The Unmanned Aerial Pesticide Application System Task Force (UAPASTF):

Update and data analysis on UAV field drift studies conducted in 2023

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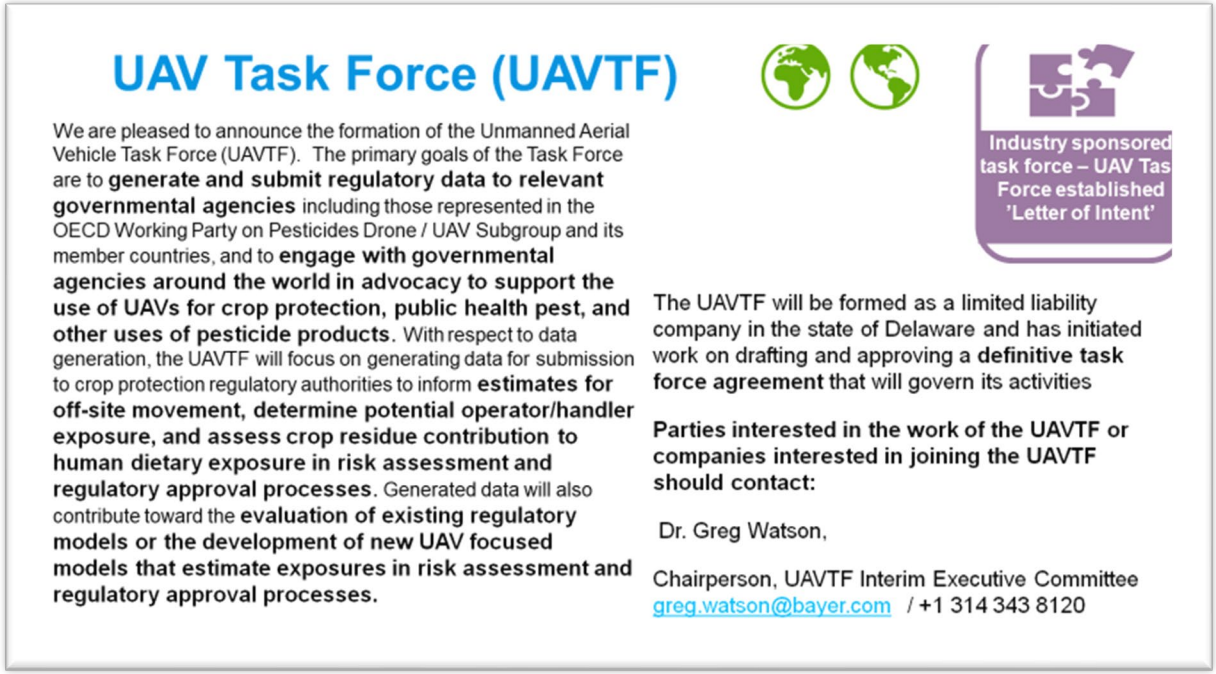
Unmanned Aerial Pesticide Application Systems Task Force (UAPASTF)

Formed 2021

- Currently comprised of eight member companies
- Engage with regulatory agencies to support UASS for crop protection
- Generate/submit regulatory data to regulatory agencies (*e.g.*, to inform estimates for off-site movement)
- Contribute toward evaluation of existing (or development of new) UASS drift models for regulatory purposes
- Alignment with OECD WPP Drone/UASS Subgroup

* UASS: Unmanned Aerial Spray Systems



UAV Task Force (UAVTF)

We are pleased to announce the formation of the Unmanned Aerial Vehicle Task Force (UAVTF). The primary goals of the Task Force are to **generate and submit regulatory data to relevant governmental agencies** including those represented in the OECD Working Party on Pesticides Drone / UAV Subgroup and its member countries, and to **engage with governmental agencies around the world in advocacy to support the use of UAVs for crop protection, public health pest, and other uses of pesticide products.** With respect to data generation, the UAVTF will focus on generating data for submission to crop protection regulatory authorities to inform **estimates for off-site movement, determine potential operator/handler exposure, and assess crop residue contribution to human dietary exposure in risk assessment and regulatory approval processes.** Generated data will also contribute toward the **evaluation of existing regulatory models or the development of new UAV focused models that estimate exposures in risk assessment and regulatory approval processes.**

Industry sponsored task force – UAV Tas Force established 'Letter of Intent'

The UAVTF will be formed as a limited liability company in the state of Delaware and has initiated work on drafting and approving a **definitive task force agreement** that will govern its activities

Parties interested in the work of the UAVTF or companies interested in joining the UAVTF should contact:

Dr. Greg Watson,

Chairperson, UAVTF Interim Executive Committee
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Screenshot adapted from previous presentations by G. Watson (UAPASTF chair)

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UAPASTF Technical Committee

Organization

- Eight member companies represented
- Technical Committee (Chair: F. Donaldson, BASF | Vice Chair: R. Sinha, Corteva)
  - Env. Eco. Exp. Subteam (N. Pai, Bayer | J. McDonald, Gowan)
  - Occupational / Applicator Exposure Subteam (E. Felkers, Bayer)

(Select) Technical Committee Targets

- ✓ Standardize a global off-site movement protocol for generating drift data from UASS application
- ○ **Generate reference drift data for use in regulatory risk assessments**
- ○ Compare drift potential from UASS to other application types
- ○ Develop data quality criteria and data analysis techniques, support spray drift model development
- ○ Operator bystander: 'job steps' survey / analysis of existing surrogate data, identification of potential regulatory information / data needs
- ○ Authority and scientific advocacy activities
- ○ Summary progress reports

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UAPASTF – Updated data generation plan

**note: pinned map locations indicate targeted regions, not specific field sites*

Globally focused Good Laboratory Practice (GLP) program

- Repeatable experiment to compare drift behavior across locations
- Enable data generation anywhere
- Single Contract Research Organization (CRO)
- UAV pilot/consultant at each field location
- Focus on single UASS platform (*i.e.,* establish a comparator / 'reference')
- Nozzles to produce three spray qualities (Fine, Medium, Coarse)
- Each UASS treatment followed by a ground sprayer (with same spray quality)
- Three treatments per nozzle ➔ 18 total treatments

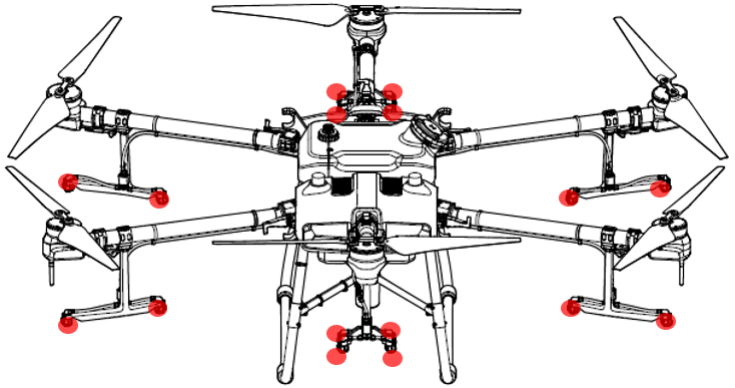
Location	Timing
USA (non GLP) (Robstown, Texas)	February 2023
Canada (GLP) (Saint-Jean-Sur-Richelieu, Quebec)	May 2023
Brazil #1 (GLP) (Santa Helena de Goiás, Goiás)	September 2023
Hungary (GLP) (Bugac)	October 2023
Spain (GLP) (Oropesa)	November 2023
USA (GLP) (Robstown, Texas)	December 2023
Brazil #2 (GLP) (Castro, Parana)	March 2024
Australia (GLP) (Clifton, Queensland)	April 2024
South Africa #1 (GLP) (Delmas, Mpumalanga)	*September 2024*
South Africa #2 (GLP) (Hertzogville, Free State)	*September 2024*

UASS and Tractor

Equipment & Setup

- DJI Agras T30
  - Six rotors, 16 hydraulic nozzles
  - 30L payload
  - Install pressure gauges in-line – confirms spray quality during applications
  - Nozzle release height 3m above ground
  - Bare (or near-bare) ground applications
  - Multiple passes (3-4) to match reference sprayer, depending on pattern test

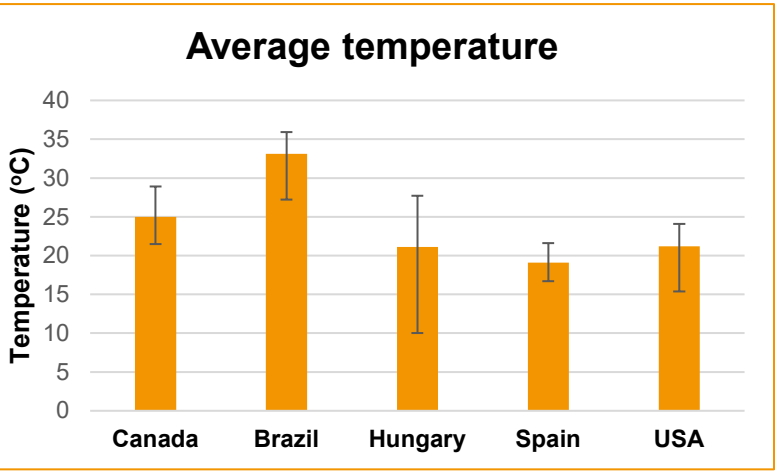
- Tractor (reference sprayer)
  - Model depends on location
  - Three nozzles with same spray quality as the UAV it is paired with
  - Release height 20 inches (*ca.* 0.5m, 'low boom')



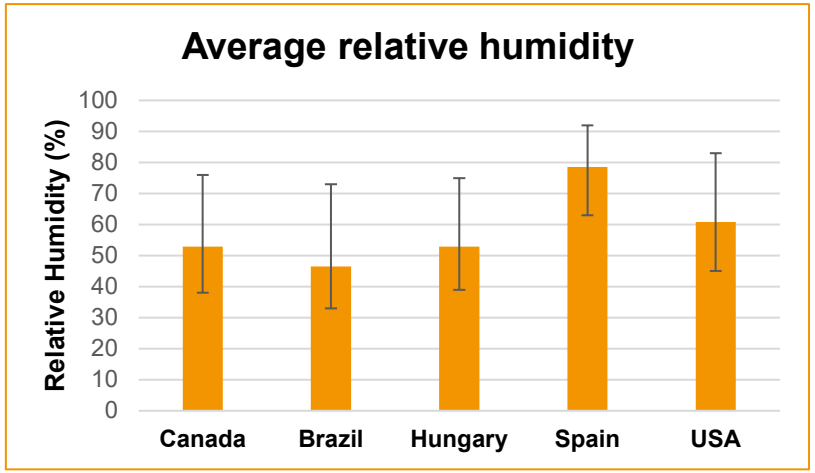
General trial setup

- Pattern testing for swath width/displacement
- 2 weather stations (up/downwind)
  - 2 heights (0.5m , 3 m) – match release heights
  - Wind speed/direction (2-5 m/s, ± 30°), temp, relative humidity
- Samples
  - Upwind
  - In-swath (AV)
  - Downwind (12 distances, 3 drift lines)
    - 0.5, 1, 1.5, 2, 3, 4, 8, 16, 32, 64, 100, 200m
- Treatment area to capture wind shift up to 30°
- Ground samplers: BoPET (Duralar™) cards paperclipped to stands
- 3 vertical samplers (for UAV only) 5 m downwind, from 0-5m height (1m increments)
- Fluorescent dye (PTSA) + FDC Blue #1 dye (visual)

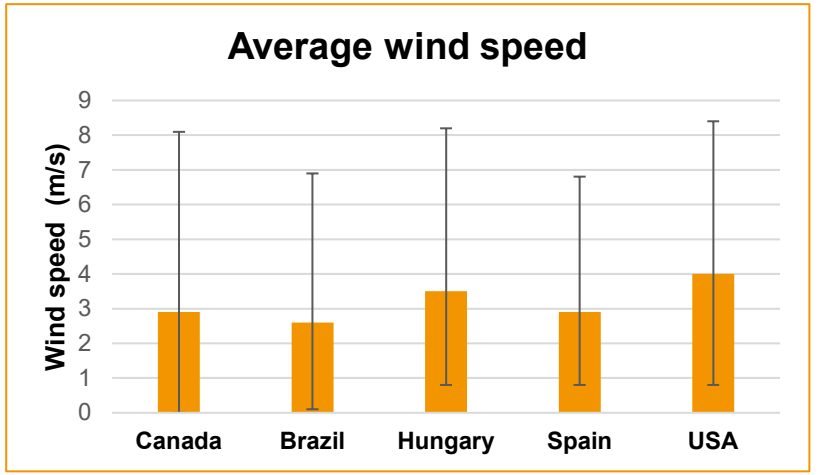
Weather data



Range: 10 – 35.9 °C (50 – 96.7 °F)



Range: 33 – 92%

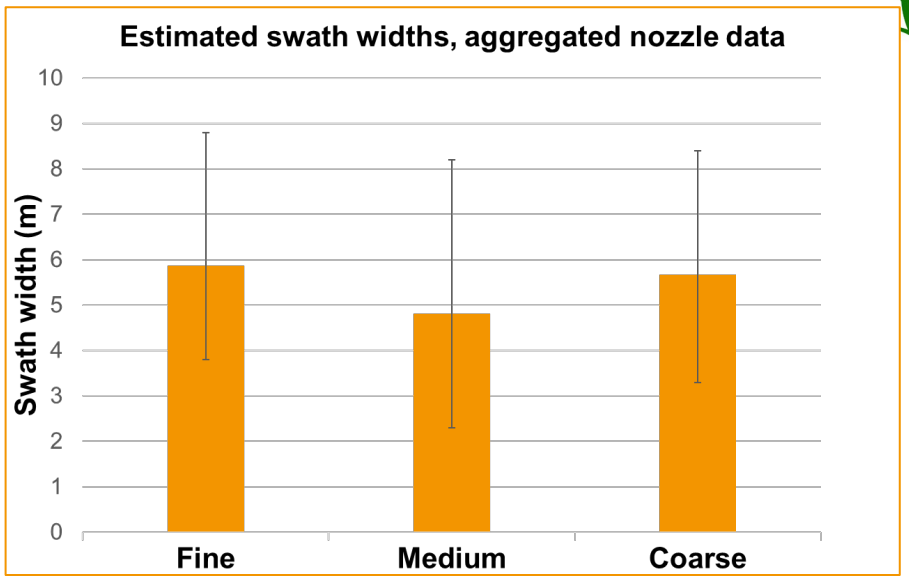


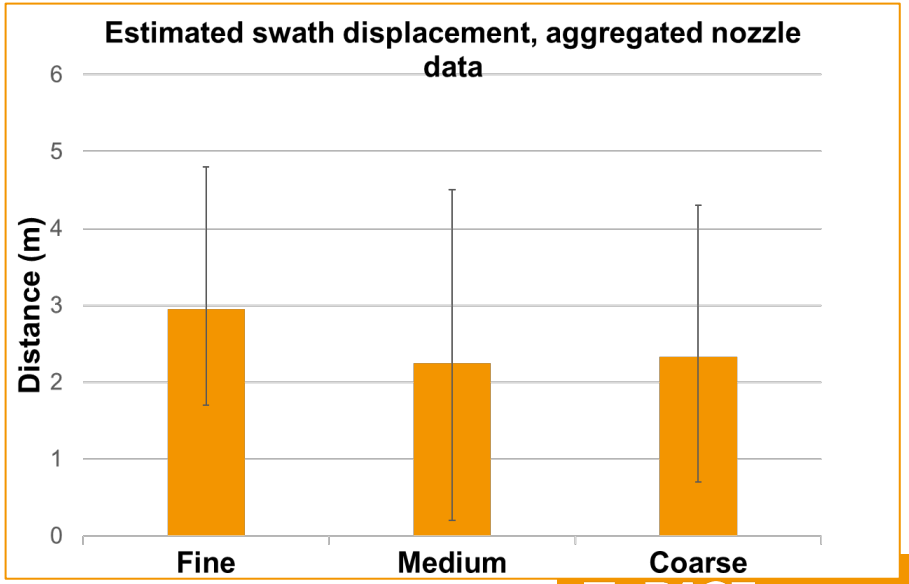
Range: 0.1 – 8.8 m/s (0.2 – 19.7 mph)

- Weather data reported in one second intervals, 2 heights, 2 positions
  - Further analysis ongoing (Brazil #2)
- Time range considers application event plus five minutes (deposition time) for relevant height
- Note: application events initiated when instantaneous and two-minute rolling average upwind speed/direction were within target range (2-5 m/s, ± 30°)

Pattern Test Observations

- Cross-wind pattern testing
- Single pass (3 m height), three replicates per nozzle
- Aggregated across 6 GLP studies (n=18)
- Swath width 5 – 6 m average
- Swath displacement 2 – 3 m average
- Work ongoing to evaluate weather effects





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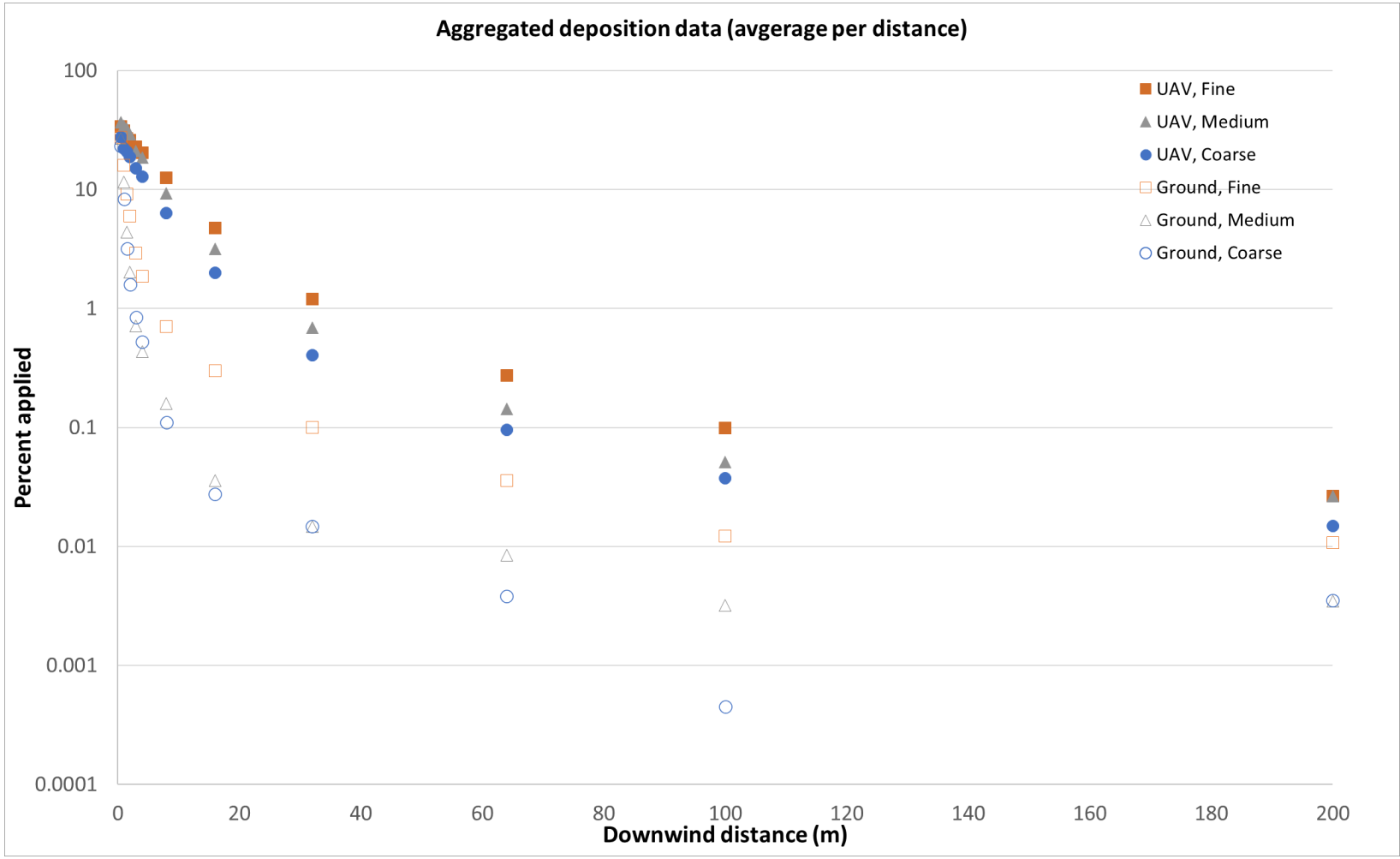
Downwind deposition data (aggregated)

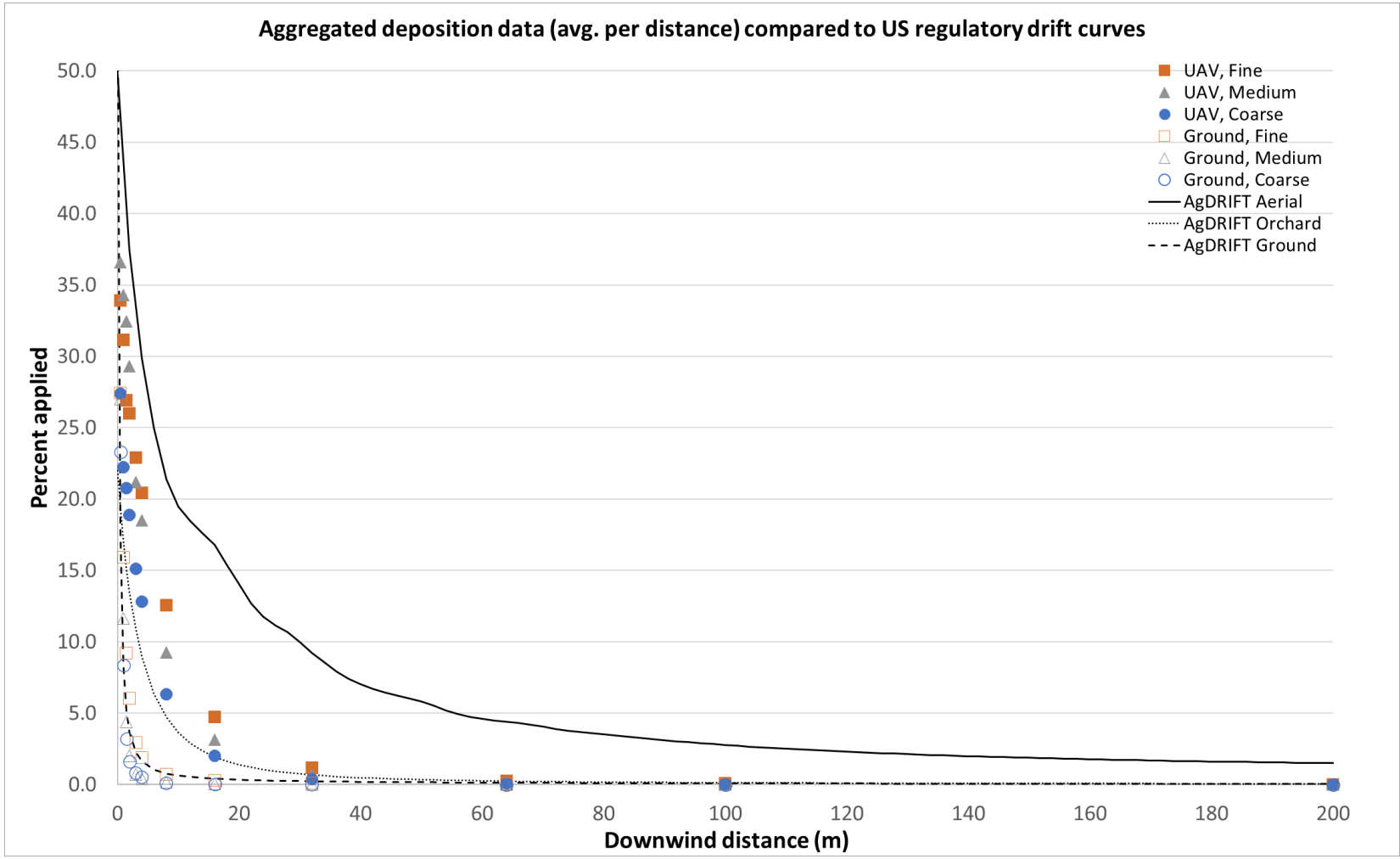
- UAV: 3m release height, bare ground
- Aggregated by spray quality (F-M-C)
- Three downwind transects, three spray events per nozzle, six GLP studies (n=54)
- UAV: 90% deposition within 16 m
  99% deposition within 32 m
  (> 99.9% by 100 m)
- Ground: 99% deposition within 16 m
  (> 99.9% by 32 m)
- Follows expected pattern based on droplet size
- Work ongoing to evaluate weather effects, covariate analysis approach



Note: y-axis is logarithmic

Downwind deposition data (aggregated, US drift curves)

- 3m release height, bare ground
- Aggregated by spray quality (F-M-C)
- US Regulatory Drift curves
  - Tier 1 Aerial, Fine-Medium
  - Tier 1 Orchard Airblast
  - Tier 1 Ground, 50th percentile, low boom, fine-medium coarse
- Data falls within ground and aerial drift curves, and generally below Tier 1 airblast by 32 m

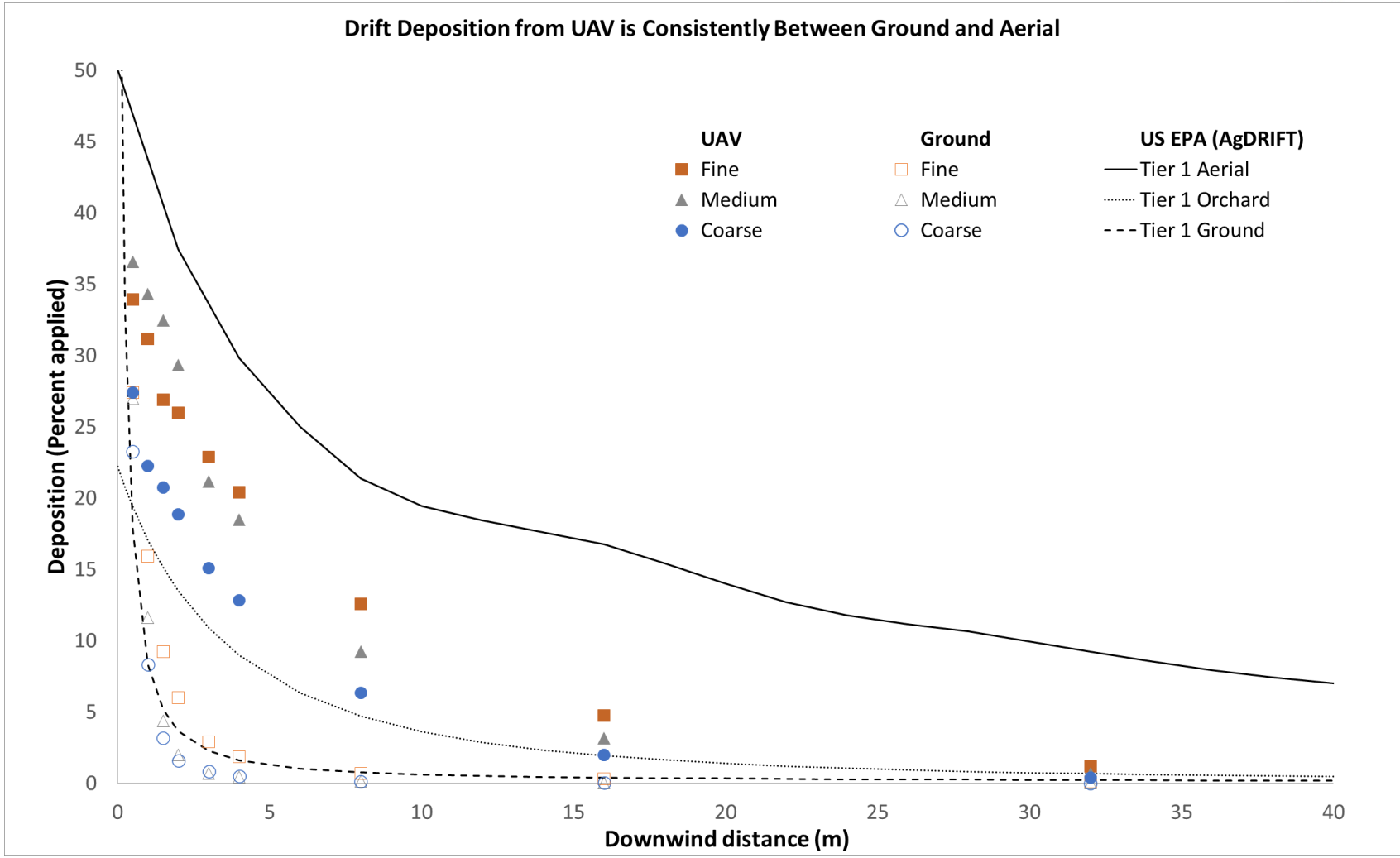


Downwind deposition data (aggregated, 40m, US drift curves)

- Deposition similarity Fine and Medium nozzles at near-edge-of-field

Next steps

- Further investigation into prevailing weather conditions, site-by-site evaluation
- Pattern test data
- Principle component analysis
- Integrate reference sprayer results
- Vertical sampler results



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Concluding remarks

- UAPASTF Technical Committee making steady progress toward stated goals
  - Five GLP studies completed in 2023, two GLP studies in 2024 (with two more in Sep 2024)
  - Collaboration with key drift experts in different areas
    - Efforts to intensify moving forward
  - Data analysis ongoing
    - Data organization and analysis plan developed, shared with regulators
  - Non-dietary exposure work has begun

- UASS deposition results
  - Follow expected trend by droplet size
  - 90% ground deposition within 16 m
    - 99% ground deposition observed by 32 m
  - Data fall between regulatory drift curves for ground and aerial applications

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