9/30/2025

ASE Technical Interchange 2025

Comparison of Meteorological Data Sources for Aircraft Altimetry System Error (ASE)

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Introduction

- Purpose: Compare two meteorological data sources for ASE calculation
- Sources:
  - GDAS (NOAA, USA)
  - Meteomatics (Swiss private company)
- Both data sets cover flight levels 180–670 (geopotential feet)
- Data grid resolution: 0.25° × 0.25° latitude/longitude

Data Details

- 24 hourly files per day + 1 file for the first hour of next day (25 total)
- Data formats and significant figures are identical for both sources
- Python ASE calculation software used for analysis

Study Objective

- Main question: Do GDAS and Meteomatics data provide similar ASE results?
- Key factors influencing differences:
  - Analysis vs forecast time differences
  - Different models for flight level height estimation
  - Data collection systems (US vs European)
  - Number of analysis cycles (GDAS: 4; Meteomatics: 2)

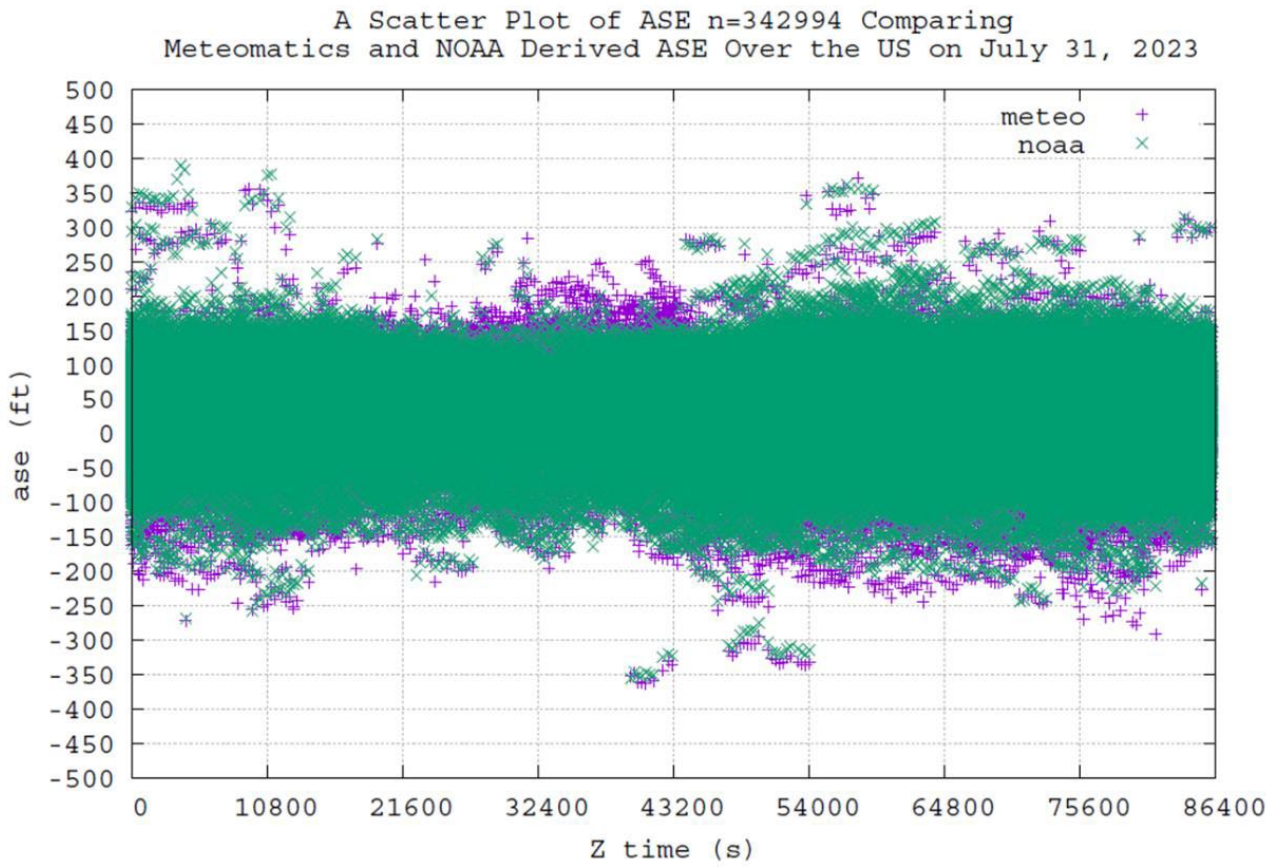
Data and Methodology

- Date analyzed: 31 July 2023
- Location: North America, RVSM airspace
- Aircraft height from ADS-B reports
- ASE calculated every 5 minutes for flight levels 290–410
- 342,995 ASE results compared

ASE Difference Statistics (Meteomatics – NOAA) on 31 July 2023

N	Mean	Median	SD	Mode	Min	Max	Range
342,995	-14	-15	18	-15	-166	117	283

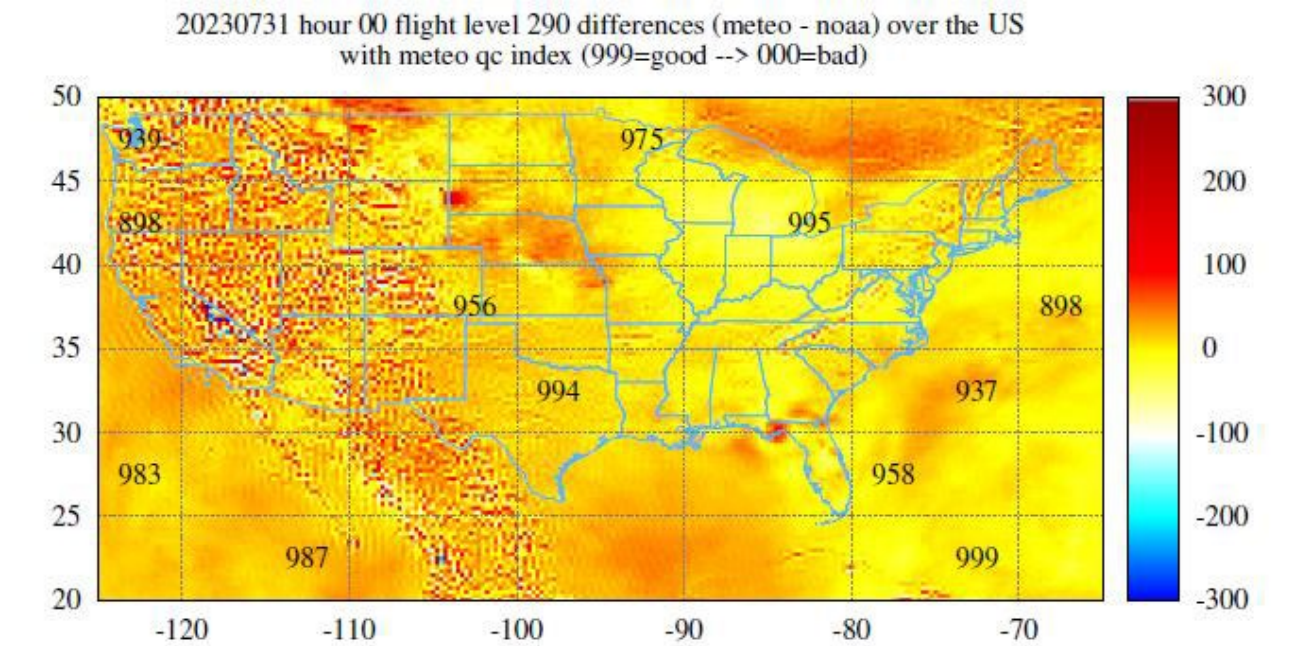
ASE Results Scatter Plot



- Variation observed around 09:00Z
- Differences likely due to forecast vs analysis timing

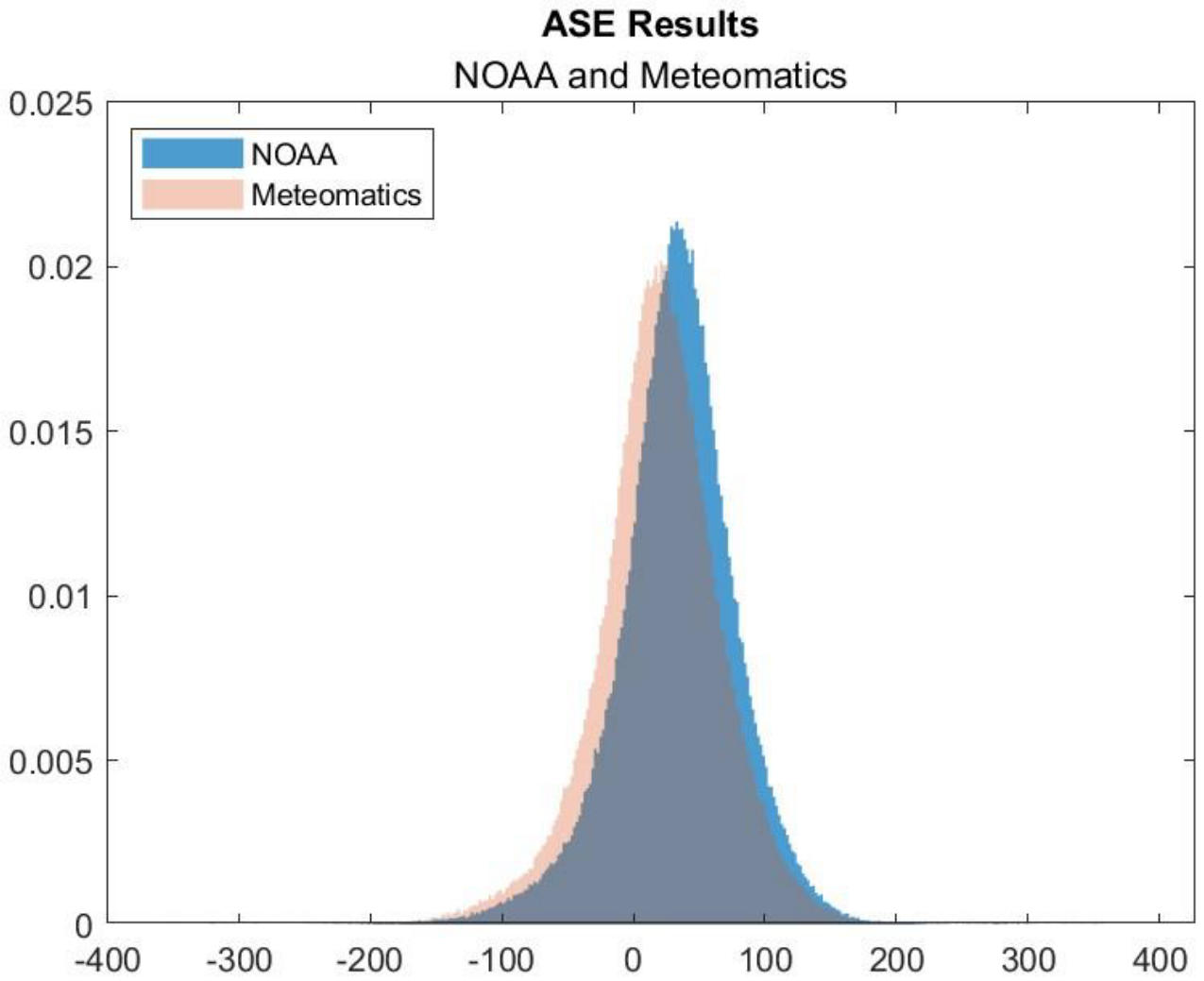
Geopotential Height Differences Heat Map

- Map over continental US for 00:00 hour on 31 July 2023
- Yellow areas: differences close to zero
- Western US: higher variability due to mountain wave activity



ASE Empirical Histograms

- Histogram comparison of ASE results from both data sources
- General agreement supports interchangeability



Summary of Findings

- Both GDAS and Meteomatics provide similar ASE results
- Data differences mainly caused by analysis cycles and model differences
- Both data sets support RVSM height-keeping performance monitoring

Conclusion

- Meteorological data from GDAS, Meteomatics, and European sources are suitable for ASE calculation
- Supports continued safe use of RVSM airspace
- Recommendation: Use all three meteorological sources for aircraft height monitoring