Ratio 5 Solvency Margin Ratio (%)	**Fiscal 2020**	**746.5**	**790.9**	**825.9**	**1,279.4**	**703.5**	**723.2**
	Fiscal 2019	701.3	702.3	815.2	1,115.3	717.3	707.0

Sources: Each company's financial statements of fiscal 2020

The Toa Reinsurance Company, Limited
6, Kanda-Surugadai 3-chome, Chiyoda-ku, Tokyo 101-8703, Japan
https://www.toare.co.jp/english/

Printed in Japan