FEATURES

Project Information

Project: ACAP-BICOL (ACAP 1.0) – Rice Crop Manager Advisory Service (RCMAS) Collaboration

Release Number: 1.0

Time Frame: June 21 – August 21 2023

Date Updated: September 22, 2023

Introduction

The collaboration project between ACAP-Bicol (ACAP 1.0) and IRRI aims to bridge the PAGASA weather forecast data, being utilized by ACAP for generating crop recommendations and bulletin PDFs with IRRI's RCMAS application for sending timely SMS crop recommendation advisories to select farmers in the Bicol region.

ACAP created several new well-documented REST API endpoints to allow the sharing of its internal PAGASA weather forecast data in a structured and organized format, with little to fewer modifications to what ACAP uses with IRRI and other trusted clients securely through the use of hard-coded tokens. Furthermore, ACAP started storing and archiving past weather forecast data for historical purposes, also made available on the REST APIs to use as a reference for backtracking and lookup.

Since this is a prototype project that uses existing ACAP Bicol components, the team had ACAP re-created on a separate infrastructure that mirrors the official ACAP Bicol system along with its standard-pricing plan cloud infrastructure for development purposes, where the new updates and features are made and tested on top of the existing system.

This document describes the process flows, architectural deployment diagrams, improvisation decisions, and relevant ideas behind the main features and use cases of the ACAP-RCMAS collaboration project.

Use Cases by Functional Area

- **PAGASA Weather Forecast REST API Endpoints**
  - UC-00: Seasonal Weather Forecast API
  - UC-01: 10-Day Weather Forecast API
  - UC-02: Special Weather Forecast API

- **PAGASA Historical Weather Forecast REST API Endpoints**
  - UC-03: Historical Seasonal Weather Forecast API
  - UC-04: Historical 10-Day Weather Forecast API

    - UC-05: Historical Special Weather Forecast API

- **PAGASA Historical Weather Forecast Data Management**
    - UC-06: Archiving and storage of Historical Seasonal Weather Forecast
    - UC-07: Archiving and storage of Historical 10 Day Weather Outlook Forecast
    - UC-08: Archiving and storage of Historical Special Weather Forecast
    - UC-09: Cron job – Auto delete outdated Historical Seasonal Weather Forecast
    - UC-10: Cron job – Auto delete outdated Historical 10-Day Weather Outlook Forecast
    - UC-11: Cron job – Auto delete outdated Historical Special Weather Forecast

- **Client Authorization**
    - UC-12: Create API keys
    - UC-13: Authorize API keys

PAGASA REST API Endpoints

The PAGASA REST API endpoints are a set of API endpoints that serve the latest active PAGASA weather forecast data synced to ACAP's database for the Bicol region on the API endpoint at https://acap-rcmas.vercel.app/api/weatherforecast. Past (historical) weather forecast data are also available at the historical API endpoints at https://acap-rcmas.vercel.app/api/weatherforecast/archives.

An online API usage documentation is available at https://acap-rcmas.vercel.app/ for detailed instructions on how to use the API. API keys are available by request.

The following diagram illustrates a simplified architectural deployment diagram of the ACAP-RCMAS collaboration. Detailed process diagrams are available in the specific sub-sections.

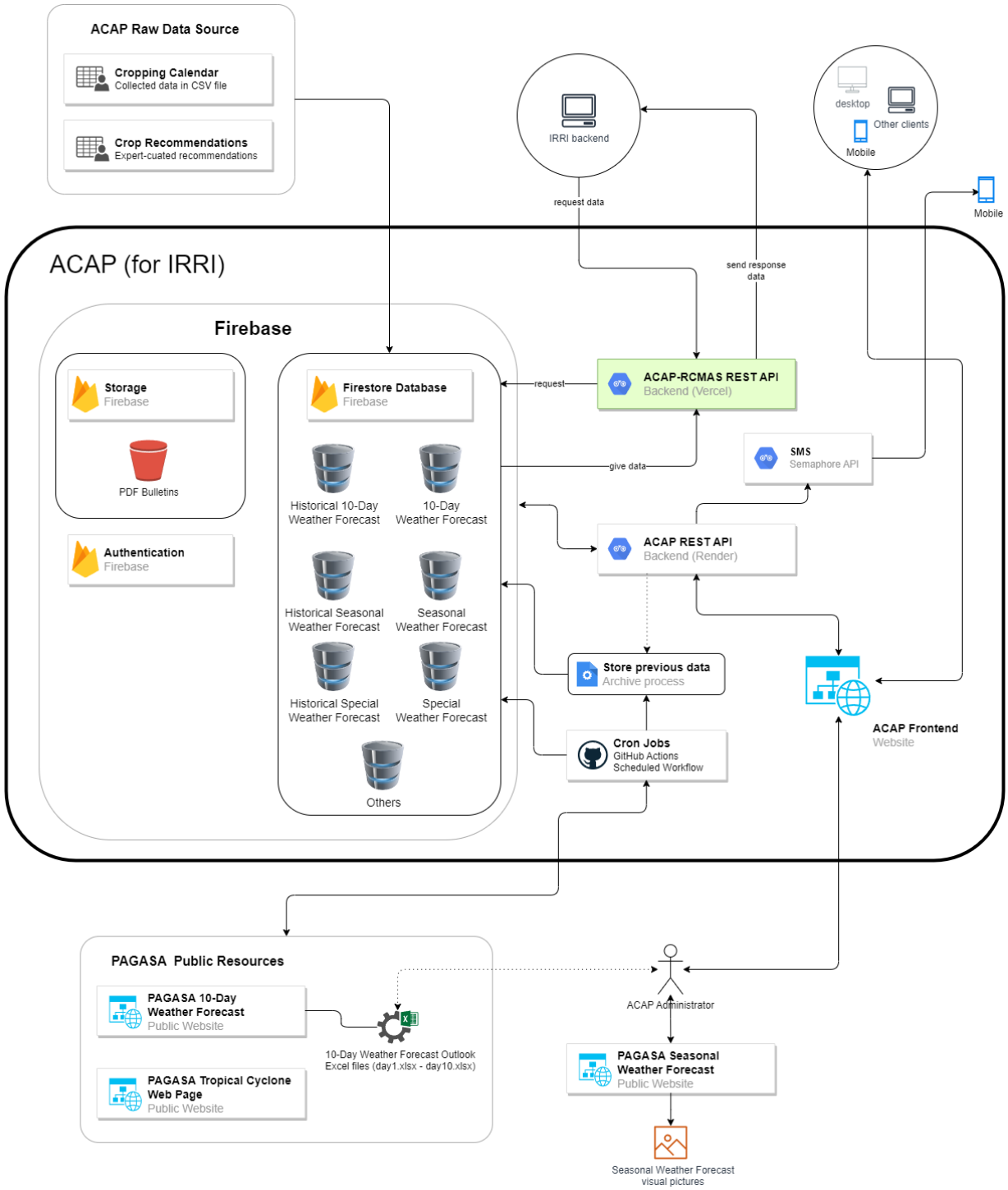


Figure 1.0 – Simplified ACAP-RCMAS deployment diagram

F-00: Seasonal Weather Forecast API

The Seasonal Weather Forecast API serves the latest PAGASA seasonal weather forecast data for the Bicol region, as updated by temporarily assigned ACAP Administrators for the project duration. Detailed instructions for using the PAGASA Seasonal Weather Forecast API are available in the online API usage documentation accessible at this link.

Seasonal Weather Forecast Architecture

The following diagram shows the updated final architecture and other processes used for the PAGASA Seasonal Weather Forecast API of the ACAP-RCMAS collaboration project. See the Data Update Process - ACAP-RCMAS: PAGASA Seasonal Weather Forecast Update Process section for more information about this process.

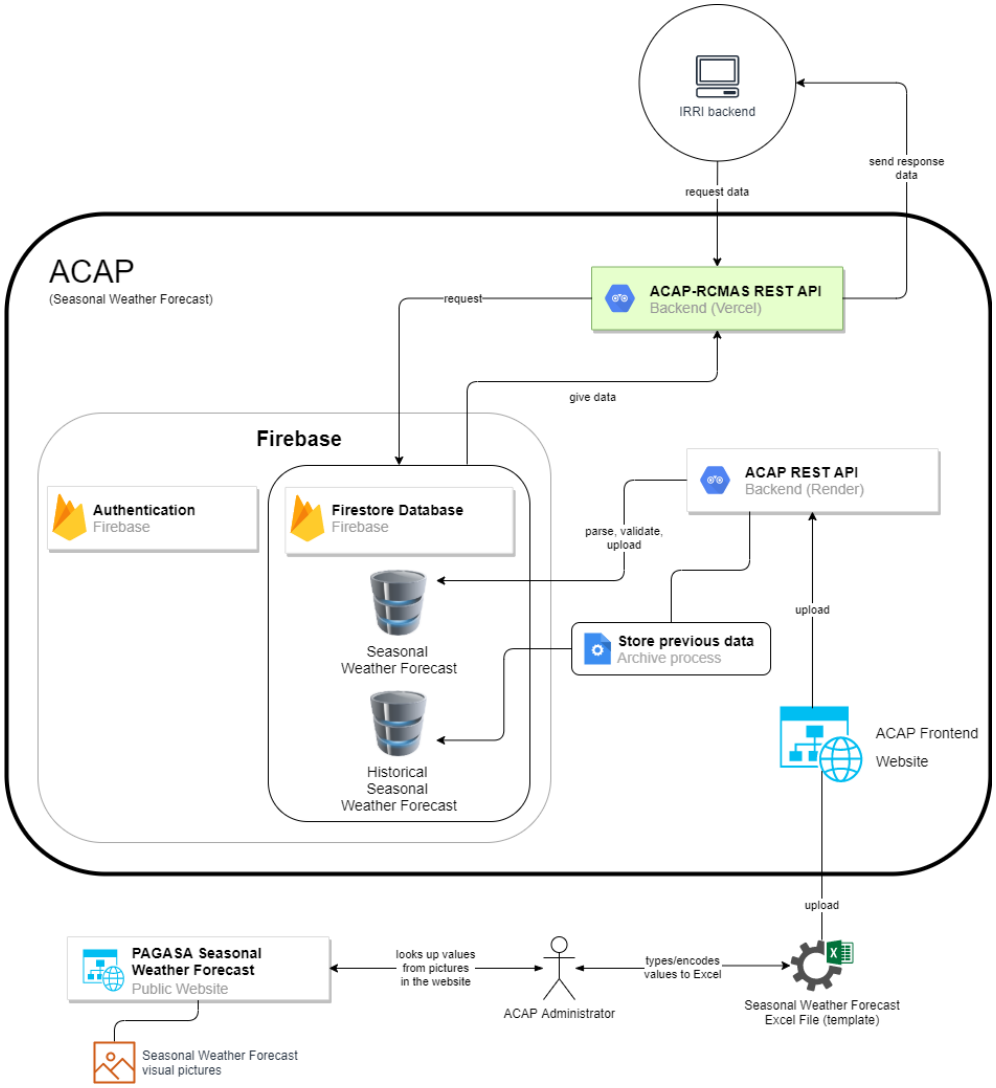


Figure 2.0 – Seasonal Weather Forecast diagram

Keywords and Components

- **PAGASA Seasonal Weather Forecast Public Website** - PAGASA's public-viewable website contains their latest seasonal weather forecast data in print-ready image/picture or PDF files

- **Seasonal Weather Forecast Excel File** - An Excel file shared by PAGASA thru email containing seasonal weather forecast data, that now serves as an Excel "template" for manually encoding new seasonal weather forecast data.

- **ACAP REST API** - Consists of several URL API endpoints responsible for serving ACAP data-mutating functions over HTTPS (hosted in Render), including uploading, parsing, validating, and storing the PAGASA seasonal weather forecast Excel file to the database and rendering bulletin PDFs for preview or storage.

- **ACAP-RCMAS REST API** - Can do everything the ACAP REST API does but fails in rendering bulletin PDFs for preview due to small storage space (hosted in Vercel). Responsible for serving the stored PAGASA (10-day, seasonal and special) weather forecast data in a faster and more user-friendly manner

- **ACAP Frontend Website** - It interacts with the ACAP REST API, and it has a user interface (UI) for uploading a Seasonal Weather Forecast Excel File to ACAP's Firestore Database

- **Firebase Authentication** - Responsible for authenticating admin logins securely to the ACAP REST API and ACAP Frontend Website-protected admin pages.

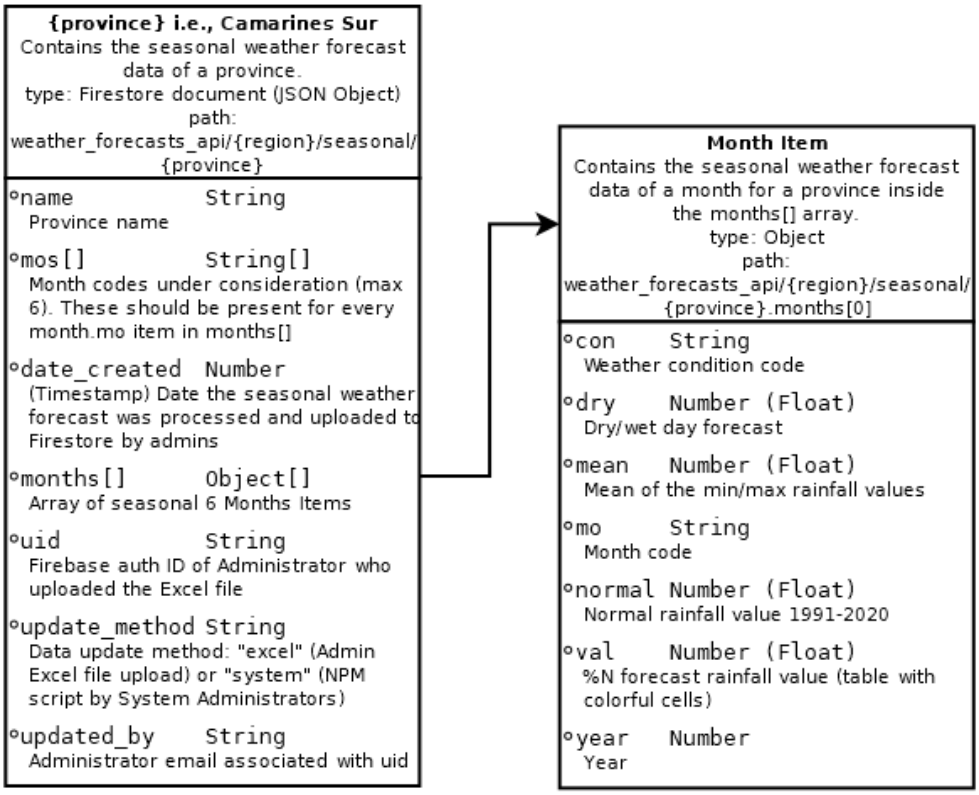
- **Firestore Database (Firebase) –** A NoSQL database responsible for storing and managing ACAP data, including the seasonal weather forecast data

- **API Key** - A random-generated code to use for authenticating trusted clients to access the ACAP-RCMAS REST APIs for PAGASA weather forecast endpoints

- **ACAP Administrator** - Responsible for looking up the PAGASA Seasonal Weather Forecast Public Website at designated time intervals, manually encoding the latest looked-up seasonal weather forecast data from the PAGASA website to a Seasonal Weather Forecast Excel File template, and uploading an updated Excel file using the ACAP Frontend Website

- **Collaborators/Clients** – Non-ACAP members 3rd party collaborators given access only to specific ACAP data sets (i.e., IRRI)

ACAP stores the processed seasonal weather forecast data to a Firestore (NoSQL) database using the following structure:




```
Example: weather_forecasts_api/bicol/seasonal/Camarines Sur

{
  "name": "Camarines Sur",
  "mos": ["sep","oct","nov","dec","jan","feb"],
  "date_created": September 5, 2023 at 8:13:23 AM UTC-8,
  "uid": "Es8jwILAhVhJdqKQiSKmybTlguu2",
  "update_method": "excel",
  "updated_by": "acaprcmasadmin1@gmail.com",
  "months": [
    {
      "con": "b_normal",
      "dry": 13,
      "mean": 242.4,
      "mo": "sep",
      "normal": 0.00,
      "val": 79.8,
      "year": 2023
    }
    ...
  ]
}
```

Figure 3.0 – Seasonal Weather Forecast database structure

PAGASA Seasonal Weather Forecast API Usage and Response

Online API Documentation

https://acap-rcmas.vercel.app/#api-PAGASA_Weather_Forecast-seasonalWeatherForecast

API Query URL

Field	Type	Description
URL	String	https://acap-rcmas.vercel.app/api/weatherforecast
Query type	GET	HTTP request type

Query Parameters

Field	Type	Description
type	String	Weather forecast type Allowed values: 'seasonal'
province	String	Case-sensitive province name in the Bicol region. Allowed values: 'Camarines Sur'
key	String	API key

API Response Success 200

Field	Type	Description
region	String	Region name
province	String	Province name
mos	String	List of the seasonal 6 months short codes in ascending order
months_year	String	A string representation of all month codes and their year
date_created	Number	(Timestamp) Date the seasonal weather forecast was processed and uploaded to Firestore by admins
date_created_str	String	The date_created field in YYYY/MM/DD date string format
months[]	Object[]	This is an array of objects, with each object containing seasonal weather forecast for a certain month. Items are arranged in ascending order by month. Please read the Months Weather Data section below for more information.
condition	String	PAGASA seasonal weather forecast condition label
condition_label_tenday	String	PAGASA 10-day weather forecast condition label counterpart of the months.condition label.
mo	String	Municipality (6) Seasonal weather months code list
year	Number	Current year associated with the month
mean	Number	Mean of the min/max rainfall values. null value means no data is available.
normal	Number	Normal rainfall value 1991-2020. null value means no data is available.
rainfall	Number	%N forecast rainfall value (table with colorful cells). null value means no data is available.
rainfall_amt_text	String	Descriptive text of rainfall amount linked with the months.condition_label_tenday label.
dry_wet	Number	Dry/wet days forecast. null value means no data is available.

API Response Example


```
{
   "region": "bicol",
   "province": "Camarines Sur",
   "mos": ["sep", "oct", "nov", "dec", "jan", "feb"],
   "months_year": "sep_2023|oct_2023|nov_2023|dec_2023|jan_2024|feb_2024",
   "months": [
      {
         "condition": "b_normal",
         "condition_label_tenday": "LIGHT RAINS",
         "mo": "sep",
         "year": 2023,
         "mean": 243.2,
         "rainfall": 71.2,
         "rainfall_amt_text": "less than 60mm of rain within 24 hours",
         "normal": 0,
         "dry_wet": 13
      },
      ...
   ],
   "date_created": 1693872803929,
   "date_created_str": "2023/09/05"
}
```


Data Update Process

The ACAP team customized the data update process of the PAGASA Seasonal Weather Forecast data for the duration of the ACAP-RCMAS project since its main dependency, the PAGASA Seasonal Weather Forecast data contained in an Excel file (for a set of the latest (6) seasonal months), previously sent by PAGASA thru email to the ACAP team for semi-automatic uploading are no longer available. The ACAP team stopped receiving Excel files after the ACAP 1.0 project ended last December 2022. The following sections discuss the established and ***improvised process*** for updating the seasonal weather forecast data for ACAP 1.0 and ACAP-RCMAS for comparison and reference.

ACAP 1.0: Original PAGASA Seasonal Weather Forecast Update Process

Before ACAP's MOA with PAGASA took effect last September 2022, ACAP team members used to manually encode each value of the seasonal weather forecast data in a spreadsheet-like input form inside ACAP's Settings page every month at no specific time or date, manually looking up the seasonal weather forecast values from PAGASA web page at https://www.pagasa.dost.gov.ph/climate/climate-prediction/seasonal-forecast.

ACAP team members started receiving Excel files from PAGASA through a MOA containing the latest seasonal weather forecast data covering the next (6) six seasonal months since October 2022. They received a total of (2) two seasonal weather forecast Excel files from PAGASA each month from October – November 2022 through email, at no definite date or schedule. They stopped receiving the Excel files in December 2022, after the ACAP 1.0 project ended.

The following methods describe the last established process for updating ACAP 1.0's seasonal weather forecast data using PAGASA-shared Excel files containing the latest seasonal weather forecast updates.

1. An ACAP team member receives an updated set of seasonal weather forecast data in an Excel file (through email) from PAGASA.
2. The ACAP team member uploads the received seasonal weather forecast Excel file to the database using the seasonal weather forecast update component (inside the Admin pages).
3. ACAP's seasonal weather forecast updater component stores the parsed weather forecast data in the database, overwriting old data if the Excel file passes a successful data validation.

ACAP-RCMAS: PAGASA Seasonal Weather Forecast Update Process

The ACAP team resorted back to manual editing the PAGASA weather forecast data, in the absence of automatic-updated seasonal weather forecast data from Excel files as a temporary means for updating the seasonal weather forecast data for the ACAP-RCMAS collaboration project since they no longer receive updated seasonal weather Forecast Excel files from PAGASA after the ACAP 1.0 project ended last December 2022. The ACAP team and the DA RFO 5 established the following process while waiting for the availability of PAGASA's seasonal weather forecast API. Using PAGASA's official seasonal weather forecast API will eliminate the need for manual input and semi-automatic uploading after syncing ACAP to work with it.

The following steps describe the improvised process of manually updating the seasonal weather forecast data that the ACAP team followed for the duration of the ACAP-RCMAS collaboration.

1. An ACAP team member manually looks up the latest PAGASA seasonal weather forecast data from their Seasonal Forecast website on https://www.pagasa.dost.gov.ph/climate/climate-prediction/seasonal-forecast every:
    a. 22nd and 27th of the month
    b. Time: 9:00 AM (office hours)
2. The ACAP team member encodes the latest seasonal weather forecast data to an Excel file, using the last seasonal weather forecast Excel file received from PAGASA (for Nov 2022 - Apr 2023) as a template.
3. The ACAP team member uploads the manually edited seasonal weather forecast Excel file to ACAP's database using its Seasonal Weather Forecast Updater component.
4. The ACAP seasonal weather forecast updater component parses the contents of the Excel file. If there are no validation errors:
    a. The updater component stores the new seasonal weather forecast data in the database.
    b. The updater component stores the previous seasonal weather forecast data in the historical database collection.
5. ACAP displays the PAGASA-DOST and other partner logos in the development mirror ACAP-Bicol (website) and ACAP-Bicol (API website) dedicated to RCMAS usage.

a. The DOST-PAGASA logo ensures that the manually-encoded seasonal weather forecast data (regarding PAGASA's Seasonal Forecast website) is legitimate with ACAP's continued MOA with PAGASA, even after the ACAP 1.0 project ended last Dec 2022

External Dependencies

- PAGASA Seasonal Weather Forecast Public Website
- Seasonal weather forecast print-ready image/picture files from the PAGASA Seasonal Weather Forecast Public Website
- Availability of ACAP personnel who will encode the updated seasonal weather forecast data to the Excel file and upload it to the ACAP database
- Access to a moderate-speed internet connection for the ACAP personnel

Future Enhancements

- Fully automatic PAGASA seasonal weather forecast updating using a REST API from PAGASA upon availability (no more manual updating and uploading of Excel files)
- Detailed API monitoring and logging

F-01: 10-Day Weather Forecast API

The 10-Day Weather Forecast API serves the latest PAGASA 10-Day weather forecast data for the Bicol region, as updated by the Cron Job or ACAP Administrators for the project duration. Detailed instructions for using the PAGASA 10-Day Weather Forecast API are available in the online API usage documentation accessible at this link.

10-Day Weather Forecast API Architecture

The following diagram shows the updated final architecture and other processes used for the PAGASA 10-Day Weather Forecast API of the ACAP-RCMAS collaboration project. See the Data Update Process section for more information about this process.

(Components connected with dotted lines indicate alternate but rarely or never-used options).

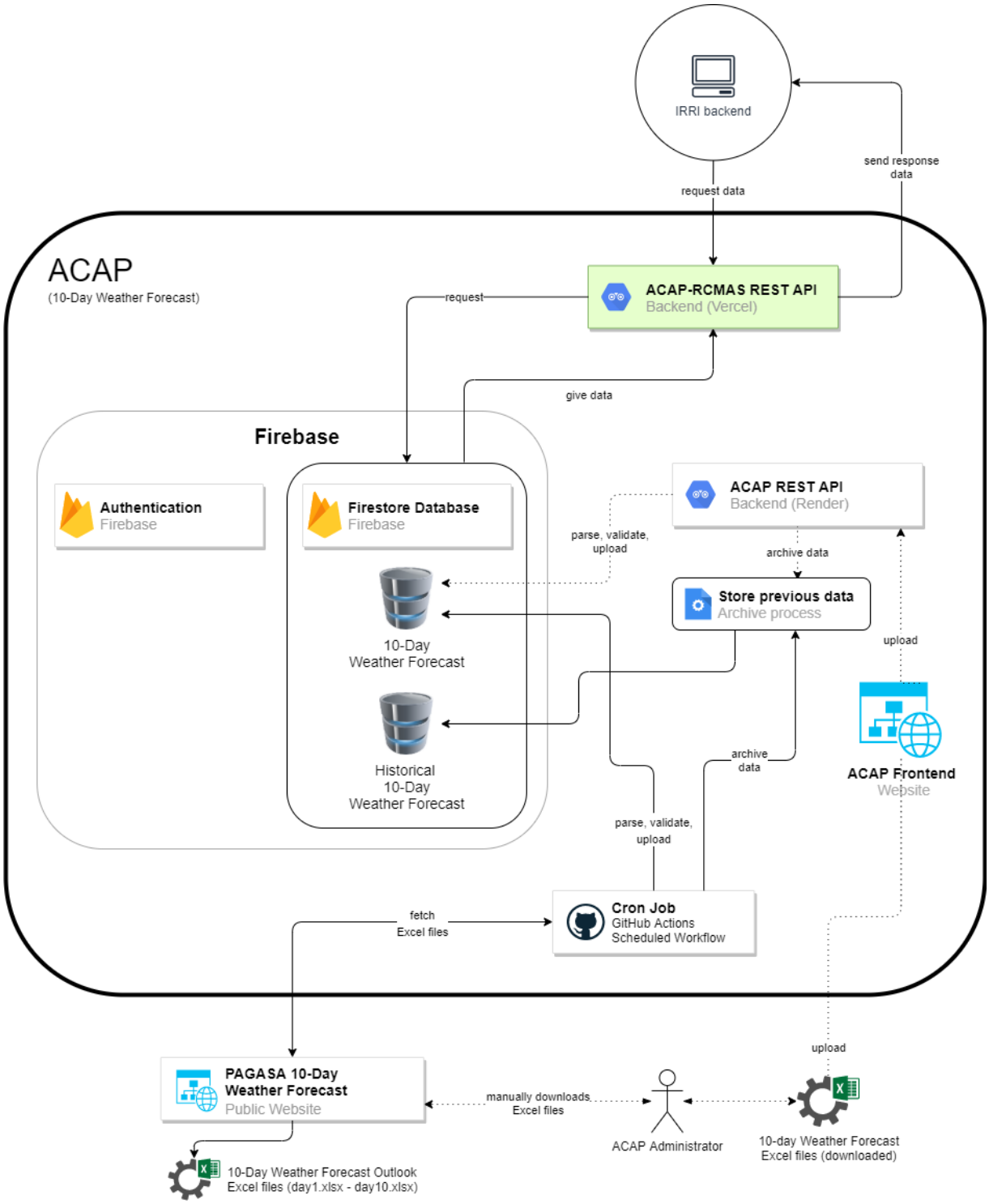


Figure 4.0 – 10-Day Weather Forecast diagram

Keywords and Components

- **PAGASA 10-Day Climate Forecast Public Website** - PAGASA's public-viewable 10-Day Climate Forecast website that contains their latest 10-day weather forecast data in downloadable Excel files (day1.xlsx – day10.xlsx)

- **10-Day Weather Forecast Excel Files** - Excel files containing the 10-day weather forecast downloadable from PAGASA's 10-Day Climate Forecast Public Website.

- **Cron Job** – A script set to run in scheduled intervals. The Cron job for the 10-day weather forecast data downloads, parses, validates, and uploads the 10-Day Weather Forecast Excel files to ACAP's database and stores old data to the historical 10-day weather forecast database collection once daily between 9:00 AM – 12:00 PM. The Data Update Process section discusses the Cron job's process flow in more detail.

- **GitHub Actions Hosted Runners** – machines that execute the 10-Day Excel files fetching and processing Cron job

ACAP stores the processed 10-day weather forecast data to a Firestore (NoSQL) database using the following structure:

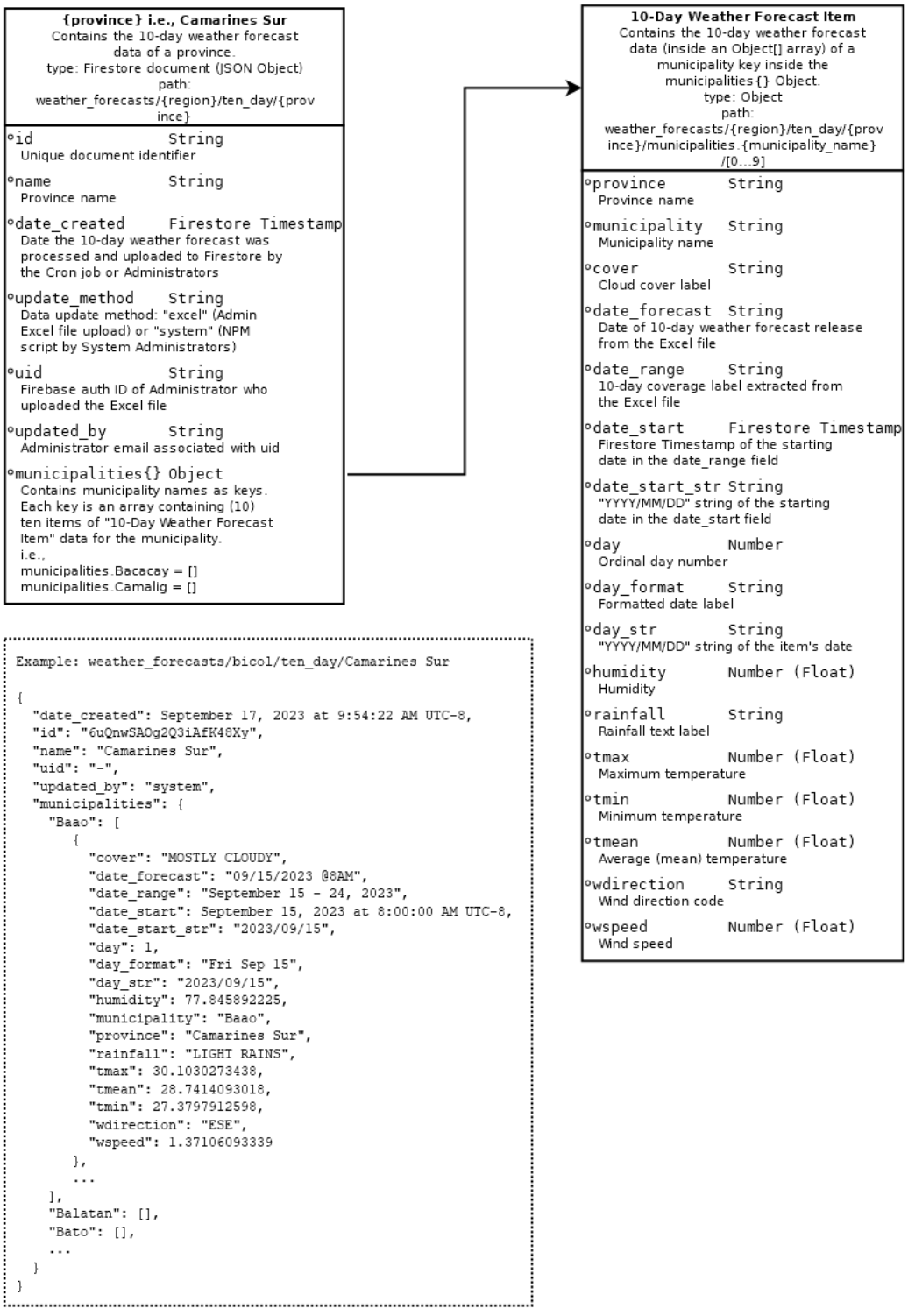


Figure 5.0 – 10-Day Weather Forecast database structure

PAGASA 10-Day Weather Forecast API Usage and Response

Online API Documentation

https://acap-rcmas.vercel.app/#api-PAGASA_Weather_Forecast-tendayWeatherForecast

API Query URL

Field	Type	Description
URL	String	https://acap-rcmas.vercel.app/api/weatherforecast
Query type	GET	HTTP request type

Query Parameters

Field	Type	Description
type	String	Weather forecast type Allowed values: 'tenday'
province	String	Case-sensitive province name in the Bicol region. Allowed values: 'Camarines Sur'
key	String	API key

API Response Success 200

Field	Type	Description
Id	String	Unique Firestore-generated document ID. Its value is null if the error object response is not null.
region	String	Region name
province	String	Province name
date_forecast	String	Date the PAGASA 10-day weather forecast was released in String format (as extracted from excel file). Its value is null if the error object response is not null.
date_forecast_str	String	Date string in YYYY/MM/DD format of the weather forecast date string extracted from the date_forecast field. Its value is null if the error object response is not null.
date_range	String	10-day validity period of the 10-day weather forecast (as extracted from excel file). Its value is null if the error object response is not null.
date_start	String	Javascript Date representation of the starting date in the date_range field. Its value is null if the error object response is not null.
date_start_str	String	The date_start field in YYYY/MM/DD date string format. Its value is null if the error object response is not null.
date_end	String	Javascript Date representation of the ending date in the date_range field. Its value is null if the error object response is not null.
date_end_str	String	The date_end field in YYYY/MM/DD date string format. Its value is null if the error object response is not null.
date_created	Number	(Timestamp) Date the 10-day weather forecast was processed and uploaded to Firestore by ACAP scheduled scripts. Its value is null if the error object response is not null.
date_created_str	String	The date_created field in YYYY/MM/DD date string format. Its value is null if the error object response is not null.
error	Object	Error log information describing the latest error encountered while fetching/parsing and validating PAGASA's 10-Day Weather Forecast Excel files every 10:00 AM - 12:00 PM daily. Its value is null if there are no errors. If there are errors, all other responses return a null value.

id	String	Unique error ID
message	String	Error message
municipalities	Object	It contains province municipality names as keys. Each municipality is an Object[] array containing parsed ten (10) day weather forecast data from PAGASA's 10-day weather forecast Excel files. The "Tiwi" municipality sample response definitions below are similar across all municipalities under a queried province ("province=Albay"). The live response data contains the 10-day weather forecast of ALL "Albay" province municipalities, not just the "Tiwi" municipality.
{Tiwi}	Object[]	It contains a list of the 10-day weather forecast (from day 1 to day 10) of the "Tiwi" municipality, a municipality under the "Albay" province if "province=Albay" in the URL province query parameter. "Tiwi" is a placeholder for a Bicol municipality. All municipality objects contain similar fields across all provinces.
province	String	Province name
municipality	String	Municipality name
tmin	Number	Minimum temperature
tmax	Number	Maximum temperature
tmean	Number	Average (mean) temperature
rainfall	String	Rainfall text description
rainfall_amt_text	String	Descriptive text of rainfall amount linked with the rainfall field.
cover	String	Cloud cover text description
humidity	Number	Humidity value
wspeed	Number	Wind speed value
wdirection	String	Wind direction text label
day_str	String	Current day's date in YYYY/MM/DD format
day_format	String	toDateString() format of the current day's date, minus year
day	Number	Day number

API Response Example


```
{
  "date_range": "September 18 - 27, 2023",
  "date_forecast": "09/18/2023 @8AM",
  "date_created_str": "2023/09/18",
  "date_created": 1695001968673,
  "date_end_str": "2023/09/27",
  "date_end": "2023-09-27T00:00:00.000Z",
  "error": null,
  "municipalities": {
    "Iriga City": [
      {
        "rainfall": "MODERATE RAINS",
        "day_str": "2023/09/18",
        "day_format": "Mon Sep 18",
        "rainfall_amt_text": "60mm - 180mm of rain within 24 hours",
        "tmax": 31.1648864746,
        "municipality": "Iriga City",
        "tmin": 27.9099731445,
        "wspeed": 4.19525457919,
        "wdirection": "ENE",
        "tmean": 29.537429809549998,
        "cover": "MOSTLY CLOUDY",
        "province": "Camarines Sur",
        "humidity": 79.0393118858,
        "day": 1
      },
    ],
    ...
  },
  "date_forecast_str": "2023/09/18",
  "date_start": "2023-09-18T00:00:00.000Z",
  "province": "Camarines Sur",
  "id": "Hz08au8BMK2lCMrREYyh",
  "region": "bicol",
  "date_start_str": "2023/09/18"
}
```

Data Update Process

ACAP runs a Cron job to regularly sync PAGASA's 10-day weather forecast data to ACAP's database. Major ACAP components use the data as visual weather outlook reference in its public pages and for generating 10-day weather outlook crop recommendations and bulletins (PDF) based on its latest rainfall values and ACAP cropping calendar data.

PAGASA's 10-Day Weather Forecast data are publicly available as downloadable Excel files on PAGASA's 10-Day Climate Forecast web page:

https://www.pagasa.dost.gov.ph/climate/climate-prediction/10-day-climate-forecast

PAGASA generates the 10-Day Weather Forecast data every Monday and Thursday [1], as noted on the PAGASA website, at 8:00 AM regarding the Excel files. Bicol RFOs create 10-day seasonal weather bulletins every ten (10) days [2].

ACAP runs this cron process once daily between 9:00 AM - 12:00 PM (10:45 AM, consistent trigger time) to store the latest and most recent PAGASA 10-day weather forecast data in ACAP's database. Unlike ACAP 1.0, the ACAP-RCMAS collaboration project keeps the latest processed data and stores the historical (past) records, made available in its **F-04: Historical 10-Day Weather Forecast API**.

[1] Monday and Thursday updates are sometimes inconsistent, with the Thursday update happening on Friday
[2] The Bicol RFO's schedule of generating a 10-day weather bulletin is subject to change.

Daily Cron for 10-Day Weather Forecast Data Fetch

1. Cron job triggers once between 9:00 AM - 12:00 PM daily.
    - 10:45 AM consistent trigger time (in GitHub Actions), with reference from PAGASA's @8AM forecast date found in Excel files
2. Fetch Excel files from PAGASA's 10 Day Climate Forecast web page.
3. Parse Excel (json)
4. Validate parsed data
5. If there are no validation errors:
    - Overwrite the existing "active" data - store the latest snapshot
    - Store the previous data to the historical Firestore DB collection

External Dependencies

- PAGASA 10-Day Climate Forecast public web page at [link].
- PAGASA 10-Day Weather Outlook Excel files (day1.xlsx – day10.xlsx) available for dowload at the PAGASA 10-Day Climate Forecast web page

Future Enhancements

- Fine-tune the date and time of triggering the Daily Cron for 10-Day Weather Forecast Data Fetch after gaining more insight on the exact date and time PAGASA updates the 10-Day Weather Outlook Excel files from the 10-Day Climate Forecast public web page.

F-02: Special Weather Forecast API

The Special Weather Forecast API serves select parts of the latest PAGASA tropical cyclone weather forecast data for the whole Philippines, with an option to include Administrator-selected typhoon-affected municipalities from the Bicol region, as updated by the Cron Job or ACAP Administrators for the project duration. Detailed instructions for using the PAGASA Special Weather Forecast API are available in the online API usage documentation accessible at this link.

Special Weather Forecast API Architecture

The following diagram shows the updated final architecture and other processes used for the PAGASA Special Weather Forecast API of the ACAP-RCMAS collaboration project. See the Data Update Process section for more information about this process.

(Components connected with dotted lines indicate alternate but rarely or never-used options).

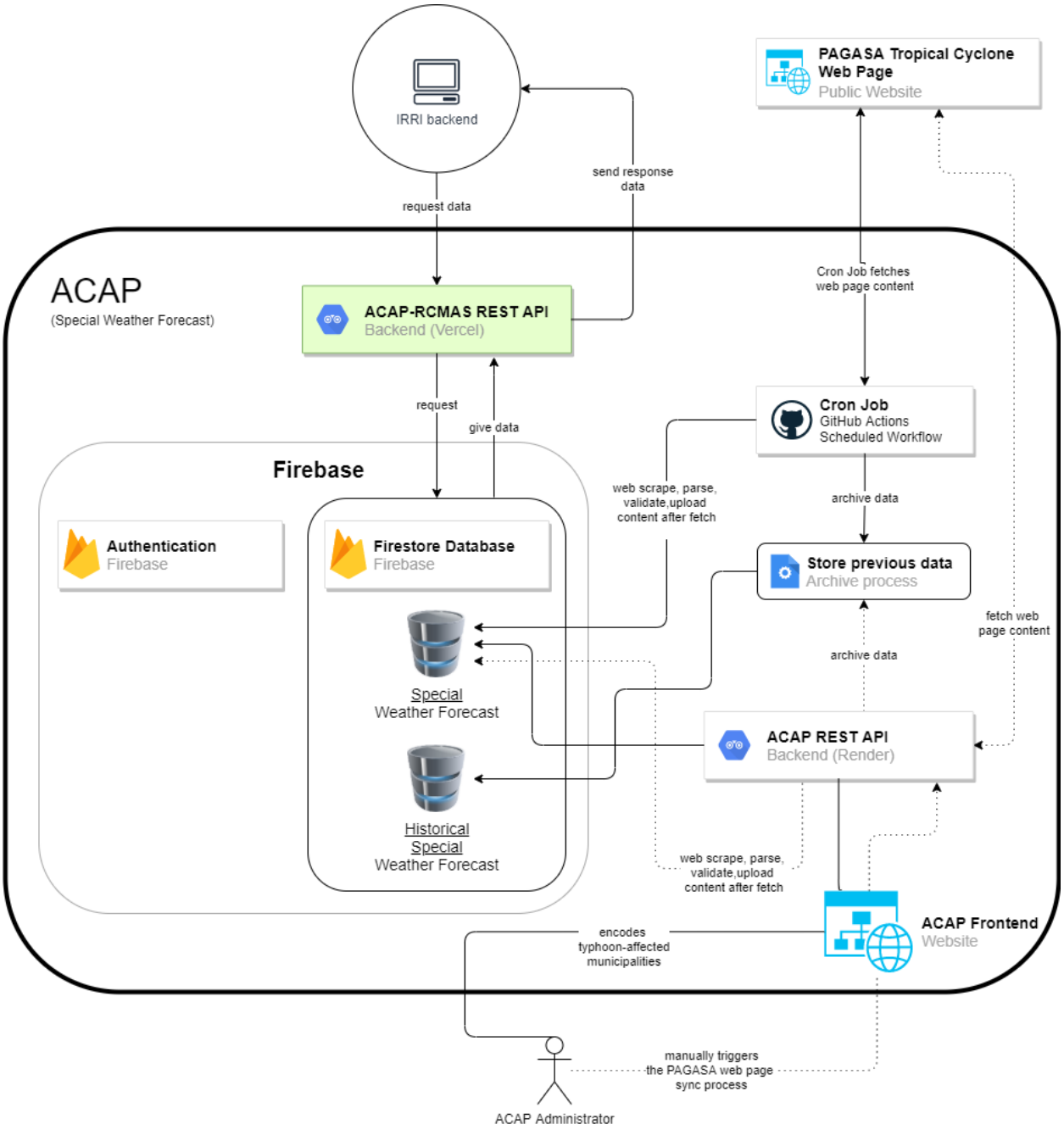


Figure 6.0 – Special Weather Forecast diagram

Keywords and Components

- **PAGASA Tropical Cyclone Web Page** - PAGASA's public-viewable Tropical Cyclone Bulletin web page containing the latest tropical cyclone forecast information.

- **Cron Job** – A script set to run in scheduled intervals. The Cron job for the severe cyclone weather forecast data web-scrapes the PAGASA Tropical Cyclone Web Page – it downloads, parses, validates, and uploads the web page's cyclone-related text content to ACAP's database and stores old data to the historical severe cyclone weather database collection every (2) two hours. The Data Update Process section discusses the Cron job's process flow in more detail.

- **GitHub Actions Hosted Runners** – machines that execute the cyclone web-scraping Cron job.

External Dependencies

- PAGASA Tropical Cyclone public web page at [link].

Future Enhancements

- Fine-tune the date and time of triggering the Cron job for Special Weather Forecast Data web-scraping after gaining more insight on the exact date and time PAGASA updates their Tropical Cyclone public web page.

ACAP stores the processed special weather forecast data to a Firestore (NoSQL) database using the following structure:

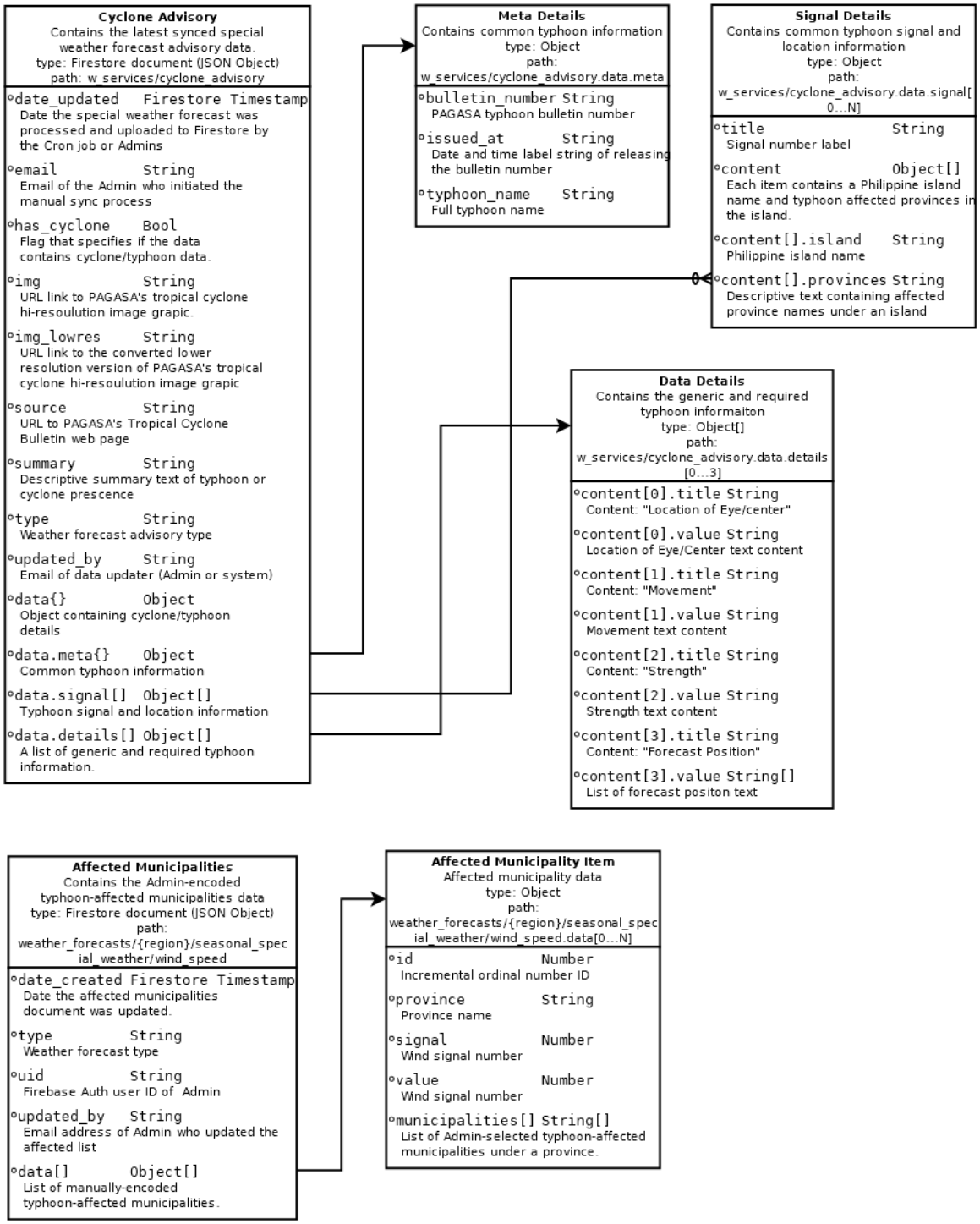


Figure 7.0 – Special Weather Forecast database structure

```
Example: w_services/cyclone_advisory

{
  "date_updated": September 18, 2023 at 2:54:32 AM UTC-8,
  "email": "-",
  "has_cyclone": true,
  "img": "https://pubfiles.pagasa.dost.gov.ph/tamss/weather/track_hanna.png",
  "img_lowres": "https://storage.googleapis.com/acap-rcmas-dev.appspot.com/images/cyclone-lowres.png...",
  "source": "https://www.pagasa.dost.gov.ph/tropical-cyclone/severe-weather-bulletin",
  "summary": "There is an active Tropical Cyclone within the Philippine Area of Responsibility.",
  "type": "cyclone_advisory",
  "updated_by": "system",
  "data": [
     {
       "details": [
         {
           "title": "Location of Eye/center",
           "value": "The center of Tropical Depression "MAYMAY" was estimated based on..."
         },
         {
           "title": "Movement",
           "value": "Moving Almost Stationary"
         },
         {
           "title": "Strength",
           "value": "Maximum sustained winds of 45 km/h near the center..."
         },
         {
           "title": "Forecast Position",
           "value": [
             "Oct 12, 2022 02:00 AM - 220 km East of Casiguran, Aurora",
             "Oct 12, 2022 02:00 PM - 125 km East of Casiguran, Aurora",
             "Oct 13, 2022 02:00 AM - 125 km East of Casiguran, Aurora"
             ...
           ]
         }
       ],
       "meta": {
         "bulletin_number": "Tropical Cyclone Bulletin #3",
         "issued_at": "Issued at 05:00 pm, 11 October 2022",
         "typhoon_name": "Tropical Depression "Maymay""
       },
       "signal": [
         {
           "title": "SIGNAL NO. 1",
           "content": [
             {
               "island": "Luzon",
               "provinces": "Isabela, Quirino, Nueva Vizcaya, Aurora, Nueva Ecija, and the extreme northern portion..."
             },
             ...
           ]
         }
       ],
       affected: [
         {
           "id": 0,
           "province": "Albay",
           "signal": 1,
           "value": 1,
           "municipalities": ["Bacacay", "Camalig", "Daraga"]
         },
         ...
       ]
     }
  ]
}
```

Figure 7.1 – Special Weather Forecast database content example

```
Example: weather_forecasts/bicol/seasonal_special_weather/wind_speed.data[]

{
  "date_created": July 25, 2023 at 3"58:55 AM UTC-8,
  "type": "windspeed",
  "uid": "NOYJhUvN3kMVzMdSfaLF0YQA26P2",
  "rcmasadmin1@gmail.com",
  "data": [
     {
       "id": 0,
       "province": "Albay",
       "signal": 1,
       "value": 1,
       "municipalities": ["Bacacay, Camalig, Daraga"]
     },
     ...
  ]
}
```

Figure 7.2 – Special Weather Forecast: typhoon-affected municipalities database content example

Data Update Process

ACAP runs a Cron job every (2) hours to regularly sync PAGASA's Tropical Cyclone web page contents to ACAP's database. Major ACAP components use the data as visual weather outlook reference in their public pages and for generating severe cyclone outlook crop recommendations and bulletins (PDF) by overlaying its values for visual reference along with the ACAP cropping calendar data.

PAGASA's Tropical Cyclone Forecast data are publicly accessible on PAGASA's Tropical Cyclone web page:

https://www.pagasa.dost.gov.ph/tropical-cyclone/severe-weather-bulletin

The ACAP-RCMAS collaboration project keeps the latest processed data and stores the historical (past) records, made available in its **F-05: Historical Special Weather Forecast API**.

Daily Cron for Web-scraping the Special Weather Forecast Data

1. Cron job triggers every (2) two hours.
2. Fetch/web-scrape text content from PAGASA's Tropical Cyclone web page.
3. Parse and validate web page content.
4. If there are no validation errors, and the parsed bulletin_no value is different from the "active" bulletin_number in ACAP's database:
    - Overwrite the existing "active" severe cyclone weather forecast data - store the latest snapshot.
    - Store the previous severe cyclone weather forecast data in the historical Firestore DB collection.

ACAP Administrator Input of Affected Bicol Provinces and Municipalities

1. An ACAP Administrator checks the latest ACAP Special Weather Forecast.
2. If there are Bicol-related areas mentioned in the Special Weather Forecast's descriptive text:
    - Encode affected (specific) Bicol provinces and municipalities in the ACAP Settings – Wind Speed List Editor.
3. Manually encoded typhoon-affected Bicol provinces and municipalities will:
    - Become available for location selection when creating Special Weather Forecast bulletin PDFs.
    - Show up in the PAGASA Special Weather Forecast API responses.

PAGASA Special Weather Forecast API Usage and Response

Online API Documentation

https://acap-rcmas.vercel.app/#api-PAGASA_Weather_Forecast-specialWeatherForecast

API Query URL

Field	Type	Description
URL	String	https://acap-rcmas.vercel.app/api/weatherforecast
Query type	GET	HTTP request type

Query Parameters

Field	Type	Description
type	String	Weather forecast type Allowed values: 'special'
province	String	Case-sensitive province name in the Bicol region. Allowed values: 'Camarines Sur'
key	String	API key

API Response Success 200

Field	Type	Description
summary	String	Brief overview showing the status if there are tropical cyclones
has_cyclone	Bool	Flag if a cyclone is detected or not
img	String	URL link to PAGASA's tropical cyclone hi-resoulution image grapic.
img_lowres	String	URL link to the converted lower resolution version of PAGASA's tropical cyclone hi-resoulution image grapic
source	String	PAGASA's Tropical Cyclone Bulletin web page
type	String	Type of weather forecast
date_created	Number	(Timestamp) Date the special weather forecast was processed and uploaded to Firestore by ACAP scheduled scripts
date_created_str	String	The date_created field in YYYY/MM/DD date string format
date_created_affected	Number	(Timestamp) Date the cyclone-affected municipalities in the data.affected[] list are encoded by admins
date_created_affected_str	String	The date_created_affected field in YYYY/MM/DD date string format
data	Object	These data contains detailed cyclone information such as the bulletin number, typhoon name, location of eye/center, movment, and speed. It also contains an array of objects, with each object containing grouped

		province, wind speed signal and admin-selected affected municipalities for the province.
meta	Object	
Bulletin_number	String	Descriptive bulletin number text
typhoon_name	String	Typhoon name
issued_at	String	Formatted text description of the Date and time the current bulletin was issued by PAGASA
details	Object[]	Main cyclone information
title	String	Cyclone information item name
value	String	Cyclone information item content text. This value becomes a String array String[] on data.details.title="Forecast Position"
signal	Object[]	List of web-scraped affected areas (Areas with TCWS) from PAGASA's website grouped by tropical wind signal number.
title	String	Signal number label
content	Object[]	Affected provinces in the (3) major island groups
provinces	String	Affected province names and other descriptive text content
island	String	Affected island group name
affected	Object[]	Cyclone-affected municipalities encoded by admins
id	Number	Ordinal numeric ID
province	String	Province name
affected	Number	Wind signal number. Allowed values: '1 - 10'
municipalities	String[]	Cyclone-affected municipalities under a province, encoded by admins

API Response Example


```
{
  "summary": "There is an active Tropical Cyclone within the Philippine Area... "
  "has_cyclone": true,
  "img": "./PAGASA_files/track_maymay.png",
  "img_lowres": "https://storage.googleapis.com/acap-rcmas-dev.appspot.com/images/cyclone...",
  "data": {
    "meta": {
      "bulletin_number": "Tropical Cyclone Bulletin #3",
      "typhoon_name": "Tropical Depression \"Maymay\"",
      "issued_at": "Issued at 05:00 pm, 11 October 2022"
    },
    "details": [
      {
        "title": "Location of Eye/center",
        "value": "The center of Tropical Depression “MAYMAY” was estimated based on all..."
      },
      {
        "title": "Movement",
        "value": "Moving Almost Stationary"
      },
      {
        "title": "Strength",
        "value": "Maximum sustained winds of 45 km/h near the center and..."
      },
      {
        "title": "Forecast Position",
        "value": [
          "Oct 12, 2022 02:00 AM - 220 km East of Casiguran, Aurora",
          "Oct 12, 2022 02:00 PM - 125 km East of Casiguran, Aurora",
          "Oct 13, 2022 02:00 AM - 125 km East of Casiguran, Aurora",
          "Oct 13, 2022 02:00 PM - In the vicinity of Kimbutan, Dupax Del Sur"
        ]
      }
    ],
    "signal": [
      {
        "title": "SIGNAL NO. 1",
        "content": [
          {
            "provinces": "Isabela, Quirino, Nueva Vizcaya, Aurora, Nueva Ecija,… ",
            "island": "Luzon"
          }
        ]
      }
    ],
```

```
    "affected": [
      {
        "province": "Albay",
        "id": 0,
        "signal": 1,
        "value": 1,
        "municipalities": [
          "Bacacay",
          "Camalig",
          "Daraga"
        ]
      },
      ...
    ]
  },
  "source": "https://www.pagasa.dost.gov.ph/tropical-cyclone/severe-weather-bulletin",
  "type": "cyclone_advisory",
  "date_created": 1687120308126,
  "date_created_str": "2023/06/19",
  "date_created_affected": 1686777515598,
  "date_created_affected_str": "2023/06/15"
}
```

PAGASA Historical REST API Endpoints

The ACAP-RCMAS collaboration project stored earlier weather forecast data and created historical weather forecast API endpoints to observe and allow back-tracking of previous PAGASA weather forecast data since the ACAP Bicol (ACAP 1.0) does not store and archive past data.

The previous sections (F-00: Seasonal Weather Forecast API, F-01: 10-Day Weather Forecast API, and F-02: Special Weather Forecast API) discuss processes of storing the weather forecast data in more detail before each dedicated process overwrites the “active” set of seasonal, 10-day, or severe cyclone weather forecast with new data. This diagram shows an overview of the housekeeping and clean-up of outdated historical weather forecast data in ACAP’s database and how it serves the archived data to requesting clients.

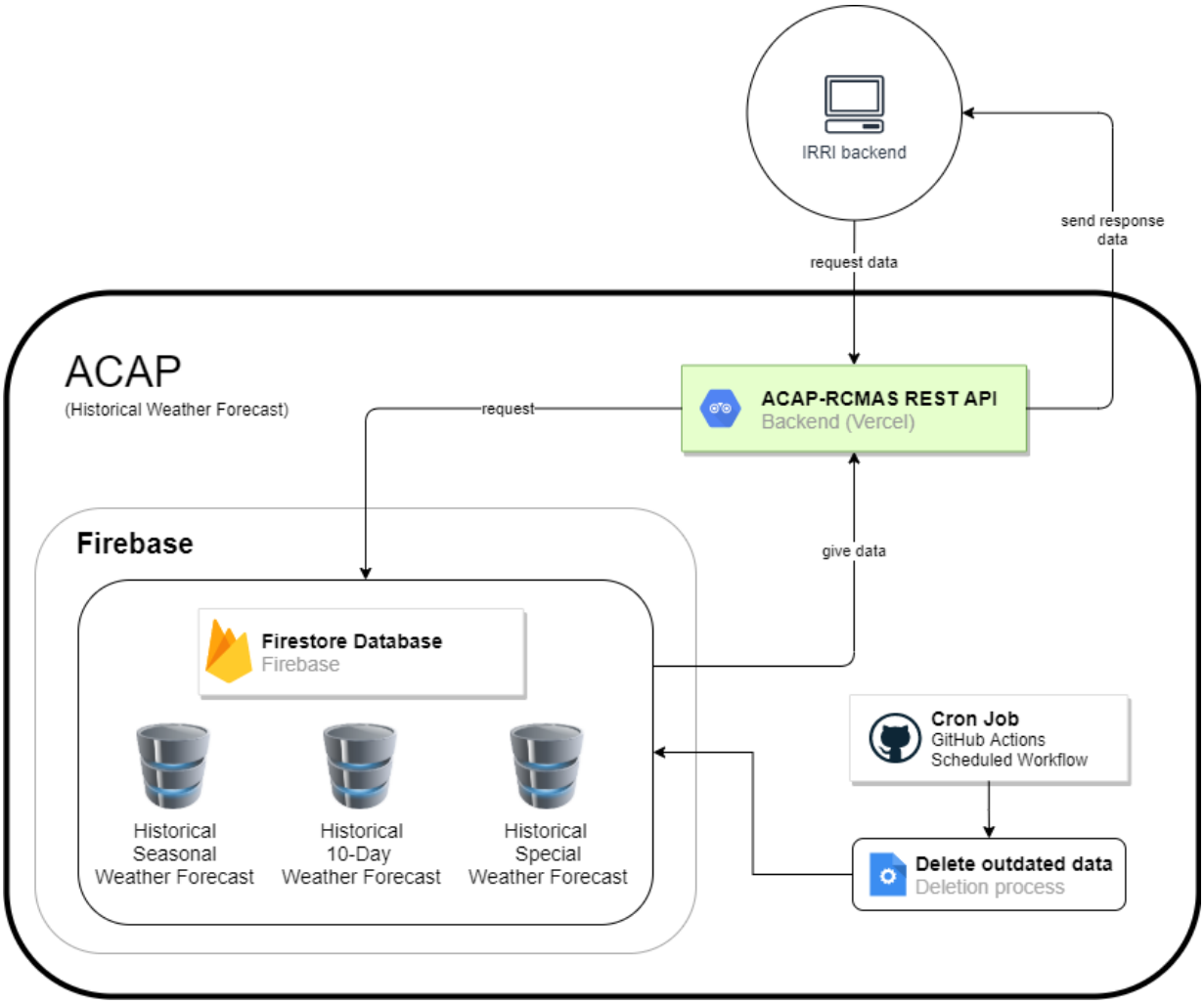


Figure 8.0 – Historical Weather Forecast

F-03: Historical Seasonal Weather Forecast API

The Historical Seasonal Weather Forecast API serves the archived PAGASA seasonal weather forecast data for the Bicol region up to cycles/sets of the past (6) six months. Detailed instructions for using the Historical Seasonal Weather Forecast API are available in the online API usage documentation accessible at this link.

The following diagram shows the Firestore (NoSQL) database structure for storing the PAGASA Historical Seasonal Weather Forecast data of the ACAP-RCMAS collaboration project. See the Data Update Process section for more information about this process.

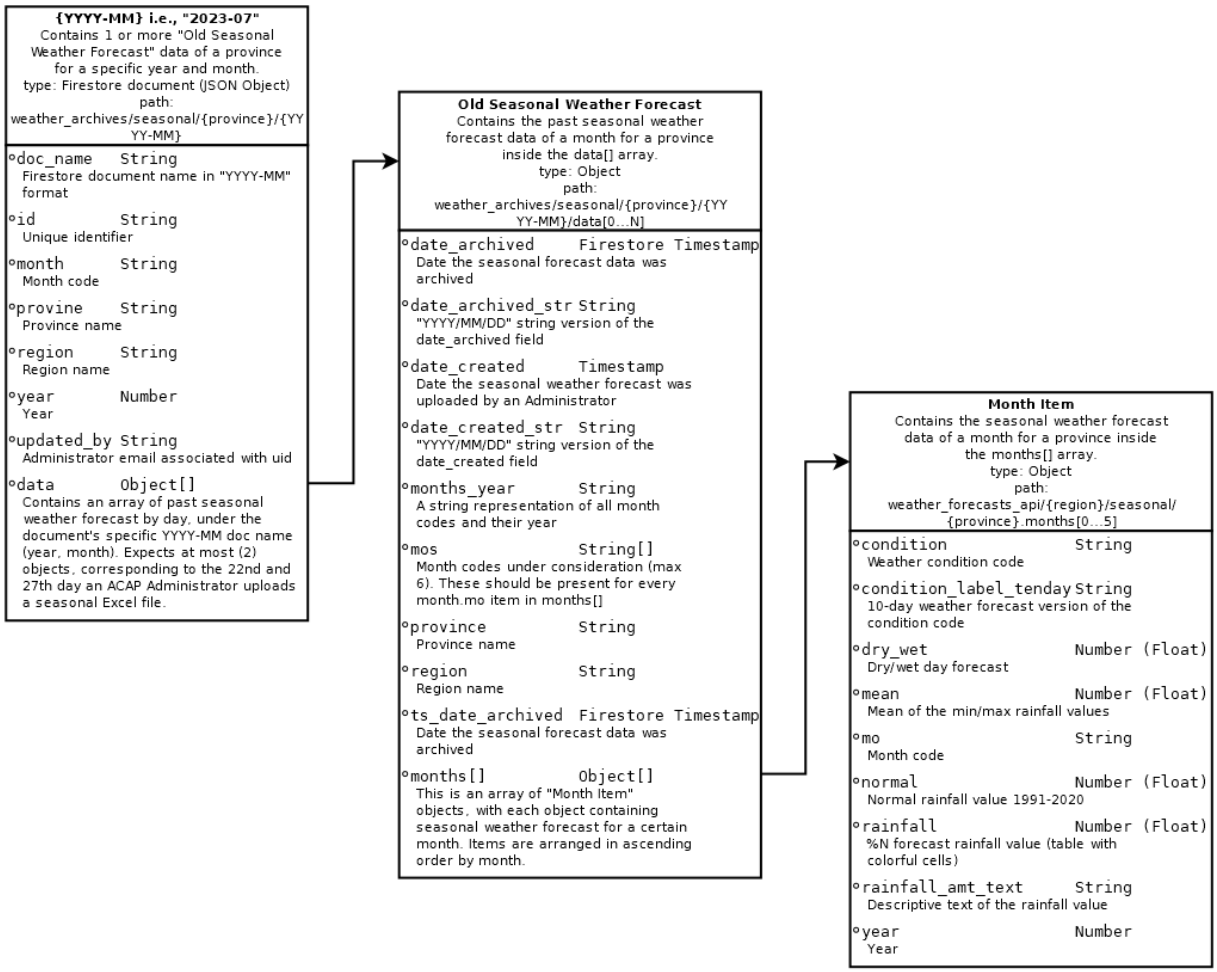


Figure 9.0 – Historical Seasonal Weather Forecast database structure

```
Example: weather_archives/seasonal/Camarines Sur/2023-07

{
  "doc_name": "2023-07",
  "id": "6PJiIDj1ZmcdrD1UvgD7",
  "month": "jul",
  "province": "Albay",
  "region": "bicol",
  "year": 2023,
  "data": [
    {
      "date_archived": September 5, 2023 at 7:45:45 AM UTC-8,
      "date_archived_str": "2023/09/05",
      "date_created": 1690231377743,
      "date_created_str": "2023/07/25",
      "months_year": "jul_2023|aug_2023|sep_2023|oct_2023|nov_2023|dec_2023",
      "mos": ["jul","aug","sep","oct","nov","dec"],
      "province": "Albay",
      "region": "bicol",
      "ts_date_archived": September 5, 2023 at 7:45:45 AM UTC-8,
      "months": [
        {
          "condition": "near_normal",
          "condition_label_tenday": "MODERATE RAINS",
          "dry_wet": 11,
          "mo": "jul",
          "normal": null,
          "rainfall": 118.5,
          "rainfall_amt_text": "60mm - 180mm of rain within 24 hours",
          "year": 2023
        },
        ...
      ]
    },
    ...
  ]
}
```

Figure 9.1 – Historical Seasonal Weather Forecast database content structure

Data Management Process

Updating the Historical Seasonal Weather Forecast Data

ACAP updates its historical seasonal weather forecast data by storing the active seasonal weather forecast data set in the historical Firestore collection right before overwriting it with new seasonal weather forecast data as a by-product of the process for updating the seasonal weather forecast data discussed in more detail under the ACAP-RCMAS: PAGASA Seasonal Weather Forecast Update Process section.

The following steps summarizes the process:

1. An ACAP team member manually updates an existing PAGASA Seasonal Weather forecast Excel file template, following the steps described in the ACAP-RCMAS: PAGASA Seasonal Weather Forecast Update Process section every:
    - 22nd and 27th of the month
    - Time: 9:00 AM (office hours)
2. The ACAP team member uploads the manually edited seasonal weather forecast Excel file to ACAP's database using its Seasonal Weather Forecast Updater component.
3. Parse and validate the Excel file on file upload. If there are no validation errors:
    - Store the new seasonal weather forecast data, overwriting the previous ones.
    - Store the previous seasonal weather forecast in the historical database collection.

Deleting Outdated Historical Seasonal Weather Forecast Data

ACAP keeps previous seasonal historical weather forecast data sets/cycles up to a maximum of the past (6) months from its "YYYY-MM" Firestore document name. A Cron job auto-deletes historical seasonal weather forecast data older than (6) six months every first day of the month.

The following steps summarizes the process:

1. Cron job triggers every first day of the month at midnight Philippine time.
2. Delete historical seasonal weather forecast Firestore documents whose "YYYY-MM" document name is older than (6) six months from triggering the Cron job.
3. Deleted historical seasonal weather forecast data will not show up in the historical seasonal weather forecast API responses.

Historical PAGASA Seasonal Weather Forecast API Usage and Response

Online API Documentation

https://acap-rcmas.vercel.app/#api-PAGASA_Historical_Weather_Forecast-historicalSeasonalWeatherForecastByFirstMonth

This endpoint returns the historical seasonal weather forecast data in ACAP's database for up to a maximum of the ***past (6) six months***, starting from the specified month_start or month and year URL query parameters, excluding the current Administrator-uploaded seasonal weather forecast data from PAGASA's shared Excel file.

Unlike the regular seasonal weather forecast API, the success response of this endpoint returns (1) one or more seasonal weather forecast data for a given month, indicating the number of times an Administrator uploaded an Excel file.

API Query URL

Field	Type	Description
URL	String	https://acap-rcmas.vercel.app/api/weatherforecast/archives
Query type	GET	HTTP request type

Query Parameters – By Month Start

This set of query parameters returns sets/cycles of past seasonal weather forecast data whose 1st month (from the group of (6) six seasonal months) starts with the "month_start" query parameter by the specified year.

Field	Type	Description
type	String	Weather forecast type Allowed values: 'seasonal'
province	String	Case-sensitive province name in the Bicol region. Allowed values: 'Camarines Sur'
key	String	API key
month_start	String	Month code of the 1st month of a set/cycle of (6) seasonal weather forecast months. If provided, make sure to omit the "month" parameter and expect to receive a successful response following the response structure of **Success 200 - Query by Start Month.** If omitted and only the year parameter is provided, the response will contain the archived seasonal weather forecast for all months under the year parameter. Allowed values: 'jan', 'feb', 'mar', 'apr', 'may', 'jun', 'jul', 'aug', 'sep', 'oct', 'nov', 'dec'
year	String	Year associated with the month_start parameter. Allowed values: '2023', '2022', '2020'

API Response Success 200 – Query By Start Month

This API response describes the 200 code success response structure of **Querying By Month Start**.

Field	Type	Description
response	Object[]	One or more groups of past seasonal weather forecast data, containing seasonal weather forecast for (6) months starting with the month_start month.
region	String	Region name
province	String	Province name
month	String	Month code of the 1st seasonal month in the data set's (6) seasonal months (month_start).
year	String	Year
doc_name	String	Year and month summary text in "YYYY-MM" format.
data	Object[]	Sets of seasonal weather forecasts beginning with the specified "month_start". We expect Administrators to upload seasonal weather forecast Excel files at most (2) two times per month, every 22nd and 27th, as confirmed by the DA RFO 5 for the duration of the ACAP-RCMAS project. Each item is a seasonal weather forecast data similar to the 200 success response of the regular **F-00: Seasonal Weather Forecast API**.

API Response Example - Query By Start Month


```
[
  {
    "province": "Camarines Sur",
    "month": "jul",
    "data": [
      {
        "mos": ["jul", "aug", sep", "oct", "nov", "dec"],
        "date_archived": { "_seconds": 1693871145, "_nanoseconds": 587000000 },
        "months": [
          {
            "normal": null,
            "condition": "above_normal",
            "mo": "jul",
            "rainfall": 120.5,
            "condition_label_tenday": "HEAVY RAINS",
            "year": 2023,
            "mean": 331.7,
            "rainfall_amt_text": "greater than 180mm of rain within 24 hours",
            "dry_wet": 12
          },
          ...
        ],
        "province": "Camarines Sur",
        "date_created_str": "2023/07/25",
        "date_created": 1690231380035,
        "months_year": "jul_2023|aug_2023|sep_2023|oct_2023|nov_2023|dec_2023",
        "ts_date_archived": { "_seconds": 1693871145, "_nanoseconds": 587000000 },
        "region": "bicol",
        "date_archived_str": "2023/09/05"
      },
      {
         "mos": ["jul", "aug", sep", "oct", "nov", "dec"],
         "months": [...],
         "date_created_str": "2023/07/27",
         "date_archived_str": "2023/08/22",
         ...
      },
      ...
    ],
    "year": 2023,
    "doc_name": "2023-07",
    "id": "nNc9DOtGZkYdCcZLVyrw",
    "region": "bicol"
  },
]
```

Query Parameters – Fetch All Months

This set of query parameters returns the past seasonal weather forecast values only of the specified "month" parameter by year in the context of each month of all sets/cycles of (6) seasonal months, which includes the "month" and “year” parameters.

Field	Type	Description
type	String	Weather forecast type Allowed values: 'seasonal'
province	String	Case-sensitive province name in the Bicol region. Allowed values: 'Camarines Sur'
key	String	API key
month	String	Any month code. If provided, make sure to omit the “month_start” parameter and expect to receive a successful response following the response structure of **Success 200 - Fetch All Months.** Allowed values: 'jan', 'feb', 'mar', 'apr', 'may', 'jun', 'jul', 'aug', 'sep', 'oct', 'nov', 'dec'
year	String	Year associated with the month_start parameter. Allowed values: '2023', '2022', '2020'

API Response Success 200 – Query Fetch All Months

This API response describes the 200 code success response structure of **Querying By Fetch All Months**.

Field	Type	Description
response	Object	One or more groups of past seasonal weather forecast data containing the data of only the specified “month” and “year” parameters in the context of each month from other sets/cycles of (6) six seasonal months that also include the month and year.
province	String	Province name
month	String	Month code
year	String	Year
forecast	Object	Set of seasonal weather forecasts for the specified month and year, as recorded in each of the past (5) months and given (1) month that includes the month parameter. It contains the past (5) months up to the specified month (for a total of (6) seasonal months) as month code keys, indicating several month_starts. Each month code key is an Object array containing minimal seasonal weather forecast data for the specified month included in the key's (6) internal seasonal months.
{jul}	Object[]	(Jul is a placeholder for other month code keys for (6) six seasonal month sets/cycles starting with the past (5), and the current (1) month includes the month parameter.)
id	String	Unique identifier
info	String	Data set description
date_created_str	String	Date in YYYY/MM/DD string format, indicating the date of of successfully uploading and saving the data set to the database.
date_archived_str	String	Date in YYYY/MM/DD string format, indicating the date when this data set is stored in the historical arhives collection.
ts_date_archived	String	Firestore Timestamp version of the date_archived_str field.

year	Number	Seasonal weather forecast year of the month parmeter inside one of the (5) seasonal months after {jul}.
months_year	String	A string representation of all month codes and their year
condition	String	PAGASA seasonal weather forecast condition label of the month parmeter inside one of the (5) seasonal months after {jul}.
condition_label_tenday	String	PAGASA 10-day weather forecast condition label counterpart of the months.condition label of the month parmeter inside one of the (5) seasonal months after {jul}.
rainfall	String	%N forecast rainfall value (table with colorful cells) of the month parmeter inside one of the (5) seasonal months after {jul}.
rainfall_amt_text	String	Descriptive text of rainfall amount linked with the months.condition_label_tenday label of the month parmeter inside one of the (5) seasonal months after {jul}.

API Response Example - Query Fetch All Months


```
{
  "province": "Camarines Sur",
  "month": "jul",
  "year": "2023",
  "forecast": {
    "may": [
      {
        "id": 0,
        "info": "JUL 2023 seasonal forecast extracted from the (6) months MAY - OCT 2023
           seasonal forecast data set archived on Sat 2023/05/27 08:50:45 AM",
         "condition": "b_normal",
        "date_created_str": "2023/05/22",
        "date_archived_str": "2023/05/27",
        "year": 2023,
        ...
      },
      {
        "id": 1,
        "info": "JUL 2023 seasonal forecast extracted from the (6) months MAY - OCT 2023
           seasonal forecast data set archived on Sat 2023/05/27 08:50:45 AM",
         "condition": "wb_normal",
        "date_created_str": "2023/05/27",
        "date_archived_str": "2023/06/22",
        "year": 2023,
        ...
      },
      ...
    ],
    "jun": [
      {
```

```
        "id": 0,
        "info": "JUL 2023 seasonal forecast extracted from the (6) months JUN - NOV 2023
           seasonal forecast data set archived on Sat 2023/05/27 08:50:45 AM",
         "condition": "b_normal",
        "date_created_str": "2023/06/22",
        "date_archived_str": "2023/06/27",
        "year": 2023,
        ...
      },
      {
        "id": 1,
        "info": "JUL 2023 seasonal forecast extracted from the (6) months JUN - NOV 2023
           seasonal forecast data set archived on Sat 2023/05/27 08:50:45 AM",
         "condition": "normal",
        "date_created_str": "2023/06/27",
        "date_archived_str": "2023/07/25",
        "year": 2023,
        ...
      },
      ...
    ],
    "jul": [
      {
        "id": 0,
        "info": "JUL 2023 seasonal forecast extracted from the (6) months JUL - DEC 2023
           seasonal forecast data set archived on Tue 2023/09/05 07:45:45 AM",
        "date_created_str": "2023/07/25",
        "date_archived_str": "2023/09/05",
        "ts_date_archived": "2023-09-04T23:45:45.587Z",
        "year": 2023,
        "months_year": "jul_2023|aug_2023|sep_2023|oct_2023|nov_2023|dec_2023",
        "condition": "above_normal",
        "condition_label_tenday": "HEAVY RAINS",
        "rainfall": 120.5,
        "rainfall_amt_text": "greater than 180mm of rain within 24 hours"
      },
      ...
    ]
  }
}
```

External Dependencies

(The external dependencies of the F-00: PAGASA Seasonal Weather Forecast API also apply).

- PAGASA Seasonal Weather Forecast Public Website
- Seasonal weather forecast print-ready image/picture files from the PAGASA Seasonal Weather Forecast Public Website
- Availability of ACAP personnel who will encode the updated seasonal weather forecast data to the Excel file and upload it to the ACAP database
- Access to a moderate-speed internet connection for the ACAP personnel

Future Enhancements

- Allow more querying options, such as searching using multiple “month” parameter values.

F-04: Historical 10-Day Weather Forecast API

The Historical 10-Day Weather Forecast API serves the past PAGASA 10-Day weather forecast data for the Bicol region up to the past (3) three months maximum in ACAP's database, excluding the current-fetched data set. Detailed instructions for using the Historical 10-Day Weather Forecast API are available in the online API usage documentation accessible at this link.

The following diagram shows the Firestore (NoSQL) database structure for storing the Historical PAGASA Historical Seasonal Weather Forecast data. See the Data Update Process section for more information about this process.

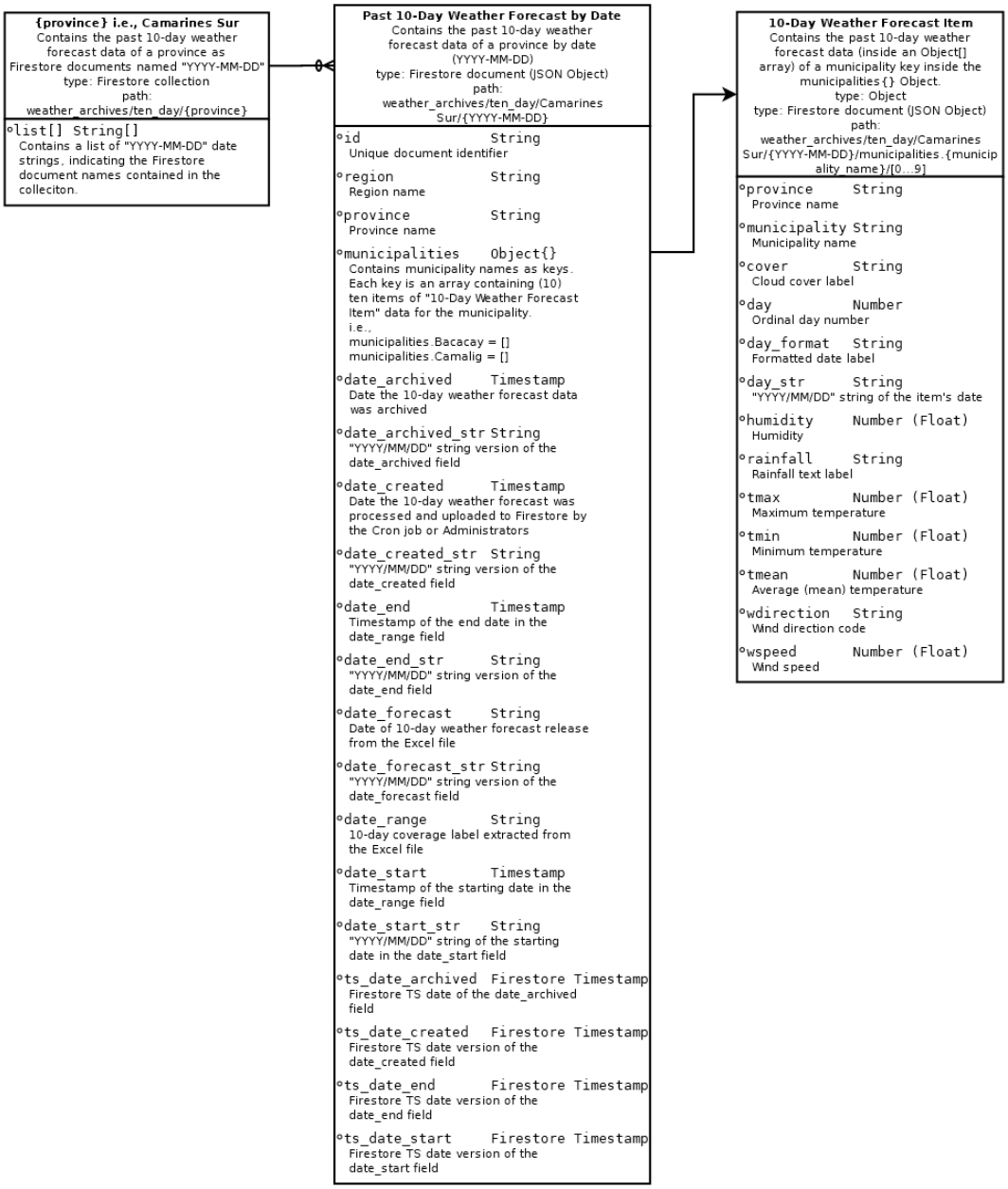


Figure 10.0 – Historical 10-Day Weather Forecast database structure

```
Example: weather_archives/ten_day/Albay/2023-06-28

{
  "id": "08DcMEZOtGHcAUeluln8",
  "region": "bicol",
  "province": "Albay",
  "date_archived": 1688005701464,
  "date_archived_str": "2023/06/29",
  "date_created": 1687919810384,
  "date_created_str": "2023/06/28",
  "date_end": "2023-07-05T00:00:00.000Z",
  "date_end_str": "2023/07/05",
  "date_forecast": "06/26/2023 @8AM",
  "date_forecast_str": "2023/06/26",
  "date_range": "Jun 26 - Jul 05, 2023",
  "date_start": "2023-06-26T00:00:00.000Z",
  "date_start_str": "2023/06/26",
  "ts_date_archived" June 29, 2023 at 10:28:21 AM UTC-8,
  "ts_date_created" June 28, 2023 at 10:36:50 AM UTC-8,
  "ts_date_end": July 5, 2023 at 8:00:00 AM UTC-8,
  "ts_date_start": June 26, 2023 at 8:00:00 AM UTC-8,
  "municipalities": {
     "Bacacay": [
        {
          "cover": "MOSTLY CLOUDY",
          "day": 1,
          "day_format": "Mon Jun 26".
          "day_str": "2023/06/26",
          "humidity": 80.0452176262,
          "nunicipality": "Daraga",
          "province": "Albay",
          "rainfall": "LIGHT RAINS",
          "tmax": 30.5899353027,
          "tmean": 28.8477783203,
          "tmin": 27.1056213379,
          "wdirection": "ENE",
          "wspeed": 1.35047665063
        },
        ...
     ],
     "Camalig": [],
     "Daraga": [],
     ...
  }
}
```

Figure 10.1 – Historical 10-Day Weather Forecast database content structure

Data Management Process

Updating the Historical 10-Day Weather Forecast Data

ACAP updates its historical 10-day weather forecast data by storing the active 10-day weather forecast data set in the historical Firestore collection right before overwriting it with new 10-day weather forecast data as a by-product of the Cron job process for updating the 10-day weather forecast data discussed in more detail under the F-01: 10-Day Weather Forecast API – Data Update Process section.

The following steps summarize the process:

1. The F-01: 10-Day Weather Forecast API Cron job triggers once between 9:00 AM – 12:00 PM daily.
2. Fetch the day1.xlsx – day10.xlsx Excel files from PAGASA's 10-Day Climate Forecast web page.
3. Parse Excel files
4. Validate parsed data
5. If there are no validation errors:
    1. Overwrite the existing "active" 10-day weather forecast data with new validated values
    2. Store the previous data in the historical Firetore DB collection.

Deleting Outdated Historical 10-Day Weather Forecast Data

ACAP keeps previous 10-day historical weather forecast data sets up to a maximum of the past (3) three months from its "YYYY-MM" Firestore document name. A Cron job auto-deletes historical 10-day weather forecast data older than (3) three months every day after running the F-01: 10-Day Weather Forecast API Cron job.

The following steps summarize the process:

1. The F-01: 10-Day Weather Forecast API Cron job triggers once between 9:00 AM – 12:00 PM daily.
2. Delete historical 10-day weather Firestore documents whose "YYYY-MM-DD" document name is older than (3) three months from triggering the Cron job.

External Dependencies

(The external dependencies of the F-01: 10-Day Weather Forecast API also apply).

- PAGASA 10-Day Climate Forecast public web page at [link].
- PAGASA 10-Day Weather Outlook Excel files (day1.xlsx – day10.xlsx) available for dowload at the PAGASA 10-Day Climate Forecast web page

Future Enhancements

- Fine-tune the date and time of triggering the Daily Cron for 10-Day Weather Forecast Data Fetch after gaining more insight on the exact date and time PAGASA updates the 10-Day Weather Outlook Excel files from the 10-Day Climate Forecast public web page.

Historical PAGASA 10-Day Weather Forecast API Usage and Response

Online API Documentation

https://acap-rcmas.vercel.app/#api-PAGASA_Historical_Weather_Forecast-historicalTendayWeatherForecast

This endpoint returns an array of Objects containing past 10-day weather forecast responses similar to the 200 success response of the 10-Day Weather Forecast API /api/weatherforecast?type=tenday endpoint, with additional date_archived and date_archived_str fields, indicating the date of archiving the data set in the archives collection for up to a maximum of the past (3) three months.

API Query URL

Field	Type	Description
URL	String	https://acap-rcmas.vercel.app/api/weatherforecast/archives
Query type	GET	HTTP request type

Query Parameters

Field	Type	Description
type	String	Weather forecast type Allowed values: 'tenday'
province	String	Case-sensitive province name in the Bicol region. Allowed values: 'Camarines Sur'
key	String	API key
date_created	String	These are comma-delimited date_created_str date(s) of specific historical 10-day weather forecast data of interest, which indicates the date their data is created (uploaded to ACAP's database) in YYYY/MM/DD string format. The comma-delimited dates should contain at most 96 ((3) three months) or fewer dates. The endpoint treats similar (duplicate) dates as one. The endpoint omits data for non-existent dates from the response. Allowed values: '2023/06/27', '2023/03/21', '2023/05/16,2023/06/26,2023/06/27'
date_created_range	String	These are (2) pairs of comma-delimited date_created_str (dates) in YYYY/MM/DD string format. The first date string indicates a "start" date, and the second date indicates an "end" date. These (2) dates indicate a date range for selecting 10-day weather forecast data by their date_created field. The date_created field indicates the date of uploading the data set to ACAP's database from PAGASA's 10-day weather forecast data by ACAP scheduled scripts. Allowed values: '2023/06/26,2023/06/28', '2023/05/25,2023/06/25', '2023/04/02,2023/04/10'
id	String	Unique Firestore-generated document ID Allowed values: 'rPk0SIfroZ1NPHrgmQlO', 'xISLyHG9cFEz67770Mwy', 'fsdhdifhai4chgdasd...'

API Response Success 200

Field	Type	Description
response	Object[]	One or more groups of 10-day weather forecast data sets by province. Each item is a 10-day weather forecast data similar to the 200 success response of the **F-01: 10-Day Weather Forecast API**, with new fields and a more detailed error object for each province group:
date_archived	Number	(Timestamp) Date the current 10-day weather forecast was archived by ACAP scheduled scripts
date_archived_str	String	The date_archived field in YYYY/MM/DD date string format
ts_date_archived	Object	Firestore Timestamp of the date_archived field, used internally for querying the Firestore DB.
ts_date_created	Object	Firestore Timestamp of the date_created field, used internally for querying the Firestore DB.
ts_date_start	Object	Firestore Timestamp of the date_start field, used internally for querying the Firestore DB.
ts_date_end	Object	Firestore Timestamp of the date_end field, used internally for querying the Firestore DB.

API Response Example


```
[
  {
    "date_range": "Aug 23 - Sep 01, 2023",
    "date_archived": 1692928277306,
    "date_forecast": "08/23/2023 @8AM",
    "date_created_str": "2023/08/24",
    "date_created": 1692841758324,
    "date_end_str": "2023/09/01",
    "ts_date_created": { "_seconds": 1692841758, "_nanoseconds": 324000000 },
    "date_end": "2023-09-01T00:00:00.000Z",
    "date_archived_str": "2023/08/25",
    "error": null,
    "ts_date_end": { "_seconds": 1693526400, "_nanoseconds": 0 },
    "municipalities": {
      "Iriga City": [
        {
          "rainfall": "NO RAIN",
          "day_str": "2023/08/23",
          "day_format": "Wed Aug 23",
          "rainfall_amt_text": "no rain is expected within the day",
          "tmax": 29.2851867676,
          "municipality": "Iriga City",
          "tmin": 27.0865478516,
          "wspeed": 4.43636359274,
          "wdirection": "SSE",
          "tmean": 28.1858673096,
          "cover": "CLOUDY",
          "province": "Camarines Sur",
```

```
          "humidity": 80.4630613327,
          "day": 1
        },
        ...
      ],
      "Iriga City": [],
      "Ragay": [],
      ...
    },
    "date_forecast_str": "2023/08/23",
    "date_start": "2023-08-23T00:00:00.000Z",
    "province": "Camarines Sur",
    "id": "5o994afEjngNT4nmuHKB",
    "ts_date_archived": { "_seconds": 1692928277, "_nanoseconds": 306000000 },
    "ts_date_start": { "_seconds": 1692748800, "_nanoseconds": 0 },
    "region": "bicol",
    "date_start_str": "2023/08/23"
  },
  {
    "date_range": "Aug 23 - Sep 01, 2023",
    "date_archived": 1693187510252,
    "date forecast": "08/23/2023 @8AM",
    "date_created_str": "2023/08/27",
    "date created": 1693101199174,
    "date_end_str": "2023/09/01",
    "ts date created": { " seconds": 1693101199, " nanoseconds": 174000000 },
    "date_end": "2023-09-01T00:00:00.000Z",
    "date archived str": "2023/08/28",
    "error": null,
    "ts date end": { " seconds": 1693526400, " nanoseconds": 0 },
    "municipalities": {
      "Iriga City": [
        {
          "rainfall": "NO RAIN",
          "day_str": "2023/08/23",
          "day_format": "Wed Aug 23",
          "rainfall_amt_text": "no rain is expected within the day",
          "tmax": 29.2851867676,
          ...
        },
        ...
      ],
      ...
  },
  ...
]
```

F-05: Historical Special Weather Forecast API

The Historical Special Weather Forecast API serves select parts of the latest PAGASA tropical cyclone weather forecast data for the whole Philippines up to a maximum of the past (3) three months, with optionally included Administrator-selected typhoon-affected municipalities from the Bicol region as updated by the Cron Job or ACAP Administrators for the project duration. Detailed instructions for using the Historical PAGASA Special Weather Forecast API are available in the online API usage documentation accessible at this link.

The following diagram shows the Firestore (NoSQL) database structure for storing the PAGASA Historical Special Weather Forecast data of the ACAP-RCMAS collaboration project. See the Data Update Process section for more information about this process.

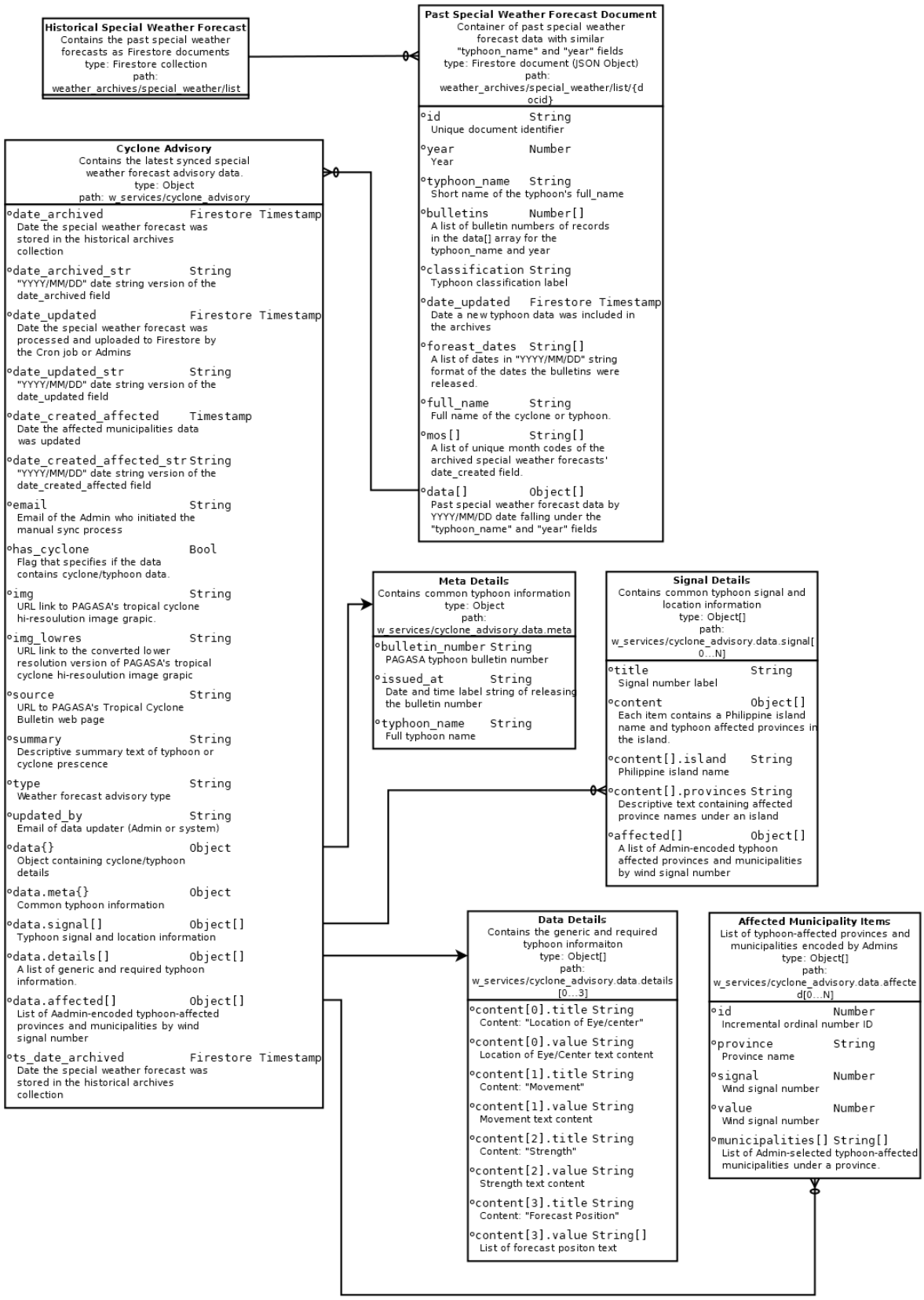


Figure 11 – Historical Special Weather Forecast database structure

```
Example: weather_archives/special_weather/list/3Yy6WGMN0cvgObFBLxk0

{
  "id": "3Yy6WGMN0cvgObFBLxk0",
  "bulletins": [33,3,4,5,6,7...],
  "classification": "Severe Tropical Storm",
  "full_name": "Severe Tropical Storm Hanna",
  "typhoon_name": "Hanna",
  "date_updated": September 4, 2023 at 2:25:36 PM UTC-8,
  "forecast_dates": ["2023/08/31", "2023/09/01", "2023/09/02",...],
  "months": ["aug", "sep"],
  "year": 2023,
  "data": [
     {
       "date_archived": August 31, 2023 at 2:23:23 PM UTC+8,
       "date_archived_str": "2023/08/31",
       "date_created_str": "2023/08/31",
       "date_updated": Augist 21, 2023 at 12:21:59 PM UTC+8,
       "email": "-",
       "has_cyclone": true,
       "img": "https://pubfiles.pagasa.dost.gov.ph/tamss/weather/track_hanna.png",
       "img_lowres": "https://storage.googleapis.com/acap-rcmas.appspot.com/images/cyclone-lowres.png...",
       "source": "https://www.pagasa.dost.gov.ph/tropical-cyclone/severe-weather-bulletin",
       "summary": "There is an active Tropical Cyclone within the Philippine Area of Responsibility.".
       "ts_date_archived": August 31, 2023 at 2:23:23 PM UTC+8,
       "type": "cyclone_advisory",
       "updated_by": "system",
       "data": {
          "meta": {
             "bulletin_number": "Tropical Cyclone Bulletin #4",
             "issued_at": "Issued at 05:00 pm, 31 August 2023",
             "typhoon_name": "Severe Tropical Storm "Hanna\"",
          },
          "details": [
             {
               "title": "Location of Eye/center",
               "value": "The center of Severe Tropical Storm HANNA was estimated based on..."
             },
             {
               "title": "Movement",
               "value": "Moving Westward at 15 km/h"
             },
             {
               "title": "Strength",
               "value": "Maximum sustained winds of 110 km/h near the center and gustiness..."
             },
             {
               "title": "Forecast Position",
               "value": [
                  "Sep 01, 2023 02:00 AM - 860 km East Northeast of...",
                  "Sep 01, 2023 02:00 PM - 660 km East Northeast of Itbayat...",
                  ...
               ]
             }
          ],
          "signal": {
             "title": "SIGNAL NO. 1",
             "content": [
               {
                 "island": "Luzon",
                 "provinces": "Isabela, Quirino, Nueva Vizcaya, Aurora, Nueva Ecija, and the extreme northern..."
               },
               ...
             ]
          },
          affected: [
            {
              "id": 0,
              "province": "Albay",
              "signal": 1,
              "value": 1,
              "municipalities": ["Bacacay", "Camalig", "Daraga"]
            },
            ...
          ]
       }
     },
     ...
  ]
}
```

Figure 11.1 – Historical Special Weather Forecast database example

(Keywords, components, external dependencies and future enhancements of the F-02: Special Weather Forecast API also apply).

Keywords and Components

- **PAGASA Tropical Cyclone Web Page** - PAGASA's public-viewable Tropical Cyclone Bulletin web page containing the latest tropical cyclone forecast information.

- **Cron Job** – A script set to run in scheduled intervals. The Cron job for the severe cyclone weather forecast data web-scrapes the PAGASA Tropical Cyclone Web Page – it downloads, parses, validates, and uploads the web page's cyclone-related text content to ACAP's database and stores old data to the historical severe cyclone weather database collection every (2) two hours. The Data Update Process section discusses the Cron job's process flow in more detail.

- **GitHub Actions Hosted Runners** – machines that execute the cyclone web-scraping Cron job.

External Dependencies

- PAGASA Tropical Cyclone public web page at [link].

Future Enhancements

- Fine-tune the date and time of triggering the Cron job for Special Weather Forecast Data web-scraping after gaining more insight on the exact date and time PAGASA updates their Tropical Cyclone public web page.

Data Management Process

Updating the Historical Special Weather Forecast Data

ACAP updates its historical severe cyclone weather forecast data by storing active tropical cyclone data set (which contains typhoon information), web-scraped from the PAGASA Tropical Cyclone web page in the historical Firestore collection right before overwriting it with new tropical cyclone data as by-product of the process for updating the severe cyclone weather forecast data discussed in more detail under the F-02: Special Weather Forecast API - Data Update Process section.

The following steps summarize the process:

Daily Cron for Web-scraping the Special Weather Forecast Data

1. Daily Cron for Web-scraping the Special Weather Forecast Data triggers every (2) two hours.
2. Fetch/web-scrape text content from PAGASA's Tropical Cyclone web page.

3. Parse and validate web page content.
4. If there are no validation errors, and the parsed bulletin_no value is different from the “active” bulletin_numberin ACAP’s database:
    - Overwrite the existing “active” severe cyclone weather forecast data - store the latest snapshot.
    - Store the previous severe cyclone weather forecast data in the historical Firestore DB collection.

ACAP Administrator Input of Affected Bicol Provinces and Municipalities

1. An ACAP Administrator checks the latest ACAP Special Weather Forecast.
2. If there are Bicol-related areas mentioned in the Special Weather Forecast’s descriptive text:
    - Encode affected (specific) Bicol provinces and municipalities in the ACAP Settings – Wind Speed List Editor.
4. Manually encoded typhoon-affected Bicol provinces and municipalities will:
    - Become available for location selection when creating Special Weather Forecast bulletin PDFs.
    - Show up in the PAGASA Special Weather Forecast API responses.

Deleting Outdated Historical Seasonal Weather Forecast Data

ACAP keeps previous special weather forecast data up to a maximum of the past (3) three months from its “date_created_str” field. A Cron job auto-deletes historical severe cyclone weather forecast data older than (3) three months after running the initial web-scraping Cron job.

The following steps summarize the process:

1. Cron job triggers every (2) hours after the web-scraping Cron Job finishes running its process.
2. Delete historical severe cyclone weather forecast data from container-like Firestore documents whose “date_created_str” field is older than (3) three months from triggering the Cron job.
3. Deleted historical severe cyclone weather forecast data will not show in the historical special weather forecast API responses.

Historical PAGASA Special Weather Forecast API Usage and Response

Online API Documentation

https://acap-rcmas.vercel.app/#api-PAGASA_Historical_Weather_Forecast-historicalSpecialWeatherForecastByDate

This endpoint returns the historical special (severe cyclone) weather forecast data in ACAP's database up to a maximum of the ***past (3) three*** months using the “date“ and “year“ URL query parameters, excluding the current active cyclone weather forecast data.

This endpoint only returns data sets that have cyclone or typhoon data.

API Query URL

Field	Type	Description
URL	String	https://acap-rcmas.vercel.app/api/weatherforecast
Query type	GET	HTTP request type

Query Parameters – By Month and Year

This set of query parameters return all severe cyclone weather forecast data available for the specified month and year.

Field	Type	Description
type	String	Weather forecast type Allowed values: 'special'
province	String	Case-sensitive province name in the Bicol region. Allowed values: 'Camarines Sur'
key	String	API key
month	String	Any month code. If provided, omit the date parameter and expect to receive a successful response following the response structure of Success 200 **Query by Month and Year**. This parameter requires having the “year” parameter present. Allowed values: 'jan', 'feb', 'mar', 'apr', 'may', 'jun', 'jul', 'aug', 'sep', 'oct', 'nov', 'dec'
year	String	Year associated with the “month” parameter. Allowed values: '2023', '2022', '2020'

API Response Success 200 – Query by Month and Year

Field	Type	Description
response	Object[]	Past special weather forecast data that occured on the specified date. Its success is similar to the 200 success response of the **F-02: PAGASA Special Weather Forecast API**, with new fields for more detailed tracking:
date_archived	Object	(Firestore Timestamp) Date the special weather forecast was archived by ACAP scheduled scripts
date_updated	Object	(Firestore Timestamp) Date the special weather forecast was web-scraped and intially stored by ACAP scheduled scripts
date_created_str	String	The date_updated field in YYYY/MM/DD date string format
date_archived_str	String	The date_archived field in YYYY/MM/DD date string format

API Response Example


```
[
  {
    "summary": "There is an active Tropical Cyclone within the...",
    "img": "https://pubfiles.pagasa.dost.gov.ph/tamss/weather/track_hanna.png",
    "date_archived": {"_seconds": 1693506185, "_nanoseconds": 18000000 },
    "date_updated": {"_seconds": 1693499088, "_nanoseconds": 453000000 },
    "img_lowres": "https://storage.googleapis.com/acap-rcmas.appspot.com/images/cyclone...",
    "data": {
      "meta": {
        "bulletin_number": "Tropical Cyclone Bulletin #5",
        "typhoon_name": "Severe Tropical Storm \"Hanna\"",
        "issued_at": "Issued at 11:00 pm, 31 August 2023"
      },
      "details": [
        {
          "title": "Location of Eye/center",
          "value": "The center of the eye was estimated based on all..."
        },
        {
          "title": "Movement",
          "value": "Moving West Northwestward at 20 km/h"
        },
        {
          "title": "Strength",
          "value": "Maximum sustained winds of 110 km/h near the center..."
        },
        {
          "title": "Forecast Position",
          "value": [
            "Sep 01, 2023 08:00 AM - 745 km East Northeast of Itbayat, Batanes",
            "Sep 01, 2023 08:00 PM - 560 km East Northeast of Itbayat, Batanes",
            "Sep 02, 2023 08:00 AM - 480 km North Northeast of Itbayat, Batanes",
            "Sep 02, 2023 08:00 PM - 535 km North of Itbayat, Batanes (OUTSIDE PAR)",
            ...
          ]
        }
      ],
      "signal": [
        {
          "title": "SIGNAL NO. 1",
          "content": []
        }
      ]
    },
    "date_created_str": "2023/09/01",
    "source": "https://www.pagasa.dost.gov.ph/tropical-cyclone/severe-weather-bulletin",
    "type": "cyclone_advisory",
    "date_archived_str": "2023/09/01",
    "has_cyclone": true,
    "updated_by": "system",
    "ts_date_archived": {"_seconds": 1693506185, "_nanoseconds": 18000000},
    "email": "-"
  },
  {
    "summary": "There is an active Tropical Cyclone within the...",
    "img": "https://pubfiles.pagasa.dost.gov.ph/tamss/weather/track_hanna.png",
    "date_archived": {"_seconds": 1693531272, "_nanoseconds": 315000000 },
    "date_updated": {" seconds": 1693520268, " nanoseconds": 203000000 }
```

```
    "img_lowres": "https://storage.googleapis.com/acap-rcmas.appspot.com/images/cyclone...",
    "data": {
      "meta": {
        "bulletin_number": "Tropical Cyclone Bulletin #6",
        "typhoon_name": "Severe Tropical Storm \"Hanna\"",
        "issued_at": "Issued at 05:00 am, 01 September 2023"
      },
      "details": [
        {
          "title": "Location of Eye/center",
          "value": "The center of Severe Tropical Storm HANNA was estimated based on all..."
        },
        {
          "title": "Movement",
          "value": "Moving West Northwestward at 20 km/h"
        },
        {
          "title": "Strength",
          "value": "Maximum sustained winds of 110 km/h near the center and gustiness of..."
        },
        {
          "title": "Forecast Position",
          "value": [
            "Sep 01, 2023 02:00 PM - 690 km East Northeast of Itbayat, Batanes",
            "Sep 02, 2023 02:00 AM - 505 km Northeast of Itbayat, Batanes",
            "Sep 02, 2023 02:00 PM - 415 km North Northeast of Itbayat, Batanes",
             ...
          ]
        }
      ],
      "signal": [
        {
          "title": "SIGNAL NO. 1",
          "content": []
        }
      ]
    },
    "date_created_str": "2023/09/01",
    "source": "https://www.pagasa.dost.gov.ph/tropical-cyclone/severe-weather-bulletin",
    "type": "cyclone_advisory",
    "date_archived_str": "2023/09/01",
    "has_cyclone": true,
    "updated_by": "system",
    "ts_date_archived": {"_seconds": 1693531272, "_nanoseconds": 315000000 },
    "email": "-"
  },
  ...
]
```


Query Parameters – By Date

This set of query parameters returns all special weather forecast data available for the specified date.

Field	Type	Description
type	String	Weather forecast type Allowed values: 'special'
province	String	Case-sensitive province name in the Bicol region. Allowed values: 'Camarines Sur'

key	String	API key
date	String	The date string in YYYY/MM/DD format of a cyclone weather forecast's "date_created" field indicates the date they were saved to the database by the Cron job. If provided, omit the "month" and "year" parameters and expect to receive a successful response following the response structure of the **F-02: Special Weather Forecast API**, with new response fields: date_archived date_archived_str ts_date_archived date_created_str If omitted and users only provide the year and month parameters, the response will contain all archived cyclone weather forecasts for the specified month under the year parameter. This query parameter generates a successful response following the response structure of Success 200 **Query by Date**. Allowed values: '2023/08/29', '2023/08/31'

API Response Example


```
[
  {
    "summary": "There is an active Tropical Cyclone within the...",
    "img": "https://pubfiles.pagasa.dost.gov.ph/tamss/weather/track_hanna.png",
    "date_archived": {"_seconds": 1693506185, "_nanoseconds": 18000000 },
    "date_updated": {"_seconds": 1693499088, "_nanoseconds": 453000000 },
    "img_lowres": "https://storage.googleapis.com/acap-rcmas.appspot.com/images/cyclone...",
    "data": {
      "meta": {
        "bulletin_number": "Tropical Cyclone Bulletin #5",
        "typhoon_name": "Severe Tropical Storm \"Hanna\"",
        "issued_at": "Issued at 11:00 pm, 31 August 2023"
      },
      "details": [...],
      "signal": [...],
    },
    "date_created_str": "2023/09/01",
    "date_archived_str": "2023/09/01",
    "has_cyclone": true,
    "updated_by": "system",
    "ts_date_archived": {"_seconds": 1693506185, "_nanoseconds": 18000000},
    ...
  },
  {
    "summary": "There is an active Tropical Cyclone within the...",
    "img": "https://pubfiles.pagasa.dost.gov.ph/tamss/weather/track_hanna.png",
    "date_archived": {"_seconds": 1693531272, "_nanoseconds": 315000000},
    "date_updated": {"_seconds": 1693520268, "_nanoseconds": 203000000},
    "img_lowres": "https://storage.googleapis.com/acap-rcmas.appspot.com/images/cyclone...",
```

```
    "data": {
      "meta": {
        "bulletin_number": "Tropical Cyclone Bulletin #6",
        "typhoon_name": "Severe Tropical Storm \"Hanna\"",
        "issued_at": "Issued at 05:00 am, 01 September 2023"
      },
      "details": [...],
      "signal": [...],
    },
    "date_created_str": "2023/09/01",
    "date_archived_str": "2023/09/01",
    "has_cyclone": true,
    "updated_by": "system",
    "ts_date_archived": {"_seconds": 1693531272, "_nanoseconds": 315000000},
    ...
  },
  ...
]
```


Client Authorization

Client Authorization gives outside Collaborators/clients access to ACAP's specific data sets through APIs and the assignment of authorized API keys. ACAP-RCMAS API keys only allow read-only access to ACAP's internal PAGASA weather forecast data.

F-12: Create API keys

Process

1. An ACAP System Administrator creates an API key consisting of random-generated text.
2. The ACAP System Administrator keeps the API key in safe storage and gives it to trusted Collaborators/clients.

F-13: Authorize API keys

Process

1. The ACAP Administrator authorizes the API key by inserting it into the backend's list of authorized API keys (environment variables).
2. A middleware program checks incoming API requests for authorized API keys.
    - The API rejects requests with invalid API keys.
    - The API accepts requests with valid API keys.