

# Forecast Search Wizard: A Tool to Search NOAA Text-Forecasts



[https://github.com/allenea/Forecast\\_Search\\_Wizard](https://github.com/allenea/Forecast_Search_Wizard)

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## Overview

- Forecasters at the National Weather Service do an excellent job creating accurate text-based forecasts every day.
- The Forecast Search Wizard is a tool developed to analyze archived NOAA text products to obtain valuable information.
- Searches for keywords in NOAA/NWS text products.
- Identifies Case Studies, Weather Events, Other Specific Information

## Benefits

- Convenient, time-saving, and accurate
- One-of-a-kind tool developed to search NOAA/NWS text-products
- Robust & efficient search algorithm
- New source of big data: A forgotten source of information
- Improve depth & quality of research
- Could be used as a tool to parse and archive NOAA text products to a database.

## Limitations

- Human-Input Text-Products
  - Abbreviations, misspellings and typos
  - Retrieving date, time, and time zone information
- Speed vs Effectiveness and Accuracy

## Features

- Select a period of years (1996-Present)
- Search for ALL or ANY keywords in a forecast
- Search by FORECAST or by DAY
- GREP-style search or search for WHOLE WORD

\*\*\*\*\* Example \*\*\*\*\*

- Recent studies show that lightning in the inner core of a hurricane, as opposed to the outer rainbands, may be a better indicator for rapid intensification<sup>[5]</sup>. In the analysis of all NHC forecasts from 1996-Present there are only 25 cases where BOTH "lightning" AND "intensification" were used in the same forecast (11 sec). Looking for BOTH "lightning" AND "rapid intensification" resulted in only 7 cases (6 sec).

## NWS Text-Product Format<sup>[1]</sup>

```
FXaaii cccc ddhhmm          WMO heading
AFDxxx                     AWIPS ID

AREA FORECAST DISCUSSION    NWS Product Name
NATIONAL WEATHER SERVICE city state Issuing Office or Agency
time am/pm time_zone day mon dd yyyy Issuing Time/Date
```

Figure 1: Sample format of the Area Forecast Discussion (AFD). Unfortunately, these protocols are not always followed. The Forecast Search Wizard is dynamic. It is capable of resolving most dates and times that do not follow this format or that contain incomplete information. *Note: the Issuing Time/Date is sometimes referred to as MND Header.*

## Workflow

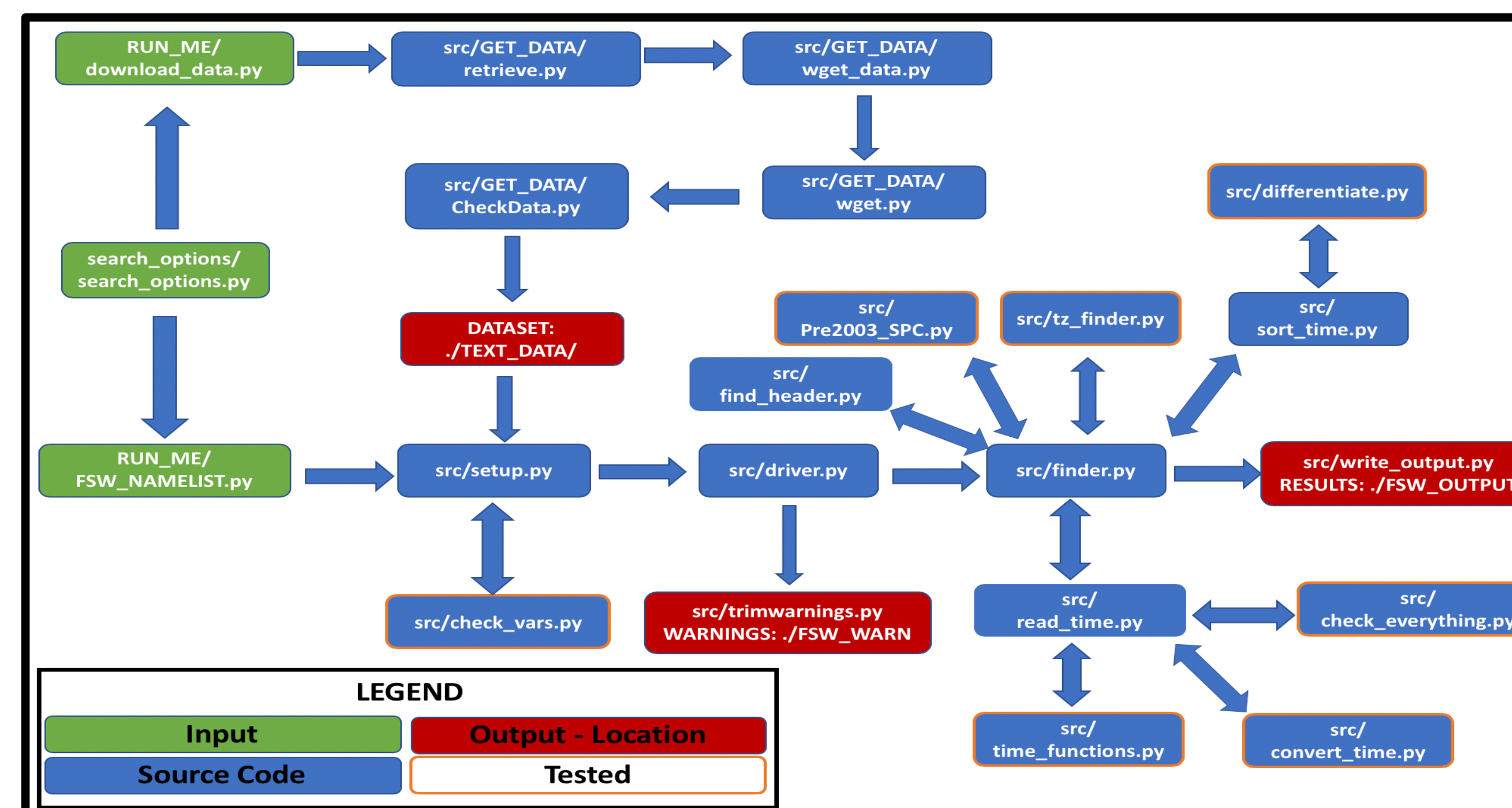


Figure 2: Shows a generalized workflow diagram for the Forecast Search Wizard. First, download the IEM<sup>[2]</sup> dataset you need by running DOWNLOAD\_DATA.py, then configure your search in FSW\_NAMELIST.py and run that file. The main component is the finder.py program. It identifies each forecast, the date-time information, and the keywords.

## Profiling

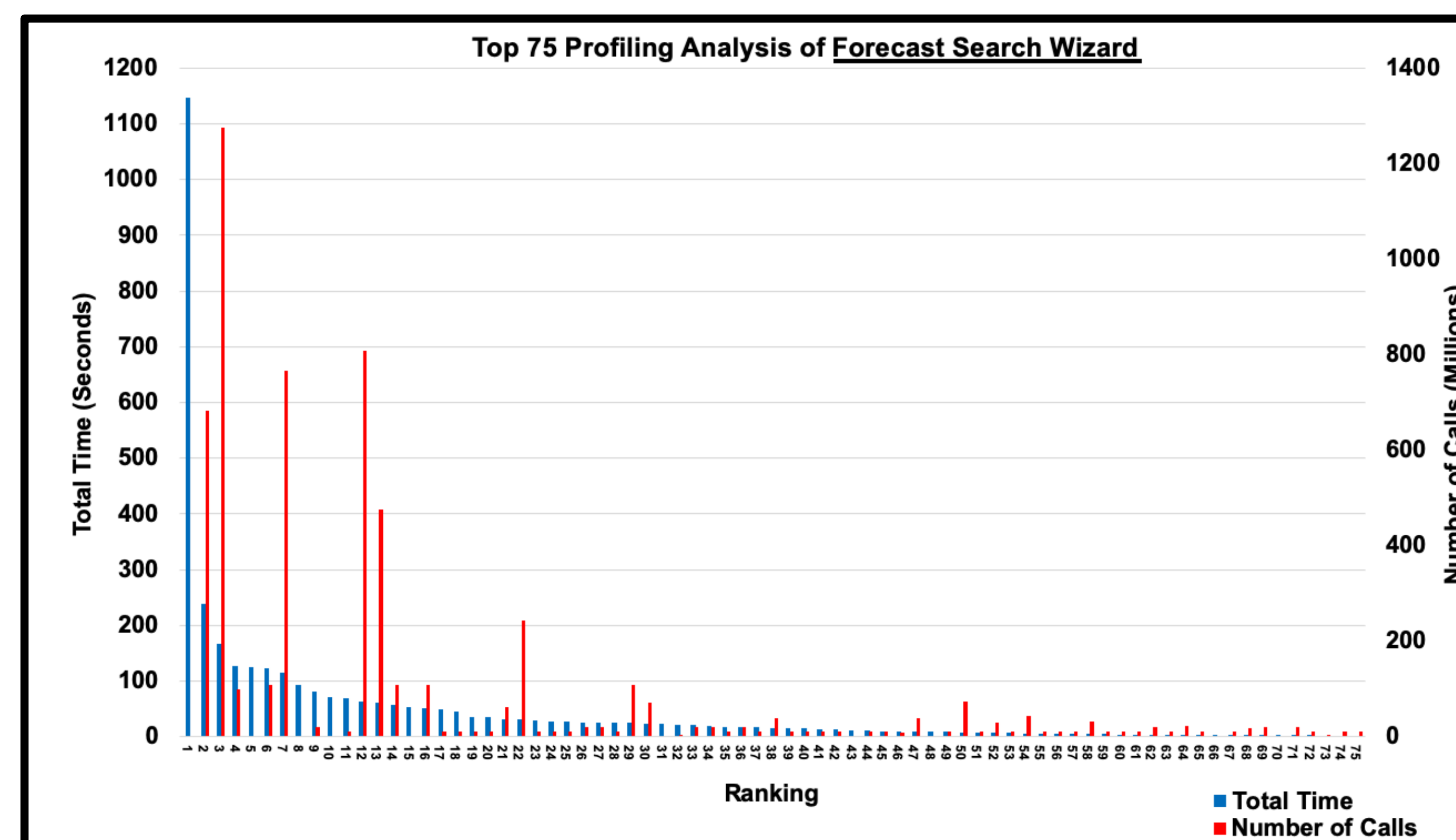


Figure 3: Shows the profiling analysis of the Forecast Search Wizard. There are 504 functions used, but this figure shows the 75 most costly functions in the program.

## Performance and Results

### Before Optimization <sup>[3]</sup>

Single Word Search Analysis			Normal Case ("Lightning")		Worst Case ("The")	
Issuing Office(s)	Total Products	Products Searched	Cases	Time	Cases	Time
Single WFO (AFDBGM)	63,619	63,590	1,282	26 sec	59,179	38 sec
All NHC Forecasts	106,602	106,412	952	20 sec	95,026	41 sec
All NCEP Forecasts	1,402,701	1,398,414	28,097	4.8 min	1,270,422	11.1 min
All Area Forecast Discussions	5,079,801	5,072,265	177,131	38.7 min	4,689,592	44.6 min
All Forecasts	10,040,958	10,027,342	609,301	55.1 min	9,124,460	74.2 min

Figure 4: Original (Beta) Forecast Search Wizard results from a simple one word GREP-style search from 1996-2019. It provided a .txt file with a list of all forecasts in which the keyword was found.

### After Optimization <sup>[4]</sup>

Search Analysis	Normal Case ("Lightning")			Worst Case ("The")		
Issuing Office(s)	Cases	Time	Difference	Cases	Time	Difference
Single WFO (AFDBGM)	1,301	10.9 sec	-15.1 sec	59,806	18.5 sec	-19.5 sec
All NHC Forecasts	960	10.9 sec	-9.1 sec	96,533	25 sec	-16 sec
All NCEP Forecasts	29,981	1.4 min	-3.4 min	1,310,042	5.4 min	-5.7 min
All Area Forecast Discussions	179,073	12.5 min	-26.2 min	4,738,314	22.3 min	-22.3 min
All Forecasts	613,817	18.5 min	-36.6 min	9,224,854	37.8 min	-36.4 min

Figure 5: Improved performance of the Forecast Search Wizard is shown in the results from a simple one word GREP-style search from 1996-2019. This dataset has been updated. It has two months of additional data than the table above.

## Future

- Additional testing
- Improved documentation
- Support user-provided datasets
- Search-By-Section of the forecast
- Move away from the IEM dataset
- Web-Based Application

## References

- [1] NOAA/NWS, 2005: NWS Instruction 10-503
- [2] Iowa Environmental Mesonet (Iowa State University)
- [3] Late 2013 iMac with an 3.2 GHz Intel Core i5 processor and 16GB RAM
- [4] Late 2016 MacBook Pro with 2.9 GHz Dual-Intel Core i5 Processor with 8GB RAM
- [5] Zhang et al., 2015. Relationship between lightning activity and tropical cyclone intensity over the northwest Pacific