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A New Perspective on the Supply and Demand of Weather Services

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Abstract: Despite efforts to estimate the demand for weather services, demand surveys that target only a few consumers with different interests have limitations in providing information about the market gap. This study proposes a method for reversing estimated demand trends by considering new value creation requirements such as national economic power or major industry types. Since no direct surveys of the actual status of services supplied through platforms for the weather service market exist, we investigated the web service status of both public ($n = 193$) and private ($n = 144$) sectors and established a weather service supply classification system. To analyze the global weather service demand environment, members of the World Meteorological Organization were classified according to their characteristics and compared with the supply status. The trend direction was suggested so that suppliers could provide services suitable for demand trends, and the corresponding significance was discussed.

Keywords: weather service industry; service supply; demand trend; public and private sector; classification system

1. Introduction

Due to increase of abnormal weather phenomena caused by climate change, damage from natural disasters has been expanding and its scale greatly increasing [1,2]. A recent Global Risk Report by the World Economic Forum warns that if our society fails to cope with these weather risks, it will be one of the worst tragedies of this era [3–5]. In fact, climate change poses several risks to businesses, investors, and overall financial stability [6–8]. Since weather risk can directly lead to social and economic losses, an efficient response from the industrial sector is urgently necessary.

According to the National Oceanic and Atmospheric Administration (NOAA), about 80% of global economic activity is directly or indirectly affected by the weather, and about 10% of global Gross Domestic Product (GDP) is directly affected by the weather [9]. Moreover, Dutton [10] conducted a qualitative analysis and concluded that in the United States, climate-sensitive areas account for 39.1% of US GDP. Lazo [11] provided an empirical methodology for estimating industrial activities and found that those directly affected by the climate accounted for 3.4% of US GDP and that the impact on the household sector was \$31 billion. Therefore, if weather and climate information is used properly, our society will be able to maintain socioeconomic value beyond mere disaster prevention. Furthermore, if this information is used more actively, high added value may be generated. However, analyses have shown that even though 90% of businesses are affected by weather and climate events, only 30% of them respond to such threats [12].

Accordingly, the global society is attempting to strengthen weather services in the public sector [13,14] and is discovering various customized weather services through linkages with the private sector [15–17]. Thus, the market for weather services is becoming increasingly active [18–20], and various types of weather services and weather service companies are being established [21,22].

As such, with the availability of weather and climate information, the risks for corporations can be minimized and the scale of profit generation can be accelerated [23]. Indeed, in the global market, weather and climate information are being used as essential business decision-making tools in the industry with the application of weather risk management concepts. Countries and companies are generating profits or reducing losses by developing various solutions that analyze both weather and industrial big data [24–26]. Moreover, the fields of application are comprehensive, the forms are highly diverse, and the weather service sector is expected to continue to grow.

However, weather services have complex characteristics in that the application method is very sensitive and depends on the conditions of use [27] and analyzing the market gap between supply and demand is difficult. Although research regarding potential markets through surveys has recently been attempted to identify the issues, this has limitations [28]. Indeed, market gaps between users and providers of weather services exist, as the services provided often do not match the needs of the users [29–32]. There are distinct differences in values for weather service users. They perceive climate change as a business threat to be concerned about, whereas suppliers view it as a potential business opportunity. While users need weather services to address threats in their areas and industries of interest, suppliers set up strategies to provide specific weather services that they can perform competently. Demand surveys limit clear understanding of the position of all consumers; thus, gaps in such research are inevitable. Addressing this from a new perspective that considers the characteristics of users, different from a question-and-answer demand survey, would be meaningful. In this regard, Georgeson et al. [26] proved that the demand for weather services is closely correlated with national wealth and industrial patterns. Based on the World Bank income group data, spending on weather service is much higher in countries with high national wealth. Therefore, we propose a method for estimating demand trends with a reverse approach by considering other value creation requirements such as national economic power or major industry type.

In this study, we investigate the weather services currently provided in the market and create a classification system. Moreover, after categorizing the countries that provide weather services according to social and environmental characteristics, we analyze the demand for weather services and suggest strategies to enable suppliers to provide services that are suitable to the expected future demand.

2. Concepts and Definitions

Weather services concern past, present, and future weather and climate information that is useful for decision-making and, thus, help a variety of industries and economic sectors [33]. In some studies, climate services are referred to separately from weather services [27,34,35]; however, in principle, climate services are considered part of weather services, as is applied in this study [36].

To understand the distribution system of these weather services, organizing the concepts through a service triad is necessary. Service triads involve a tripartite relationship between a provider, a client, and a customer (i.e., end user firm or individual consumer) [37–39]. In service triads, while a service contract is established between a client and a customer, and an agency contract between a client and a provider, there is no contract between the provider and the customer [40]. Figure 1 illustrates the application of this relationship to the weather service sector.

Providers, such as governments and international organizations, invest significantly in the infrastructure and research necessary to provide weather services and in return, obtain data and services from a range of noncommercial bodies with in-house value-adding expertise. Many of these services are freely shared with other public and private sector organizations and provide direct benefits to customers for free [20]. The client part can be regarded as the role of private weather companies. It is not financially viable for a private sector company to produce and collect such massive amounts of weather information, as the return on investment would be insufficient. Thus, these functions have traditionally been executed by government agencies on a large scale. Instead, through customer contracts, private weather companies can provide customized weather services, which the government cannot.

Figure 1. Weather service triad.

This study approaches supply and demand from a new perspective, in that we exclude the cooperative relationship between the provider and the client. Only from the customer's perspective can a classification system be created by examining the weather services available from providers and clients, and a supply strategy is presented by diagnosing the market gap between supply and demand, considering social and environmental factors by country.

3. Materials and Methods

3.1. Fact-Finding Survey

In the past, the private sector has been overlooked because the public sector has been driving the development and use of weather services. Nevertheless, the private sector serves as a mediator between the provider and the customer, and with its gradually strengthening capabilities, has become indispensable for market growth. Therefore, investigating the supply status of weather services separately in consideration of public and private sector characteristics is necessary.

This study does not classify weather services that can, theoretically be implemented with current technology; rather, it investigates the status of the actual services being provided. Therefore, relevant data were collected based on actual services displayed on the web that are accessible to consumers. Public sector services provide weather information that is universally necessary to protect the lives and property of all citizens of every country from dangerous weather and natural disasters such as floods. Countries with sufficient technology and capital directly produce and provide weather and climate information. Otherwise, indirect services are provided through the websites of neighboring countries or public trust organizations. Since providing weather and forecast information involves astronomical costs, overall production and provision of weather information for a country, in general, are promoted as a public service through cooperation between the government and international organizations. Therefore, when investigating public sector weather services, for accuracy, it is reasonable to examine the service status of the World Meteorological Organization (WMO) member countries that are officially in a global partnership for the service. As of 2020, 193 countries were registered as members of the WMO [41], and all representative websites were surveyed (Table A1).

The private sector focuses on service areas that the public sector does not provide to consumers directly. Thus, weather companies in the private sector upgrade the basic weather information shared by the public sector to provide detailed and customized weather services directly to consumers. Therefore, the reliability of the weather service provided by private meteorological companies depends upon the reliability of the original data provided by the public sector. Although many global weather service companies exist, some sampling criteria have been prepared to ensure service reliability and representativeness. The World Information System (WIS) [42] authorizes Global Information System

Centres (GISC), which are countries that have the capacity to collect and manage meteorological data through the WIS. There are 15 such countries in total, namely, Australia, Brazil, China, France, Germany, India, Iran, Japan, South Korea, Morocco, Russia, Saudi Arabia, South Africa, Britain, and the United States [43]. Three of them (the United States, Europe, and Japan) have their own weather forecast models, and they reanalyze data production technologies that enable independent weather services [44–46]. Weather companies officially affiliated with these three countries were selected for the survey. Thus, among the 351 weather companies registered with the National Weather Service [47], 106 were targeted for providing weather services (NWS), 22 were registered with the Japan Meteorological Agency (JMA), and 16 were registered with the Association at Private Meteorological Services (PRIMET). Thus, a total of 144 private weather service companies were selected, and all their websites were surveyed (Table A2).

3.2. Literature Review

A social environment survey was conducted on a range of WMO member countries to consider the demand groups that reside in countries that are officially aware of the concept of weather services, and the industrial and economic sectors were analyzed and classified. Because there are many major industries in the classification of industries by country, up to three types were prioritized for selection. The national industrial status has been promoted through more than 200 literature surveys, including each national government website and management report. According to the International Classification of Standards (ISIC), industry groups can be divided into 21 types [48]. Based on this, industries that use weather services and have similar characteristics were integrated into 13 industries (Table 1). The classification of economic status by country was determined by examining the WB Official Development Assistance (ODA) Business Policy Report [49] and the Development Assistance Committee (DAC) List [50]. For economic classification, countries were divided into four categories, which was in accordance with the Gross National Income (GNI) per capita in the previous year (Table 2). Thus, the surveyed countries were divided into 52 areas based on both industrial (13 types) and economic sector (four types).

Table 1. Classification of industrial groups for weather services.

Classification	Contents
Agriculture, forestry and fisheries	Agriculture, forestry, and fishing
Manufacturing	Manufacturing, mining, and quarrying
Energy industry	Electricity, gas, steam, and air conditioning supply
Facility management	Water supply management; sewerage, waste management and remediation activities
Construction	Construction
Wholesale and retail	Wholesale and retail trade; repair of motor vehicles and motorcycles
Transportation and storage	Transportation and storage
Hotels and restaurants	Accommodation and food service activities
Information and communication	Information and communication
Financial and insurance	Financial and insurance activities; real estate activities
Scientific and technology	Professional, scientific, and technical activities
Health and society	Human health and social work activities; education
Recreation and service activities	Entertainment and recreation; art, other service activities

Table 2. Classification of economic groups for weather services.

Contents	Description (\$)
High income	GNI > 12,375
Upper middle income	3996 ≤ GNI ≤ 12,375
Lower middle income	1026 ≤ GNI ≤ 3995
Low income	GNI ≤ 1025

4. Results

4.1. Public Service Status

The actual types of weather services offered through government websites were largely classified as weather condition, precipitation, precipitation form, rainfall probability, snowfall, temperature, wind, humidity, wave height, lightning, cyclone and storm, earthquake and volcano, and dust (Table 3). In addition, cross-classification was possible by categories of warning, nowcasting, very short, short, medium, extended, long, and climate, according to the definitions of meteorological forecasting ranges [36,51] (Table 4). The total number of public weather service cases was 1877.

Table 3. Definitions of the actual types of public weather services.

Division	Service Contents
Weather Conditions	General information on weather conditions including weather icons and weather commentary
Precipitation	The presence and quantity of precipitation
Precipitation Form	Types of precipitation, such as rain, freezing rain, snow, sleet, and hail
Rainfall Probability	Probability information for the possibility of precipitation
Snowfall	The amount or depth of snow falling over a period of time
Temperature	Quantitatively indicates the cold and hot temperature of the air, expressed in degrees Celsius or Fahrenheit temperature, and includes cold wave or heat wave information.
Wind	Indicates wind direction and wind speed, including information on strong winds
Humidity	The degree to which water vapor is contained in the air, expressed in absolute humidity and relative humidity; also includes information on dryness.
Wave Height	Indicates information about the height between the valley and the floor of the waves, mainly in the ocean or large lake, and includes tsunami information.
Lightning	Information about the discharge between clouds and clouds, or between clouds and the earth
Cyclone and Storm	Information on very serious tropical cyclones
Earthquake and Volcano	Surveillance Information on earthquakes and volcanoes
Dust	Information indicating the degree of suspended solids in the atmosphere

The ratio of general weather services for weather conditions, including weather icons and weather descriptions, was the highest at 25.4% (476 cases), followed by 17.3% (324 cases) and 11.9% (224 cases) for temperature and wind information, respectively. In addition, although precipitation information was at 10.2%, the ratio of precipitation-related information in the precipitation form (7.7%), rainfall probability (4.0%), and snowfall (3.8%) categories was significantly higher at 25.7%. Considering forecast time range, the ratio of short-range weather forecasting service was the highest at 25.6% (481 cases), followed by warning service at 23.2% (435 cases). These statistical results allow us to see which services were prioritized by the government in the provision of public weather services (Figure 2).

According to the data, as of 2019, there were 61 high-income, 56 upper-middle-income, 46 lower-middle-income, and 31 low-income countries worldwide. The number of service cases in high-income countries was 1072, in upper-middle-income, 470; in lower-middle-income, 274; and in low-income countries, 61 (Figure 3a). The average number of national services per economic group has been increasing in high-income countries and was at 17.8 in 2016, about 9.3 times higher than that in low-income countries (i.e., 1.9; Figure 3b). In addition, as income increased to higher national units, the proportion of nowcasting and very short categories of forecasting services increased by about 68% (Figure 4a). This is a result of national investment in areas that require capital and technology for driving a country's own numerical weather forecasting models. By contrast, the diversity of weather services in low-income countries decreased, while the proportion of simple services at the level of

weather delivery increased. Weather condition services in low-income countries accounted for 57.4% of all offered services (Figure 4b).

Table 4. Definitions of meteorological forecasting ranges.

Ranges	Contents
Warning	Real-time weather information, such as warning and alerts
Nowcasting	A description of current weather parameters and 0 to 2 h of forecasted weather parameters
Very short	Up to 12 hours' description of weather parameters
Short	Beyond 12 hours' and up to 72 hours' description of weather parameters
Medium	Beyond 72 hours' and up to 240 hours' description of weather parameters
Extended	Beyond 10 days' and up to 30 days' description of weather parameters, usually averaged and expressed as a departure from climate values for that period
Long	From 30 days up to two years (include seasonal outlook)
Climate	Beyond two years

Figure 2. Analysis of public weather service status by (a) weather service type and (b) forecasting ranges.

(a)

(b)

Figure 3. Public weather service status by national economic classification: (a) by total number of service cases and (b) by average number of service cases per country.

(a)

(b)

Figure 4. Distribution chart of public weather services by national economic classification by (a) meteorological forecasting ranges and (b) type of weather services.

4.2. Private Service Status

There were 13 categories in the classification of services by related industries to facilitate social environment classification and correlation (as analyzed later in Chapter 3), namely, agriculture,

forestry, and fisheries; manufacturing; energy; facility management; construction; wholesale and retail; transportation and storage; hotels and restaurants; information and communication; financial and insurance; science and technology; health and society; and recreation and service activities. Following certain classification criteria, the total number of private weather services supplied was 2400. The analysis of the status of private weather services provided by related industries showed that health and society services, which provided raw data of 400 cases (16.7%), had the highest volume of services. This was followed by transportation and storage (11.9 %), financial and insurance (10.0%), energy (9.7%), recreation and service activities (8.7%), science and technology (7.5%), information and communication (7.3%), construction (6.2%), facility management (4.5%), wholesale and retail (3.8%), manufacturing (3.4%), and hotels and restaurants (1.8%; Figure 5a). In most industrial categories, the concentration of the health and society service sector was strong (Figure 5b).

Figure 5. Analysis of (a) the private weather service status and (b) the concentration of that service by weather service type.

In addition, the types of private weather services actually offered at the website of private weather companies were largely classified as advisory, data management, measurement, modeling, operation, other consulting, and processing reanalysis and interoperability publication (Table 5). This was based on the classification of services defined in the study of the Market Research for a Climate Services Observatory (MARCO) [20]. The analysis of the status of supply cases of private weather services by weather service type showed that operation services, which provided raw data of 641 cases (26.7%) had the highest volume of services, followed by modeling service (23.0%), other consulting (16%), measurement (14.8%), publication (10.2%), advisory (3.9%), data management (3.8%), and processing reanalysis and interpretation (1.5%; Figure 6a). In most industrial categories, the concentration of the operation service sector was strong (Figure 6b). According to the MARCO report, in terms of transactions, advisory ranked the highest at 890,400 (25%), followed by other consulting (21%), processing reanalysis and interpretation (12%), modeling (12%), measurement (10%), publication (8%), operation (7%), and data management (6%; Figure 7).

Table 5. Definitions of the actual types of private weather services.

Service Type	Contents
Advisory	Advisory services, risk assessment, and decision support tools provided to public and private sector organizations relevant to global weather, climate and climate change, i.e., risk assessment for the long-term location of nuclear power stations.
Data Management	Provision of calibrated data sets, data archiving, data certification, and data sales for global weather, climate and climate change applications, i.e., the provision of validated data sets to consultancies for further analysis.
Measurement	Instruments and technologies for measurement and calibration for global weather, climate and climate change applications, i.e., the provision of assistance and advice in the assembly of sensing arrays for ground-based weather stations.
Modelling	Modeling of data, both certified and non-certified, for global weather, climate and climate change, i.e., the modelling of collated data from the arctic survey to predict the most likely rate of degradation of the polar ice cap.
Operation	Collection and provision of raw data for global weather, climate and climate change applications i.e., the provision of raw data to media weather centers.
Other Consulting	Consulting services for global weather, climate and climate change not elsewhere covered, i.e., the provision of advice on corporate statements to shareholders on corporate policy towards climate change. “Other Consulting” often includes more general consulting services about corporate responses to the challenges arising from specific weather and climate data (whether purchased separately or processed internally) and also more specialist services (incorporation of new data sets).
Processing, Reanalysis and Interpretation	Provision of data analysis and retrieval services including data mining tools, for global weather, climate and climate change, i.e., the provision of essential climate variable models to academia.
Publication	General publication of analysis findings for global weather, climate and climate change, i.e., the assembly of publications on climate forecasts based on data and analysis for both private and public sector organizations.

Figure 6. Analysis of (a) private weather service status and (b) the concentration of that service by related industries.

Figure 7. Volume of weather service transactions by service type.

Both the supply and transaction volumes of these quantitatively investigated weather services show differences in patterns among them. For example, the operation service had the highest supply volume but the lowest transaction volume. High supply means that the unit cost tends to be low because of many competitors. A high supply and low unit cost but low transaction volume mainly indicates that demand has risen from services with low willingness to pay (WTP). By contrast, low supply means that there is high tendency toward a high unit cost due to fewer competitors. Low supply with high unit cost but high transaction volume results from rising demand for services with high WTP. By contrast, low supply means that high unit cost is quite likely due to fewer competitors. Low supply with high unit cost but high transaction volume mainly indicates that demand has risen for services with high WTP. The trend was analyzed by calculating the ratio of supply to transaction volume for each weather service type and converting the maximum value to 1 (Figure 8a). The average of expenditures for meteorological services per capita (in dollars) for countries classified by development status based on the World Bank Income Group were 0.89 (for low-income countries), 2.35 (low-middle), 5.65 (high-middle), and 19.83 (high-income). Figure 8b shows the trend by converting the maximum value to 1 so that a comparison can be made with Figure 8a. Based on this figure, operation services is likely to be in demand for the low-income countries. The WTP trend value for the lower-middle-income countries is 0.12, which is a likely range of demand for operation to publication services. Similarly, for upper-middle-income countries, data management service is likely to be in demand, and for high-income countries, all services are within the range of demand (Figure 8c). Based on these results, the taxonomy table is presented for diagnosing the types of weather services likely to be in demand in accordance with the national social environment (i.e., national income and industrial characteristics; Table 6). The taxonomy lists the industry (I) classifications on the vertical axis and the economy (E) classifications on the horizontal axis. An IE code was assigned to each cell and configured to allow estimation of the range of weather service types that are likely to be suitable for each code. This table can serve to diagnose which type of service the supplier should be more interested in, mainly considering the industry characteristics and economic conditions of the supplier's target demand.

Table 6. Taxonomy table for diagnosing the types of weather services that are likely to be in demand according to the national social environment (i.e., national income and industrial characteristics).

Division	Weather Service Type							
	Operation	Modeling	Measurement	Publication	Other Consulting	Data Management	Advisory	Processing, Reanalysis, and Interpretation
Economy /Industry	<div>Low-income E₄</div> <div>Lower-middle-income E₃</div> <div>Upper-middle-income E₂</div> <div>High-income E₁</div>							
Agriculture, forestry and fisheries	I ₁	I ₁ E ₄		I ₁ E ₃		I ₁ E ₂		I ₁ E ₁
Manufacturing	I ₂	I ₂ E ₄		I ₂ E ₃		I ₂ E ₂		I ₂ E ₁
Energy industry	I ₃	I ₃ E ₄		I ₃ E ₃		I ₃ E ₂		I ₃ E ₁
Facility management	I ₄	I ₄ E ₄		I ₄ E ₃		I ₄ E ₂		I ₄ E ₁
Construction	I ₅	I ₅ E ₄		I ₅ E ₃		I ₅ E ₂		I ₅ E ₁
Wholesale and retail	I ₆	I ₆ E ₄		I ₆ E ₃		I ₆ E ₂		I ₆ E ₁
Transportation and storage	I ₇	I ₇ E ₄		I ₇ E ₃		I ₇ E ₂		I ₇ E ₁
Hotels and restaurants	I ₈	I ₈ E ₄		I ₈ E ₃		I ₈ E ₂		I ₈ E ₁
Information and communication	I ₉	I ₉ E ₄		I ₉ E ₃		I ₉ E ₂		I ₉ E ₁
Financial and insurance	I ₁₀	I ₁₀ E ₄		I ₁₀ E ₃		I ₁₀ E ₂		I ₁₀ E ₁
Scientific and technology	I ₁₁	I ₁₁ E ₄		I ₁₁ E ₃		I ₁₁ E ₂		I ₁₁ E ₁
Health and society	I ₁₂	I ₁₂ E ₄		I ₁₂ E ₃		I ₁₂ E ₂		I ₁₂ E ₁
Recreation and service activities	I ₁₃	I ₁₃ E ₄		I ₁₃ E ₃		I ₁₃ E ₂		I ₁₃ E ₁

(a)

(b)

(c)

Figure 8. (a) Ratio trend of the supply volume to the transaction volume by type of weather service, (b) willingness to pay (WTP) trend according to national economic level classification, and (c) estimation of the range of major weather services that are likely to be in demand based on the national economic level.

4.3. Social Environment Classification

In the national social environmental analysis, the number of cases, at 1029, was derived according to the classification criteria. According to the industry analysis, manufacturing ranked highest for the largest number of industries, with 295 cases (28.7%), followed by agriculture, forestry, and fisheries (22.1%), hotels and restaurants (10.3%), health and society (7.7%), energy (6.7%), construction (5.4%), transportation and storage (5.3%), and availability management (1.0%). According to the analysis by economic level, 303 cases (29.4%) were included in the category of upper-middle-income countries, which was the largest group, followed by high-income (28.3%), lower-middle-income (24.5%), and low-income (17.8%) countries. For the recreation and service activities and science and technology categories, high-income countries accounted for more than three quarters. Thus, these industries are likely to have sufficient demand in high-income countries. The lower the income level, the greater is the proportion of agriculture, forestry, and fisheries, and health sectors in major projects. This implies that these industries are likely to have sufficient demand in low-income countries. However, the proportion of the hotels and restaurants and recreation and service industries tended to decrease, which is likely because countries with lower income levels have more difficulty in activating weather services.

5. Discussion

From the suppliers' perspective, the supply of weather services to the public sector focused on providing simple information on weather factors and weather conditions according to weather forecasting time. Meanwhile, the supply of weather services in the private sector was divided by industry, where various service types were provided. This results from the mutually complementary relationship between the public and private sectors, as previously defined in the weather service triad. We compared the actual supply status directly surveyed and the transaction status investigated in the prior study to confirm that the gap between demand and supply occurs for each type of weather service. We were able to derive new supply strategies based on the characteristics of the demand source and the research result that social environment affects the demand for weather service.

According to the classification by national economic level, the case of the group of high-income countries accounted for 28.3%, whereas the size of weather services accounted for 57.1%, of the total service. From the customer's perspective, the higher the national economic level, the higher are the benefits from public weather services. Therefore, consumers in high-income countries have little incentive to pay for private weather services. However, it is likely that there will be demand for specific weather services such as advisory on processing and reanalysis, and interpretations, which have high WTP, for corporate decision-making in the high-income market. According to the classification by national economic level, the case of low-income countries accounted for 17.8%, whereas the size of weather services accounted for 3.2%, of the total service. Because the weather services that consumers can receive from the public sector are limited, customers who need weather services must obtain their desired services from the private sector. Since low-income countries have low WTP, it is expected that in these countries, private service demand for operational weather services that mainly focus on raw data will increase. Similarly, the data analyzed in this study between public and private sector services point to the future direction of commercialization of weather services. From the analysis of the status of private weather service supply, we found that weather services in the health and society sector are intensively serviced regardless of type. Amid the recent spread of coronavirus disease (COVID-19) pandemic, the health sector is expected to become even more critical [52], such that weather considerations would be essential to determining the rate of COVID-19 outbreaks. Meanwhile, in the analysis of social environment by country, health and society industries are expected to grow in underdeveloped countries. Thus, it is reasonable to consider actively expanding health services that apply weather services as required by underdeveloped countries.

The results of the social environment analysis conducted on WMO-member countries shows that I2E2 has the highest rate, with 83 cases (Figure 9). Thus, weather services such as other consulting, data management, which corresponds to the manufacturing sector of upper-middle-income countries

are most likely to generate demand. By contrast, since services were found to be relatively low in concentration, efforts to secure a market for these services are likely to create demand. Referencing the classification table in this way can help develop a response plan for weather service businesses, based on IE characteristics by country. This is of great significance because it presents a new perspective on the supply and demand of meteorological services, as it breaks away from the existing method of preparing a supply plan by identifying demand based on a consumer survey.

Figure 9. Analysis of (a) the characteristics of national income groups by major industry classification and (b) major industry classification by national income group.

This study is designed to estimate the real demand by comparing the actual supply status of weather services surveyed by the author with the transaction status surveyed in previous studies, to identify the gap between supply and demand, find trends, and estimate real demand. To derive the actual supply status of weather services, we conduct a thorough survey of web sites that have been

sampled and adopt a methodology to derive statistical data of meteorological service, by standardizing vast amounts of unstructured information. For this reason, there are limitations in the statistics creation and analysis, and uncertainties arising from this issue need to be partially improved. In addition, the proposed measures also need to be flexibly applied according to the volatility of each country's industrial structure and economic growth over time.

In the future, studies that apply a methodology similar to this one, or organically combine other improved methodologies to interview surveys and/or research cases, will yield better results in resolving the supply and demand gap. In addition, adding climatic conditions not considered in this study to the analysis of social environment would be a good attempt to find an improved method. We are confident that if we continue to secure various perspectives to reduce the gap between supply and demand of meteorological services, we will ultimately be able to expect positive effects in expanding the weather service market.

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Appendix A

Table A1. Weather service supply channel of the public sector.

Nation	Government Meteorological Authority	Website
Afghanistan	Afghan Meteorological Authority	no website provided
Albania	The Hydrometeorological Institute	no website provided
Algeria	Office National de la Météorologie	http://www.meteo.dz/
Andorra	Environment Minister Goberne DeNierto	no website provided
Angola	Instituto Nacional de Hidrometeorologia e Geofisica	http://www.inamet.gov.ao/
Antigua and Barbuda	Meteorological Services	http://www.antiguamet.com/
Argentina	Servicio Meteorológico Nacional	https://www.smn.gob.ar/
Armenia	Armenian State Hydro and Monitoring Service	http://www.meteo.am/
Australia	Bureau of Meteorology	http://www.bom.gov.au/
Austria	Central Institute for Meteorology and Geodynamics	http://www.zamg.ac.at/
Azerbaijan	National Hydrometeorological Department	http://www.eco.gov.az/
Bahamas	Department of Meteorology	no website provided
Bahrain	Bahrain Meteorological Service	http://www.bahrainweather.com/
Bangladesh	Bangladesh Meteorological Department	http://www.bmd.gov.bd/
Barbados	Meteorological Services	http://www.barbadosweather.org/
Belarus	Department of Hydrometeorology	http://www.pogoda.by/
Belgium	Institut Royal Météorologique	http://www.meteo.be/
Belize	National Meteorological Service	http://www.hydromet.gov.bz/
Benin	Service Météorologique National	http://www.meteo-benin.net/
Bhutan	Council for Renewable Natural Resources Research	no website provided
Bolivia	Servicio Nacional de Meteorología e Hidrología	no website provided
Bosnia and Herzegovina	Meteorological Institute	http://fhmzbih.gov.ba/
Botswana	Botswana Meteorological Services	http://www.weather.info.bw/
Brazil	Instituto Nacional de Meteorologia	http://www.inmet.gov.br/
British Caribbean Territories	Caribbean Meteorological Organization	http://www.cmo.org.tt/
Brunei Darussalam	The Brunei Meteorological Service	http://www.bruneiweather.com.bn/
Bulgaria	National Institute of Meteorology and Hydrology	http://www.meteo.bg/

Table A1. Cont.

Nation	Government Meteorological Authority	Website
Burkina Faso	Direction de la Météorologie	http://www.meteo-burkina.net/
Burundi	Institut Géographique du Burundi	no website provided
Cabo Verde	Instituto Nacional de Meteorologia e Geophísica	http://www.meteo.cv/
Cambodia	Department of Meteorology	http://www.cambodiameteo.com/
Cameroon	Direction de la Météorologie Nationale	no website provided
Canada	Meteorological Service of Canada	http://www.ec.gc.ca/meteo-weather/
Central African Rep.	Direction Générale de l'Aviation Civile et de la Météorologie	no website provided
Chad	Direction des Ressources en Eau et de la Météorologie	no website provided
Chile	Dirección Meteorológica de Chile	http://www.meteochile.cl/
China	China Meteorological Administration	http://www.cma.gov.cn/
Colombia	Instituto de Hidrología, Meteorología y Estudios Ambientales	http://www.ideam.gov.co/
Comoros	Direction de la Météorologie Nationale	no website provided
Congo, Dem. Rep.	Agence Nationale de Météorologie et de Télédétection par Satellite	http://www.meteo-congo-kinshasa.net/
Congo, Rep.	Direction de la Météorologie Nationale	http://www.meteo-congo-brazza.net/
Cook Islands	Cook Islands Meteorological Service	http://www.cookislands.pacificweather.org/
Costa Rica	Instituto Meteorológico Nacional	http://www.imn.ac.cr/
Côte d'Ivoire	Direction de la Météorologie Nationale	no website provided
Croatia	Meteorological and Hydrological Service	http://meteo.hr/
Cuba	Instituto de Meteorología	http://www.insmet.cu/
Curaçao and Sint Maarten	Meteorological Service	http://www.meteo.cw/
Cyprus	Meteorological Service	http://www.moa.gov.cy/ms
Czech Republic	Czech Hydrometeorological Institute	http://www.chmi.cz/
Denmark	Danish Meteorological Institute	http://www.dmi.dk/
Djibouti	Service de la Météorologie	no website provided
Dominica	Dominica Meteorological Services	http://www.weather.gov.dm/
Dominican Rep.	Oficina Nacional de Meteorología	http://www.indrhi.gob.do/
Ecuador	Instituto Nacional de Meteorología e Hidrología (INAMHI)	http://www.serviciometeorologico.gob.ec/
Egypt	The Egyptian Meteorological Authority	http://www.nwp.gov.eg/
El Salvador	Servicio Nacional de Estudios Territoriales	http://www.snet.gob.sv/
Eritrea	Civil Aviation Authority	no website provided
Estonia	Estonian Meteorological and Hydrological Institute	http://www.emhi.ee/
Ethiopia	National Meteorological Services Agency	http://www.ethiomet.gov.et/
Fiji	Fiji Meteorological Service	http://www.met.gov.fj/
Finland	Finnish Meteorological Institute	http://www.fmi.fi/
France	Météo-France	http://www.meteo.fr/
French Polynesia	Météo-France Polynésie Française	http://www.meteo.pf/
Gabon	Direction de la Météorologie Nationale	no website provided
Gambia	Department of Water Resources	no website provided
Georgia	Department of Hydrometeorology	http://www.hydromet.ge/
Germany	Deutscher Wetterdienst	http://www.dwd.de/
Ghana	Ghana Meteorological Services Department	http://www.meteo.gov.gh/
Greece	Hellenic National Meteorological Service	http://www.hnms.gr/
Guatemala	Instituto Nacional de Sismología, Vulcanología, Meteorología e Hidrología	http://www.insivumeh.gob.gt/
Guinea	Direction Nationale de la Météorologie	http://www.meteo-guinee-conakry.net/

Table A1. Cont.

Nation	Government Meteorological Authority	Website
Guinea-Bissau	Météorologie de Guinée Bissau	http://www.meteo-guinee-bissau.net/
Guyana	Hydrometeorological Service	no website provided
Haiti	Centre national de météorologie	http://www.meteo-haiti.gouv.ht/
Honduras	Servicio Meteorológico Nacional	http://www.smn.gob.hn/
Hong Kong, China	Hong Kong Observatory	http://www.hko.gov.hk/
Hungary	Meteorological Service of Hungary	http://www.met.hu/omsz.php
Iceland	Icelandic Meteorological Office	http://www.vedur.is/
India	India Meteorological Department	http://www.imd.gov.in/
Indonesia	Meteorological and Geophysical Agency	http://www.bmkg.go.id/
Iran, Islamic Rep.	Islamic Republic of Iran Meteorological Organization	http://www.irimo.ir/
Iraq	Iraqi Meteorological Organization	no website provided
Ireland	The Irish Meteorological Service	http://www.met.ie/
Israel	Israel Meteorological Service	http://www.ims.gov.il/
Italy	Servizio Meteorologico	http://www.meteoam.it/
Jamaica	Meteorological Service	http://www.metservice.gov.jm/
Japan	Japan Meteorological Agency	http://www.jma.go.jp/jma/
Jordan	Jordan Meteorological Department	http://www.jometeo.gov.jo/
Kazakhstan	Kazhydromet	http://www.kazhydromet.kz/
Kenya	Kenya Meteorological Department	http://www.meteo.go.ke/
Kiribati	Kiribati Meteorological Service	no website provided
Korea, Dem. People's Rep.	State Hydrometeorological Administration	no website provided
Korea, Rep.	Korea Meteorological Administration	http://www.kma.go.kr/
Kuwait	Department of Meteorology	http://www.met.gov.kw/
Kyrgyzstan	Main Hydrometeorological Administration	http://www.meteo.ktnet.kg/
Lao People's Democratic Rep.	Department of Meteorology and Hydrology	http://dmhlao.etllao.com/
Latvia	Latvian Environment, Geology and Meteorology Agency	http://www.meteo.lv/
Lebanon	Service Météorologique	no website provided
Lesotho	Lesotho Meteorological Services	http://www.lesmet.org.ls/
Liberia	Ministry of Transport	no website provided
Libya, State of	Libyan National Meteorological Centre	no website provided
Lithuania	Lithuanian Hydrometeorological Service	http://www.meteo.lt/
Luxembourg	Administration de l'Aéroport de Luxembourg	http://www.meteolux.lu/
Macao, China	Meteorological and Geophysical Bureau	http://www.smg.gov.mo/
Macedonia, FYR	Republic Hydrometeorological Institute	http://www.meteo.gov.mk/
Madagascar	Direction Générale de la Météorologie	http://www.meteomadagascar.mg/
Malawi	Malawi Meteorological Services	http://www.metmalawi.com/
Malaysia	Malaysian Meteorological Department	http://www.met.gov.my/
Maldives	Department of Meteorology	http://www.meteorology.gov.mv/
Mali	Direction Nationale de la Météorologie du Mali	no website provided
Malta	Meteorological Office	http://www.maltaairport.com/weather/
Mauritania	Office National de Météorologie	http://www.onm.mr/
Mauritius	Mauritius Meteorological Services	http://metservice.intnet.mu/
Mexico	Servicio Meteorológico Nacional	http://smn.cna.gob.mx/
Micronesia, Federated States of	FSM Weather Station	http://weather.noaa.gov/weather/
Moldova	Serviciul Hidrometeorologic de Stat Moldova	http://www.meteo.md/
Monaco	Mission Permanente de la Principauté de Monaco	http://www.monaco-un.org/

Table A1. Cont.

Nation	Government Meteorological Authority	Website
Mongolia	National Agency for Meteorology, Hydrology and Environment Monitoring	no website provided
Montenegro	Hydrometeorological Institute of Montenegro	http://www.meteo.co.me/
Morocco	Direction de la Météorologie Nationale	http://www.marocmeteo.ma/
Mozambique	Instituto Nacional de Meteorologia	http://www.inam.gov.mz/
Myanmar	Department of Meteorology and Hydrology	http://www.dmh.gov.mm/
Namibia	Namibia Meteorological Service	http://www.meteona.com/
Nauru	Department of National Emergency Services	no website provided
Nepal	Department of Hydrology and Meteorology	http://www.dhm.gov.np/
Netherlands	Royal Netherlands Meteorological Institute	http://www.knmi.nl/
New Caledonia	Météo-France Nouvelle Calédonie	http://www.meteo.nc/
New Zealand	New Zealand National Meteorological Service	http://www.metservice.co.nz/
Nicaragua	Dirección General de Meteorología	http://www.ineter.gob.ni/
Niger	Direction de la Météorologie Nationale	http://www.meteo-niger.net/
Nigeria	Nigerian Meteorological Agency	http://nimet.gov.ng/
Niue	Niue Meteorological Service	http://informet.net/niuemet
Norway	Norwegian Meteorological Institute	http://www.met.no/
Oman	Department of Meteorology	http://www.met.gov.om/
Pakistan	Pakistan Meteorological Department	http://pmd.gov.pk/
Panama	Hidrometeorología	http://www.hidromet.com.pa/
Papua New Guinea	Papua New Guinea Meteorological Service	http://www.pi-gcos.org/
Paraguay	Dirección de Meteorología e Hidrología	http://www.meteorologia.gov.py/
Peru	Servicio Nacional de Meteorología e Hidrología	http://www.senamhi.gob.pe/
Philippines	Philippine Atmospheric Geophysical and Astronomical Services Administration	http://www.pagasa.dost.gov.ph/
Poland	Institute of Meteorology and Water Management	http://www.imgw.pl/
Portugal	Instituto de Meteorologia	http://www.meteo.pt/
Qatar	Civil Aviation Authority	http://qweather.gov.qa/
Romania	National Meteorological Administration	http://www.inmh.ro/
Russian Federation	Russian Federal Service for Hydrometeorology and Environmental Monitoring	http://www.meteorf.ru/
Rwanda	Rwanda Meteorological Agency	http://www.meteorwanda.gov.rw/
Saint Lucia	Meteorological Services	http://www.cdera.org/weather/
Samoa	Samoa Meteorology Division	http://www.mnre.gov.ws/
Sao Tome and Principe	Institut National de Météorologie	no website provided
Saudi Arabia	Presidency of Meteorology and Environment	http://www.pme.gov.sa/
Senegal	Direction de la Météorologie Nationale	http://www.meteo-senegal.net/
Serbia	Republic Hydrometeorological Service of Serbia	http://www.meteo.rs/
Seychelles	National Meteorological Services	http://www.meteo.gov.sc/
Sierra Leone	Meteorological Department	no website provided
Singapore	Meteorological Services Division	http://www.weather.gov.sg/
Slovakia	Slovak Hydrometeorological Institute	http://www.shmu.sk/
Slovenia	Meteorological Office	http://www.rzs-hm.si/
Solomon Islands	Solomon Islands Meteorological Service	http://www.met.gov.sb/
Somalia	Permanent Mission of Somalia	no website provided
South Africa	South African Weather Service	http://www.weathersa.co.za/
South Sudan	South Sudan Weather Service	no website provided
Spain	Agencia Estatal de Meteorología	http://www.aemet.es/
Sri Lanka	Department of Meteorology	http://www.meteo.slt.lk/

Table A1. Cont.

Nation	Government Meteorological Authority	Website
Sudan	Sudan Meteorological Authority	http://www.ersad.gov.sd/
Suriname	Meteorological Service	http://www.meteosur.sr/
Swaziland	Swaziland Meteorological Service	http://www.swazimet.gov.sz/
Sweden	Swedish Meteorological and Hydrological Institute	http://www.smhi.se/
Switzerland	MeteoSwiss	http://www.meteoswiss.ch/
Syrian Arab Rep.	Ministry of Defence Meteorological Department	no website provided
Tajikistan	Main Administration of Hydrometeorology and Monitoring of the Environment	http://www.meteo.tj/
Tanzania	Tanzania Meteorological Agency	http://www.meteo.go.tz/
Thailand	Thai Meteorological Department	http://www.tmd.go.th/
Timor-Leste	Dirrecção Nacional Meteorologia e Geofísica	http://www.dnmg.gov.tl/
Togo	Direction de la Météorologie Nationale	no website provided
Tonga	Tonga Meteorological Service	http://www.met.gov.to/
Trinidad and Tobago	Meteorological Service	http://www.metoffice.gov.tt/
Tunisia	National Institute of Meteorology	http://www.meteo.tn/
Turkey	Turkish State Meteorological Service	http://www.mgm.gov.tr/
Turkmenistan	Administration of Hydrometeorology	no website provided
Tuvalu	Tuvalu Met Service	http://informet.net/tuvmet/
Uganda	Department of Meteorology	http://www.meteo-uganda.net/
Ukraine	Ukrainian Hydrometeorological Center	http://www.meteo.gov.ua/
United Arab Emirates	National Center for Meteorology and Seismology	http://www.ncms.ae/english/
United Kingdom	Met Office	http://www.metoffice.gov.uk/
United States of America	National Oceanic and Atmospheric Administration	http://www.weather.gov/
Uruguay	Dirección Nacional de Meteorología	http://www.meteorologia.com.uy/
Uzbekistan	Uzhydromet	http://www.meteo.uz/
Vanuatu	Vanuatu Meteorological Services	http://www.meteo.gov.vu/
Venezuela, Bolivarian Rep.	Instituto Nacional de Meteorología e Hidrología	http://www.inameh.gob.ve/
Viet Nam	Hydrometeorological Service	http://www.nchmf.gov.vn/
Yemen	Yemen Meteorological Service	http://www.ymns.gov.ye/
Zambia	Zambia Meteorological Department	http://www.zmd.gov.zm/
Zimbabwe	Zimbabwe Meteorological Services Department	http://www.weather.co.zw/

Table A2. Weather service supply channel of the private sector.

Weather Company	Website
AccuWeather	https://www.accuweather.com/
3BMeteo	http://www.3bmeteo.com
Aerospace and Marine International (AMI)	http://www.amiwx.com/
Agricultural Weather Information Service (AWIS)	http://www.awis.com/
Air Science Consultants, Inc.	http://www.skywatchweather.com/
Alert Weather Services, Inc.	http://www.alertweather.com/
Applied Meteorological Engineering Consulting Service (AMECS)	http://www.amecs.co.jp/
AnythingWeather.com	http://www.anythingweather.com/
ATMOGRAPH ModelVis	http://www.atmograph.com/
AtmosForecast	http://www.atmosforecast.com/
Atmospheric and Environmental Research (AER)	https://www.aer.com/
Aura	http://www.aura.com.pl
Automated Weather Source	https://www.earthnetworks.com/

Table A2. Cont.

Weather Company	Website
Baron Services	http://www.baronweather.com/
Belginur	http://www.belgingur.is
Bioweather Service	http://www.bioweather.net/
Blue Sky Wetteranalysen	http://www.blueskywetter.at
ClimaData Corp.	http://www.climadata.com/
Climatological Consulting Corporation	http://www.ccc-weather.com/
Climet Systems	http://www.climetsystems.com/
Commanders Weather Corporation	https://www.commandersweather.com/
CompuWeather, Inc.	https://www.compuweather.com/
Connecticut Weather Center, Inc.	http://www.ctweather.com/
Consultingweather.com	http://consultingweather.com/
Continental Weather and Earth Sciences, Inc.	http://www.continentalweather.com/
Cox Weather Services	http://www.coxweatherservices.com/
CTC(Challenging Tomorrow's Changes)	http://www.weather-eye.com/
CustomWeather, Inc.	http://www.customweather.com/
DayWeather Inc.	http://www.dayweather.com/
DBS Weather Impact Corp.	http://www.bridgesights.com/
Disaster Warning Network, Inc.	http://www.disasterwarning.com/
Early Alert, Inc.	http://www.earlyalert.com/
Earth Communication Provider	https://n-kishou.com/
EJS Weather	http://www.ejsweather.com/
Expert Weather Investigations (EWI)	http://www.expertweather.com/
Fair Skies Consulting	http://fairskiesconsulting.com/
FleetWeather, Inc.	http://www.fleetweather.com/
Forecasting Consultants LLC	http://www.forecastingconsultants.com/
ForeFlight	http://www.foreflight.com/
Forensic Weather Consultants	http://www.weather-consultants.com/
Fox Weather, LLC	http://www.foxweather.com/
Franklin Japan	https://www.franklinjapan.jp/
Freese-Notis	http://www.weather.net/
Golden Gate Weather Services	http://ggweather.com/
Great Circle	http://www.greatcircle.be
Great Lakes Weather Service	http://www.greatlakesweatherserv.com/
Happy Life Expert (HALEX)	http://www.halex.co.jp/
Hermess	http://www.hermess.nl
Hurricane by Kitty Code	http://kittycode.com/
HurricaneMapping	http://www.hurricanemapping.com/
Idokep	http://www.idokep.hu
International Meteorological and Oceanographic Consultants Co. LTD (iMOC)	http://www.imocwx.com/
ION Weather, Inc.	http://www.ionweather.com/
iWeatherNet	http://www.iweathernet.com/
iWindsurf.com	http://www.iwindsurf.com/
Jenifer Clark's Gulfstream	http://www.erols.com/
Japan Weather Association (JWA)	https://tenki.jp/
Lake Street Consulting	http://www.lakestreetconsulting.co.uk
Life Business Weather (LBW)	http://tenki.lbw.jp/
Marine Weather Center	http://www.mwxc.com/
MBC	http://www.mbc.co.jp/

Table A2. Cont.

Weather Company	Website
Meteorological Engineering Center (MEC)	http://www.meci.jp/
Meridian Environmental Technology Inc.	http://www.meridian-enviro.com/
Meteo News	http://www.meteonews.ch
Meteoblue	http://www.meteoblue.com
MeteoGroup	http://www.meteogroup.com/
Meteologica	http://www.meteologica.com
Meteomatics	http://www.meteomatics.com
Meteopress	http://www.meteopress.cz
Meteorological Solutions Inc.	http://www.metsolution.com/
MeteoServices	http://www.meteoservices.be
MeteoStar	http://www.meteostar.com/
MetLoop Precision Weather Technologies	http://www.metloop.com/
Metro Weather, Inc.	http://www.metroweather.com/
Mobile Weather Team, Inc.	http://www.mobileweather.com/
MountainWeather	http://www.mountainweather.com/
New England Weather Associates	http://www.newenglandweather.com/
NY NJ PA Weather	http://www.nynjpawweather.com/
Ocean-Pro	http://www.ocean-pro.com/
Palm Beach Post	http://www.palmbeachpost.com/
Planalytics	http://www.planalytics.com/
Qwikcast	http://www.qwikcast.com/
Sailing Weather Service	http://www.sailwx.com/
SHIMADZU Business System (SBS)	http://tenki.shimadzu.co.jp/
ScoutLook Weather	http://www.scoutlookweather.com/
Shade Tree Meteorology LLC	http://www.shadetreemeteorology.com/
Skyview Weather	http://www.skyviewweather.com/
Sapporo Information Network (SNET)	http://www.sapporotenki.jp/
Speedwell	http://www.speedwellweather.com/
StatWeather	http://www.statweather.com/
Storm Shield Weather Radio App	http://www.stormshieldapp.com/
StormNow	http://www.stormnow.com/
Stormpulse	http://www.stormpulse.com/
StormStock	http://www.stormstock.com/
Sunny Spot	https://www.sunny-spot.net/
Surflegend	http://www.surflegend.co.jp/
Swift Weather	http://www.swiftwx.com/
Tactical Weather	http://www.tacticalweather.com/
TBS	http://www.tbs.co.jp/weather/
Tempest Tours Storm Chasing Expeditions	http://www.tempesttours.com/
The Weather Channel	http://www.weather.com/
The Weather Company	http://www.theweathercompany.com/
The Weather Medic	http://www.weathermedic.com/
The Weather Underground	http://www.wunderground.com/
Tornado Project	http://www.tornadopproject.com/
Unisys Weather	http://weather.unisys.com/
Weather 2000	http://www.weather2000.com/
Weather 2020	http://www.weather2020.com/
Weather Atlas	http://www.weather-atlas.com/

Table A2. Cont.

Weather Company	Website
Weather Bank	http://www.weatherbank.com/
Weather Command	http://www.weathercommand.com/
Weather Currents	http://www.weathercurrents.com/
Weather Decision Technologies	http://www.wdtinc.com/
Weather Display	http://www.weather-display.com/
Weather Extreme	http://www.weatherextreme.com/
Weather for My Wedding	http://www.weatherformywedding.com/
Weather for You	http://www.weatherforyou.com/
Weather Guy	http://www.weatherguy.com/
Weather History Research	http://www.weatherclaims.com/
Weather Information Network	http://broadcast-weather.net/
Weather map	https://www.weathermap.co.jp/
Weather news	http://weathernews.com/
Weather or Not	http://www.weatherornot.com/
Weather Routing	http://www.wriwx.com/
Weather Source	https://weathersource.com/
Weather Sphere	http://www.weathersphere.com/
Weather street	http://www.weatherstreet.com/
weather TAP	http://www.weathertap.com/
Weather tech	http://www.wet.co.jp/
Weather things	http://www.weatherthings.com/
weather USA	http://www.weatherusa.net/
Weather Watch Service	http://www.weatherwatchservice.com/
Weather Works	http://www.weatherworksinc.com/
WeatherNet	http://www.weather.net.co.uk
Weathernews	http://weathernews.jp/
West Coast Weather	http://www.westcoastweather.com/
Wetteronline	http://www.wetteronline.de
Weather Information and Communications Services LTD (WICS)	https://www.wics.co.jp/
Wilkens Weather Technologies	http://www.wilkensweather.com/
WorldWinds	http://www.worldwindsinc.com/
Weather Service (WS)	http://www.weather-service.co.jp/
WxUSA	http://www.wxusa.com/
ZoomRadar	http://zoomradar.com/
otenki	http://hp.otenki.com/

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