

My Q: How many different sources of raw atmospheric and other data exist (including NOAA) that are used to create our weather models? Are there any models that do NOT use NOAA data? Are there private weather-data companies now?

Grok: Raw Data Sources for Weather Models: Overview

Numerical Weather Prediction (NWP) models like **GFS (NOAA)**, **ECMWF/IFS**, **ICON (DWD)**, **UKMO**, and **GEM (Environment Canada)** ingest **~1-2 billion observations daily** globally, coordinated via **WMO's Global Observing System (GOS)** and **Global Telecommunication System (GTS)**. **NOAA** contributes ~20-30% (e.g., GOES satellites, NEXRAD radars, US buoys/radiosondes), but data is international.

There is **no fixed "number"** of sources—it's dynamic—but **~12-15 major categories** cover **90%+ of inputs**. ECMWF alone uses **800 million/day** from **90+ satellite instruments** + surface/aircraft. Here's the breakdown:

Major Categories of Raw Data Sources

Category	Examples/Providers	Daily Volume (Approx.)	Key Role
Surface Stations	~11,000 land stations (SYNOP/METAR); NOAA ASOS, global met services	1-2 million	Temp, wind, pressure, precip
Marine Surface	Ships (~3,000 VOS), moored/drifting buoys (NOAA TAO, E-SURFMAR)	50,000+	Ocean winds, waves, SST
Upper-Air (Radiosondes)	~900 launches/day (NOAA, global)	900 profiles	Vertical profiles to 30km
Aircraft	AMDAR/MDARS (~200k flights)	50-100 million	Mid-upper winds/temp
Satellites: Infrared/Visible	GOES (NOAA), Meteosat (EUMETSAT), Himawari (JMA)	100s millions pixels	Cloud cover, temps
Satellites: Microwave	JPSS/NOAA-20 (NOAA), MetOp (EUMETSAT)	10s millions	Precip, humidity
Satellites: GPS Radio Occultation (GPSRO)	COSMIC-2, Spire (private)	10,000+ profiles	High-altitude temp/pressure

Weather Radars	NEXRAD (NOAA 160+), OPERA (Europe)	1-5 million scans	Precip, winds
Ocean Subsurface	ARGO floats (4,000+), gliders	100,000+	Temp/salinity profiles
Profilers/LIDAR	Wind profilers, Doppler LIDAR	10,000+	Boundary layer winds
Lightning Networks	GLD360, WWLLN	Millions strikes	Convection tracking
Other/Emerging	Citizen sensors (PWS), drones	1-10 million	Hyper-local

Total "Sources": >100 distinct instrument types/providers, but 12 core categories dominate 95% of assimilation weight. Data flows via **MADIS (NOAA), BUFR format.**

Models That Do NOT Use NOAA Data?

No major operational models fully avoid NOAA data—global sharing via **WMO** makes it impossible.

- **ECMWF/IFS:** Uses **NOAA GOES/JPSS** (~20% of satellite data).
- **ICON/UKMO/GEM:** Same global pool.
- **AI Models** (GraphCast, FourCastNet): Trained on **ERA5 reanalysis** (ECMWF, includes NOAA).
- **Private/Hybrid:** IBM's **GraphCast** or **The Weather Company** blend public (NOAA-heavy) + proprietary, but **still ingest GTS data**. **Edge Cases:** Purely regional/private (e.g., Tomorrow.io hyper-local) ignore NOAA for tiny areas, but **no global model** skips it without accuracy loss.

Private Weather-Data Companies (2025 Boom)

Yes—exploding due to NOAA cuts (staffing/budget issues post-2024). Privates now **supply 10-20% of global raw data**, some **to NOAA itself**. They operate **satellites, radars, buoys, balloons**.

Company	Hardware	Data Type	Notes
WindBorne Systems	Reusable balloons (1,000s)	Upper-air profiles	Filling NOAA gaps; 2025 contracts.
Tomorrow.io (ClimaCell)	10,000+ radars/sensors	Precip, wind (hyper-local)	Private radar net > NEXRAD in density.

Spire Global	100+ LEO satellites	GPSRO, winds	20% of global RO data.
Blue Sky Analytics	Sat processing/AI	Fire, air quality	Geospatial raw feeds.
Baron Services	Radars, lightning	Severe weather	Private NEXRAD alternative.
Orbital Weather	Hyperspectral sats	Cloud/atmosphere	Emerging 2025.
DTN (Agrivi)	Sensors/buoys	Ag-specific	Farm radars/buoys.

Trend: US gov buying private data (**\$100M+ contracts 2025**), risking **global forecast quality** if not shared freely. Privates **enhance** (e.g., denser radars) but **can't replace** NOAA's scale.

Bottom Line: **12+ core sources** fuel models; **all majors use NOAA**; **privates are vital now** (check Tomorrow.io for Bahamas routing integration). Need specifics on a model?