

AF Life Cycle Management Center

Providing the Warfighter's Edge



**Exploit the Weather
for Battle:**
**One USAF Perspective on
the Importance of Weather
in UAS Mission Planning**

Capt John Radovan
AFLCMC/HBAW

Integrity - Service - Excellence



Overview



Providing the Warfighter's Edge

- **Mission Planning Framework for UAS Support**
- **Novel Uses of Climatology**
- **Machine Learning – Decreasing the Decision Cycle**
- **Q&A**



UAS Mission Planning Framework



Providing the Warfighter's Edge



The Challenge

- **Manned** aircraft mission planning framework is too rigid and **not suitable for UAS Ops**
- In general, **UAS weather tolerances** are much **lower than manned counterparts**
- Mission Planning must take into account **UAS safety AND mission objective**
 - **Weather is the #1 efficiency driver**

Responding to a Shifting Reality

- Mission Planning becomes **dynamic** vs static AND **continues** during the mission
- Level of **weather input** into the planning process is **exponentially higher** than manned
 - Drives an **increase in human-in-the-loop support**
- **Weather** flight performance model **preflight testing is vital**

Implications

- **Mission Planning = Risk Reduction**
 - Weather risk is **managed over time** during the planning process
 - Weather mitigation strategies developed
- Flexible framework allows users to **anticipate** and **exploit the weather** for operations
- **Plan around the weather** and not through it



Climatology as Risk Reduction

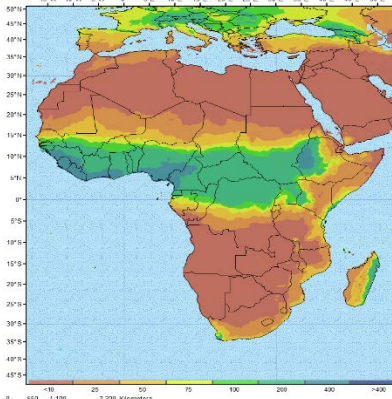


Providing the Warfighter's Edge

Exploiting Weather Patterns

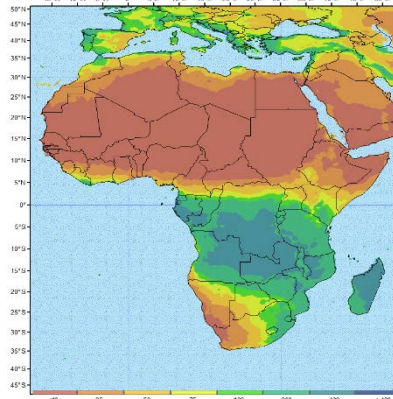
- Vital to **short-to-medium-range planning**
- When juxtaposed with regional climatology, it can **identify** adverse weather **“bottlenecks”**
- When integrated into the UAS Mission Planning framework, it provides decision makers **timely, decision-grade impact data**

Mean Precipitation (mm) Climatology June



Africa

Mean Precipitation (mm) Climatology December



Africa

Regional Climatology

- Incorporating seasonal and regional climatology into UAS mission planning creates efficiencies in **long-term planning**
- Aids in **pre-decisional UAS deployment** considerations
- **Identifies weather risks early** – allowing weather to be incorporated into the initial concept of operations

Global Tropics Hazards and Benefits Outlook - Climate Prediction Center

Week 1 - Valid: Apr 11, 2018 - Apr 17, 2018

Week 2 - Valid: Apr 18, 2018 - Apr 24, 2018

Produced: 04/10/2018
Forecaster: Artusa

Confidence		
High	Moderate	
		Development of a tropical cyclone (tropical depression - TD, or greater strength).
		Weekly total rainfall in the upper third of the historical range.
		Weekly total rainfall in the lower third of the historical range.
		7-day mean temperatures in the upper third of the historical range.
		7-day mean temperatures in the lower third of the historical range.

Product is updated once per week, except from 6/1 - 11/30 for the region from 120E to 0, 0 to 40N. The product targets broad scale conditions integrated over a 7-day period for US interests only. Consult your local responsible forecast agency.

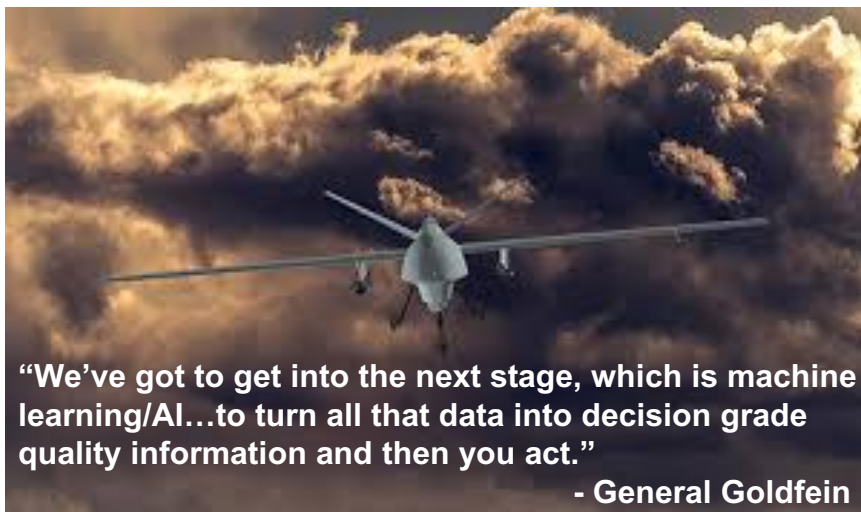
Logos: Central Weather Bureau, UNIVERSITY AT ALBANY, Australian Government Bureau of Meteorology, NPS, etc.



Applying Machine Learning to Weather



Providing the Warfighter's Edge



“We’ve got to get into the next stage, which is machine learning/AI...to turn all that data into decision grade quality information and then you act.”

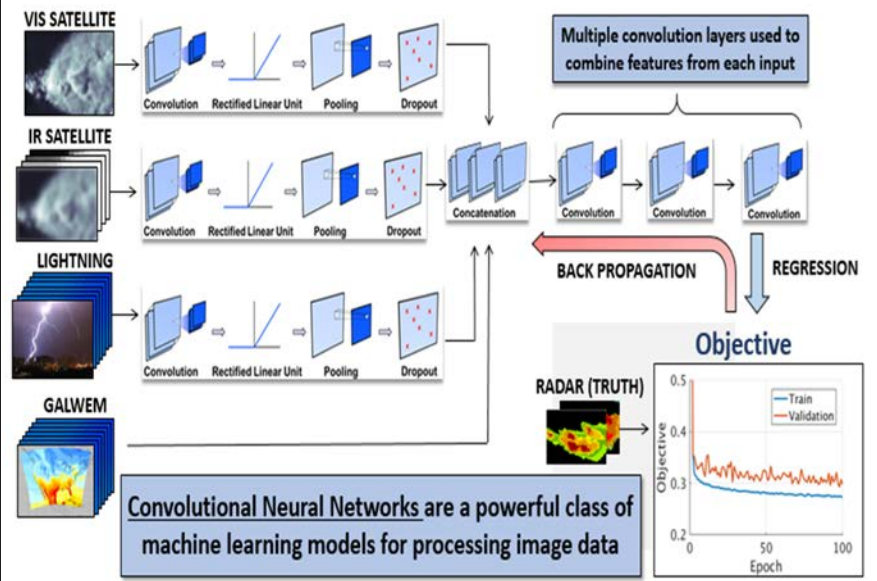
- General Goldfein

The Innovation Blind Spot

- Delivers **technical capability** with human excellence
- **Scalable solution** as new data sources flood the market
- Currently partnering with MIT Lincoln Labs to **fuse existing heterogeneous data** in data sparse areas into near real-time weather radar

Opportunity out of Necessity

- **Expands capability** without expanding infrastructure
- **Bridges the gap** where communication between planners and forecasters most often breaks down and process stall
- Can provide aircrew **mission-saving** environmental **situational awareness**





Questions



Providing the Warfighter's Edge



Integrity - Service - Excellence