

SwarmDF: A Python toolbox for high-latitude ionospheric electrodynamics

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Abstract



SwarmDF key features

- End-to-end **automated** workflow
- **Multi-instrument** data fusion
- 2D electrodynamics mapping (Lompe)
- Built-in validation (LompeOSSE)
- **Reproducible** results
- **User-friendly** interface



Code & documentation
github.com/Margot-D/SwarmDF
 (ongoing development)

Datasets (automatically retrieved)

- Swarm: magnetic field, cross-track ion flow
- SuperMAG: ground magnetic perturbations
- SuperDARN: plasma convection
- Iridium/AMPERE: field-aligned currents
- DMSP/SSIES: ion drift

Core method: lompe

- “Local mapping of polar ionospheric electrodynamics”
- Data assimilation technique
- Combines heterogeneous observations
- Reconstructs 2D ionospheric electrodynamics at high latitudes

[Lompe papers: Laundal et al. (2022); Hovland et al. (2022)]

SwarmDF workflow: from observations to reconstruction and validation

Input to SwarmDF:
 Swarm pass (ID & time interval) +
 analysis grid + complementary datasets

Lompe reconstruction:
 2D electrodynamics maps
 along and around the Swarm trajectory (> 50° lat)

Quantitative validation:
 Assess experiment setup performance using OSSE
 (OSSE reconstruction vs. known truth)

