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Weather Alerts Data with R

Ian Cook | ian@cloudera.com

useR! 2016 Stanford

Weather Alerts Data

- Weather data is of interest to many R users
- Existing R packages, including weatherData, provide access to sources of current and historical weather *conditions* data
- There was no R package to retrieve current weather *alerts* data
  - Advisories, watches, and warnings issued by government weather agencies
- The United States National Weather Service (NWS) syndicates information on current weather alerts at https://alerts.weather.gov/cap/us.php?x=1

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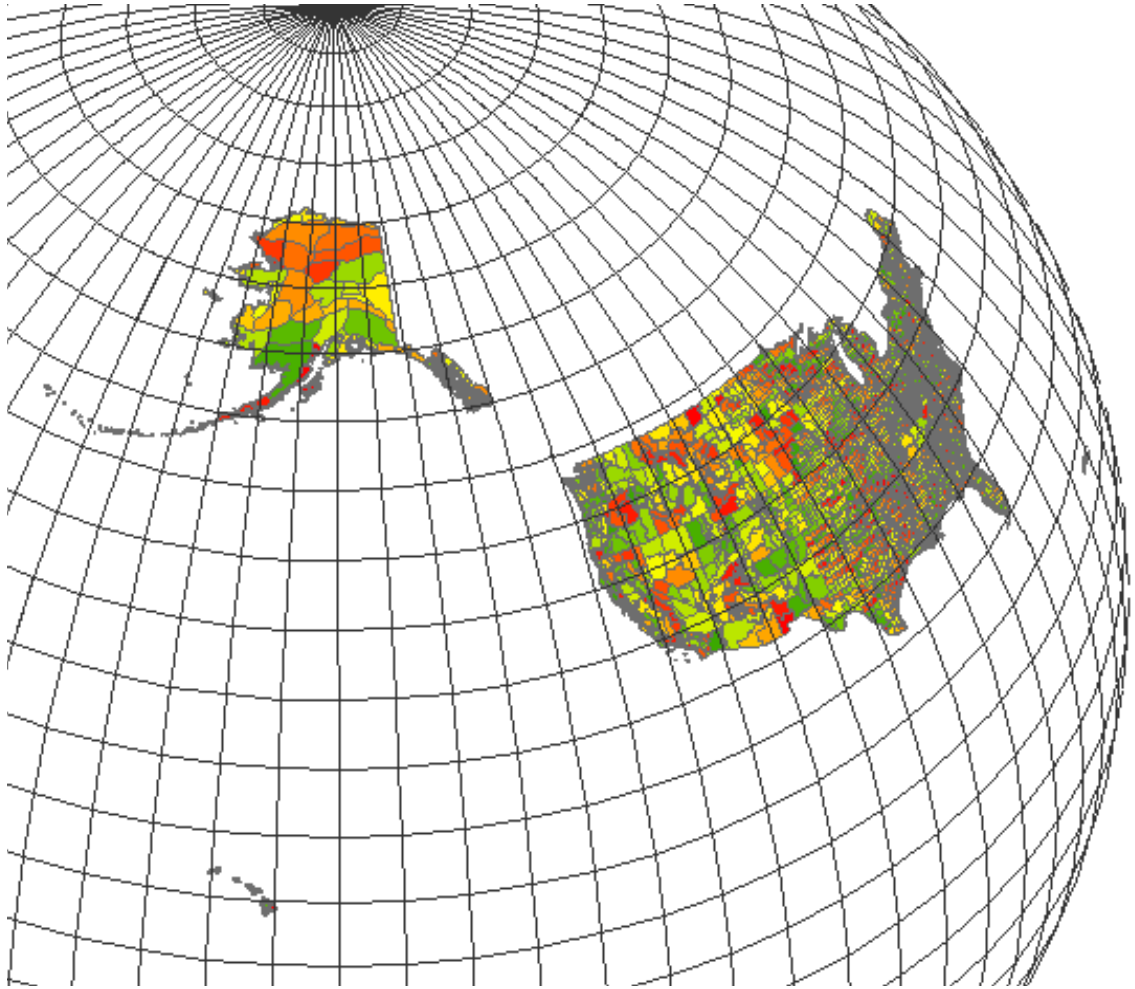
Predefined Alert Areas

- The NWS defines the geographic areas under weather alerts using UGC codes
- Corresponding geographic polygons are defined in four shapefiles at http://www.nws.noaa.gov/geodata/
  - States, counties, zones, fire zones
  - Files are large (118 MB) and challenging to work with



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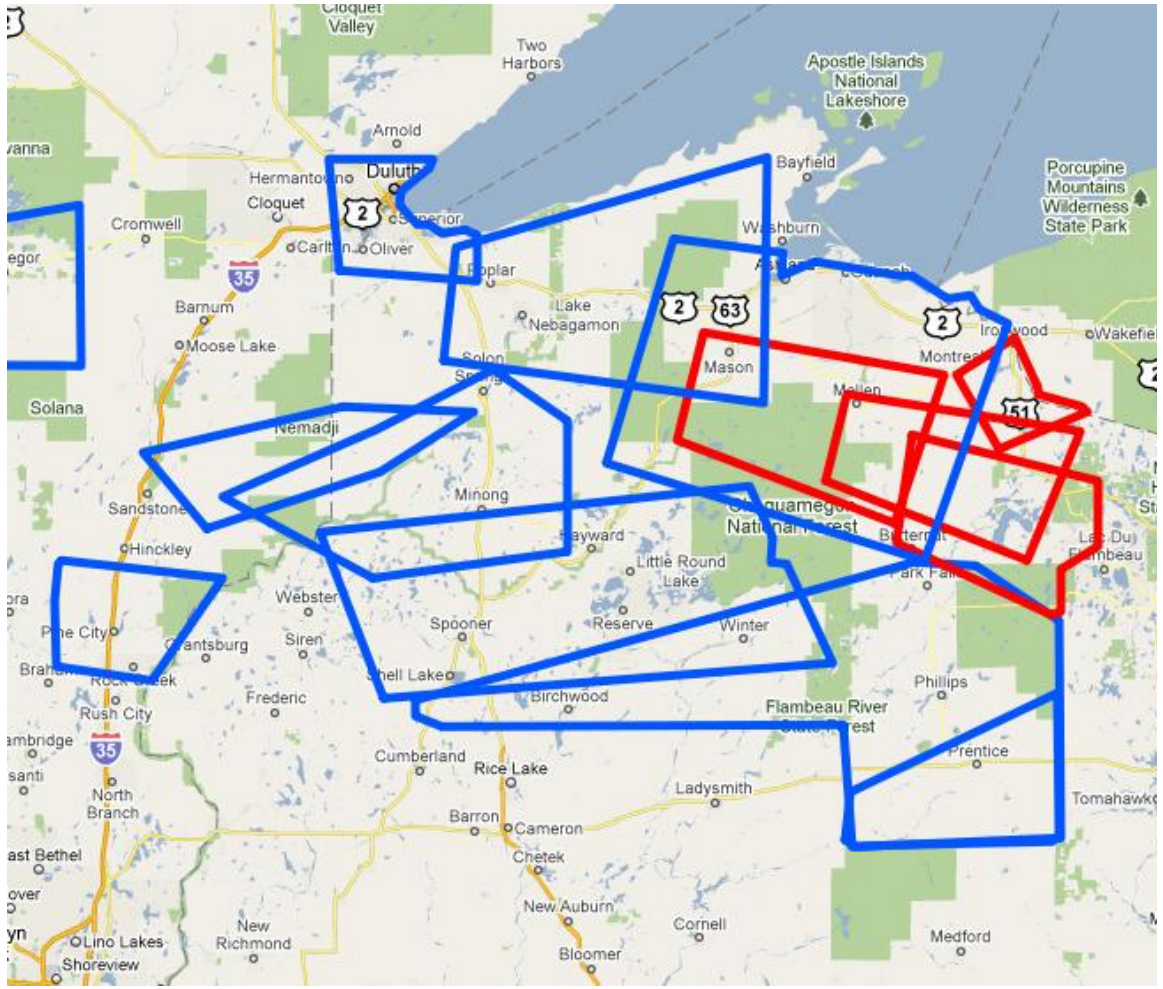
Ad-Hoc Alert Areas

- In addition, many alert areas are defined via ad-hoc polygons
- Need to merge alert area polygons with alerts information to perform mapping or spatial analysis of weather alerts



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Solution

- Two R packages
  - weatherAlerts – gets weather alerts
  - weatherAlertAreas – defines alert areas (7356 polygons, 22 MB)
- Both on GitHub
  - https://github.com/ianmcook/weatherAlerts
  - https://github.com/ianmcook/weatherAlertAreas

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Getting Started

- Install both packages from GitHub

```
library(devtools)
install_github("ianmcook/weatherAlerts")
install_github("ianmcook/weatherAlertAreas")
```

- Load package weatherAlerts and read documentation for function getAlerts

```
library(weatherAlerts)
?getAlerts
```

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Usage

- 50 US states and Washington DC

```
alerts <- getAlerts()
```

- Contiguous US

```
alerts <- getAlerts(excludeStates = c("AK", "HI"))
```

- Specific US state(s)

```
alerts <- getAlerts(includeStates = "CA")
```


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Output

- If package weatherAlertAreas is installed, getAlerts returns a SpatialPolygonsDataFrame containing alerts information and the associated alert area polygons
- Otherwise returns a data frame containing alerts information

```
class(alerts)
```

```
[1] "SpatialPolygonsDataFrame
"attr(,"package")
[1] "sp"
```

```
colnames(alerts@data)
```

```
 [1] "id"        "updated"   "published"
 [4] "title"     "summary"   "event"
 [7] "effective" "expires"   "status"
[10] "msgType"   "category"  "urgency"
[13] "severity"  "certainty" "area"
[16] "state"     "stateName" "polygon"
[19] "FIPS"      "UGC"
```

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Processing Output

- Assign colors to represent alert severity levels

```
severity <- alerts@data$severity
colorMap <- c(Minor = "green",
              Moderate = "yellow",
              Severe = "red",
              Extreme = "magenta",
              Unknown = "white")
severityColors <- unname(colorMap[severity])
```

- Filter based on weather event

```
severeThunderstormWarnings <- alerts[
  alerts@data$event == "Severe Thunderstorm Warning", ]
```

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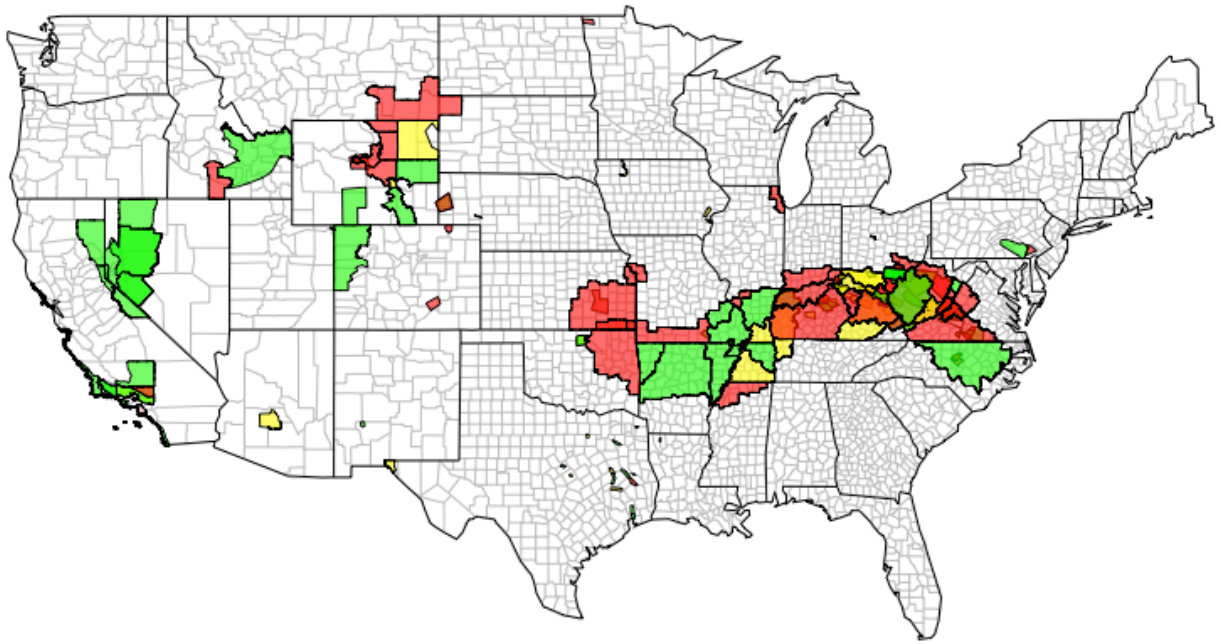
Mapping Output with **maps**

```
library(maps)
alertsMap <- SpatialPolygons2map(alerts)
map("county", col = "gray")
map("state", add = TRUE)
map(alertsMap, add = TRUE, fill = TRUE, col = severityColors)
```



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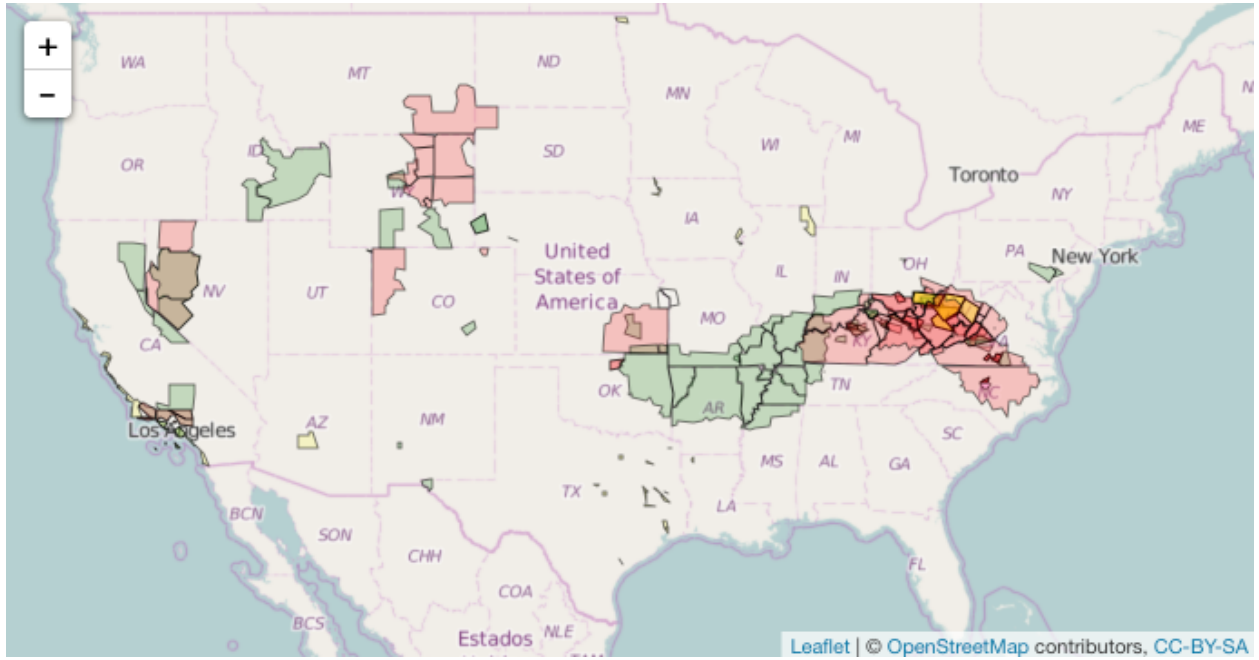
Mapping Output with leaflet

```
library(leaflet)
leaflet() %>%
  addTiles() %>%
  addPolygons(data = alerts, color = "black",
              fillColor=severityColors, weight=1)
```



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Finding Weather Alerts for a Specific Location

- Geocode address

```
library(ggmap)
siepr <- geocode("366 Galvez St, Stanford CA")
```

- Perform spatial overlay

```
library(sp)
mylocation <- SpatialPoints(
  coords = siepr,
  proj4string = CRS("+proj=longlat +datum=WGS84")
)
localAlerts <- over(mylocation, alerts, returnList = TRUE)[[1]]
```

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Tornado Warning (1)


```
alerts <- getAlerts(includeStates = "NC")

tornadoWarnings <- alerts[
  alerts@data$event == "Tornado Warning", ]

home <- geocode("Robert Hunt Dr, Carrboro NC")

leaflet() %>%
  addTiles() %>%
  addPolygons(data = tornadoWarnings) %>%
  addMarkers(lng = home$lon, lat = home$lat)
```

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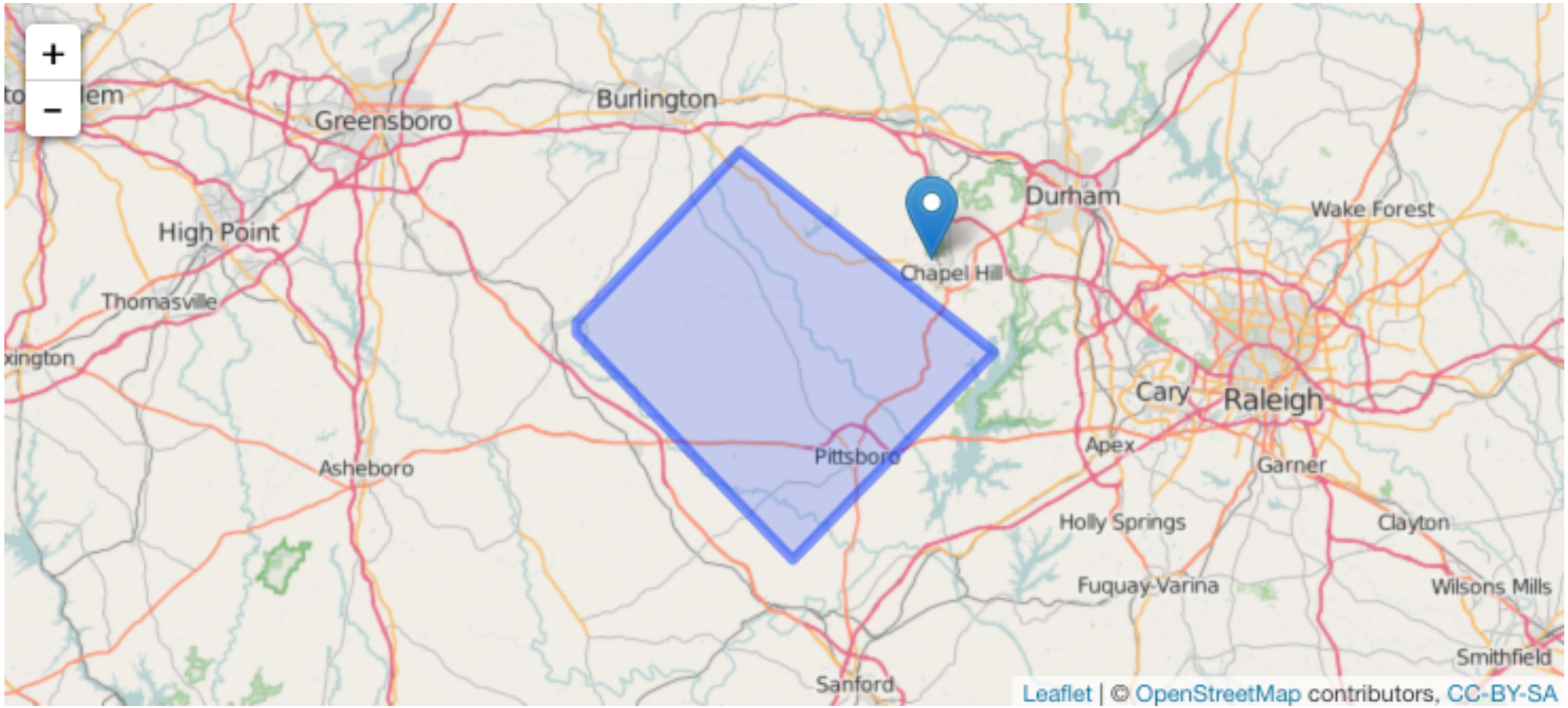
Tornado Warning (2)



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What's Next

- Improve performance
- Do things Hadley's way (httr, rvest, underscores)
- Submit to CRAN
- Keep up to date with NWS alert area changes and API changes
- Track developments in R's facilities for spatial data (https://github.com/edzer/sfr)
- Find international collaborators

Thank you

Ian Cook | ian@cloudera.com

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