

NOAA ProbSevere v3 file format description

Definitions:

- NOAA – the National Oceanic and Atmospheric Administration
- MRMS – Multi-Radar Multi-Sensor
- NWP – numerical weather prediction
- HRRR – High-Resolution Rapid Refresh model
- ENI – Earth Networks Incorporated®
- ENGLN – Earth Networks Global Lightning Network
- CAPE – convective available potential energy
- GOES – Geostationary Operational Environment Satellite
- GLM – Geostationary Lightning Mapper
- AGL – above ground level
- 2D – two-dimensional
- UTC – coordinated universal time
- YYYYMMDD – the UTC year, month, and date. E.g., 20250301
- HHMMSS – the UTC hour, minutes, and seconds. E.g., 083156

Product description: NOAA ProbSevere is a subsystem of [MRMS](#) integrating radar, satellite, lightning, and NWP data to provide short-term storm-based probabilistic guidance to forecasters. The four ProbSevere products in v3 are: ProbHail, ProbWind, ProbTor, and probability of any severe (probSevere).

Format: geoJSON (<http://geojson.org/>)

Filename convention: MRMS_PROBSEVERE_YYYYMMDD_HHMMSS.json

Frequency: 2 minutes (updates with MRMS 2D severe-weather products)

Size: variable; f (number and spatial size of features); generally between 20 kB and 2 MB

File description

Metadata

```
{  
  "source": "NOAA/NCEP Central Operations",  
  "product": "ProbSevere 3.0",  
  "validTime": "20250606_171641 UTC",  
  "productionTime": "20250606_171805 UTC",  
  "machine": "vm-aws-mrms-dev-probsvr1.private.nssl",  
  "type": "FeatureCollection",  
  "features":  
    . . .
```

- "source": the production location and system

- "product": ProbSevere version 3.
- "validTime": the MRMS UTC timestamp for this file
- "productionTime": the UTC timestamp when this file was written
- "machine": the Linux machine running the production code
- "type": the type of data in this file – a "FeatureCollection"
- "features": A list of storm objects and associated attributes and properties.

Features

Each feature represents an identified storm object at the `validTime`, including its geometry and associated attributes. Each feature has a `type` field, which will always be `Feature`.

```
"type": "Feature"
```

Each feature has a `geometry` field, containing the latitudes and longitudes defining the outer boundary of a storm object polygon.

The `type` of each `geometry` is `Polygon`. The `coordinates` is a double-nested list of longitude and latitude pairs (using the WGS84 coordinate system, longitudes < 0 are in the western hemisphere). The first and last lon/lat pair will be identical.

```
"geometry":
  "type": "Polygon",
  "coordinates": [[[-92.95, 42.59], [-92.92, 42.59], [-92.88,
42.55], [-92.88, 42.49], ... [-92.95, 42.59]]]
```

The `models` field of each feature contains four attributes, one for each ProbSevere v3 model: `probsevere`, `probhail`, `probwind`, and `probtor`. Below is an example of the `probsevere` model for one feature.

The `PROB` is the computed probability for the storm at the `validTime` (in %). The `LINEs` are the suggested display of storm attributes.

```
"models": {
  "probsevere": {
    "PROB": 11,
    "LINE01": "ProbSevere: 11%; ProbHail: 1%; ProbWind: 7%; ProbTor:
2%"
    "LINE02": "- MESH: 0.3 in.; VIL 19 g/m^2",
    "LINE03": "- ENI Flash Rate: 4 fl/min",
    "LINE04": "- ENI Flash Density: 0.32 fl/min/km^2",
    "LINE05": "- Max LLazShear: 0.004 /s",
    "LINE06": "- 98% LLazShear: 0.003 /s",
    "LINE07": "- 98% MLazShear: 0.004 /s",
    "LINE08": "- Norm. vert. growth rate: 2.1%/min (moderate)",
    "LINE09": "- EBShear: 43 kt; SRH 0-1km: 60 m^2/s^2",
    "LINE10": "- MeanWind 1-3km: 28 kt",
    "LINE11": "- LR 0-3km: 6.1 C/km; Max LR 2-6km: 6.5 C/km",
    "LINE12": "- MUCAPE: 1304 J/kg; MLCAPE 938 J/kg; MLCIN: -2 J/kg",
    "LINE13": "- Wetbulb 0C hgt: 13.1 kft AGL; PWAT: 1.9 in.",
    "LINE14": "GLM: max FED: 9 fl; sum FCD: 8 fl/5-min",
    "LINE15": "GLM: max TOE: 86 fJ; min flash area: 140 km^2"
```

Properties

The `properties` attribute contains ProbSevere predictor values for each feature or storm, as well as some additional storm-centric attributes.

- `MaxFED`: The spatial-maximum flash-extent density in the storm object, in units of flashes/[5 min]. Computed from the GOES-East GLM.
- `MaxFCD`: The spatial-maximum flash-centroid density in the storm object, in units of flashes/[5 min]. Computed from the GOES-East GLM.
- `AccumFCD`: The sum of GLM flash centroids within the storm object over 5 minutes. This is the GLM flash rate (flashes/[5 min]).
- `MaxTE`: The spatial-maximum total optical energy in the storm object, in fJ. Computed from the GOES-East GLM.
- `MinFlashArea`: The spatial-minimum flash area in the storm object, in km². Computed from the GOES-East GLM.
- `TE@MaxFCD`: The maximum total optical energy at the point of maximum flash-centroid density in the storm, in fJ. Computed from the GOES-East GLM.
- `AvgGroupArea`: The spatial-mean group area in the storm object, in km². Computed from the GOES-East GLM.
- `MUCAPE`: The spatial-median MUCAPE in the storm object, in J/kg. Computed from the HRRR.
- `MLCAPE`: The spatial-median CAPE (0-90 mb AGL) in the storm object, in J/kg. Computed from the HRRR.
- `MLCIN`: The spatial-median CIN (0-90 mb AGL) in the storm object, in J/kg. Computed from the HRRR.
- `EBSHEAR`: The spatial-median effective bulk shear in the storm object, in kt. Computed from the HRRR.
- `SRH01KM`: The spatial-median storm-relative helicity in the storm object, in m²/s². Computed from the HRRR.
- `MEANWIND_1-3kmAGL`: The spatial-median mean wind in the 1-3 km AGL layer in the storm object, in kt. Computed from the HRRR.
- `COMPREF`: The spatial-maximum MRMS MergedReflectivityQCComposite in the storm object, in dBZ.
- `REF20`: The spatial-maximum MRMS reflectivity at -20°C in the storm object, in dBZ.
- `REF10`: The spatial-maximum MRMS reflectivity at -10°C in the storm object, in dBZ.
- `MESH`: The spatial-maximum MRMS maximum expected size of hail in the storm object, in inches.
- `H50_Above_0C`: The spatial-maximum MRMS height of the 50-dBZ echo above the 0°C isotherm in the storm object, in km AGL.
- `EchoTop_50`: The spatial-maximum MRMS 50-dBZ echo top height in the storm object, in km AGL.
- `VIL`: The spatial-maximum MRMS vertically integrated liquid in the storm object, in kg/m².
- `FLASH_RATE`: The ENGLN flash rate in the storm object, in units of flashes/min. Summed `FLASH_DENSITY` in an object over space and time.
- `FLASH_DENSITY`: The spatial-maximum ENGLN flash density in the storm object, in units of flashes/km²/min
- `MAXLLAZ`: The spatial-maximum of the 0-2 km azimuthal shear in the storm object, in units of s⁻¹.
- `P98LLAZ`: The spatial-98th percentile of the 0-2 km azimuthal shear in the storm object, in units of s⁻¹.
- `P98MLAZ`: The spatial-98th percentile of the 3-6 km azimuthal shear in the storm object, in units of s⁻¹.

- `MAXRC_EMISS`: The normalized satellite growth rate for the storm object, in units of %/min.
- `ICP`: The “[intense convection probability](#)”-- a satellite-based measure of storm intensity (units of %).
- `WETBULB_0C_HGT`: The spatial-minimum wet-bulb 0°C height in the storm object, in kft. Computed from the HRRR.
- `PWAT`: The spatial-median precipitable water in the storm object, in inches. Computed from the HRRR.
- `CAPE_M10M30`: The spatial-median CAPE in the -10°C to -30°C layer in the storm object, in J/kg. Computed from the HRRR.
- `LLLR`: The spatial-median 0-3 km lapse rate in the storm object, in °C/km. Computed from the HRRR.
- `MLLR`: The spatial median maximum 0-2 km lapse rate within the 2-6 km layer for the storm object, in °C/km. Computed from the HRRR.
- `DCAPE`: The spatial-median downdraft CAPE in the object, in J/kg. Computed from the HRRR.
- `SRW02KM`: The spatial-median storm-relative wind in the 0-2 km layer in the storm object, in kt. Computed from the HRRR.
- `SRW46KM`: The spatial-median storm-relative wind in the 4-6 km layer in the storm object, in kt. Computed from the HRRR.
- `LCL`: The spatial-minimum surface-based lifted condensation level in the storm object, m AGL. Computed from the HRRR.
- `LJA`: A modified lightning jump algorithm anomaly, using the `FLASH_RATE` (dimensionless).
- `MLAT`: The spatial-mean latitude of the object (> 0 in northern hemisphere).
- `MLON`: The spatial-mean longitude of the object (< 0 in western hemisphere).
- `SIZE`: The number of pixels in the object. This is approximately equivalent to the area of the object in km².
- `AVG_BEAM_HGT`: The average radar beam height across the storm object, in kft AGL, assuming beam refraction for a standard atmosphere.
- `MOTION_EAST`: The mean motion eastward of the storm object, in m/s. Eastward is > 0, westward is < 0. **NB:** `MOTION_EAST` and `MOTION_SOUTH` often have large variances from one time to the next. Thus, additional quality-control such as averaging over multiple times is encouraged
- `MOTION_SOUTH`: The mean motion southward of the storm object, in m/s. Southward is < 0, northward is > 0. **NB:** `MOTION_EAST` and `MOTION_SOUTH` often have large variances from one time to the next. Thus, additional quality-control such as averaging over multiple times is encouraged.
- `ProbSevere`: The computed probability of any severe hazards in the next 60 minutes.
- `ProbHail`: The computed probability of severe hail in the next 60 minutes.
- `ProbWind`: The computed probability of a severe wind gust in the next 60 minutes.
- `ProbTor`: The computed probability of a tornado in the next 60 minutes.
- `ID`: The object ID number for this feature/storm object. This helps link together trends for each storm through time.