RPAS (aka drones): An emerging tool's potential to democratise access to Earth and Environmental Sciences GIS data

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Outline

1. RPAS scientific use globally
2. Some projects I’m working on
3. The potential value of RPAS data and some cautions
4. A challenge to the research community

Quick poll of the room
What are your top 3 domains of expertise?
(Submit a couple “hashtags” for yourself)

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RPAS scientific use globally

- RPAS/drones/UAV/UAS/…
- sUAS: small Unmanned Aircraft Systems
  - “A UA weighing less than 55 pounds, including everything that is onboard or otherwise attached to the aircraft, and can be flown without the possibility of direct human intervention from within or on the aircraft.” - FAA AC-107 4.2.6
RPAS scientific use globally

- An emerging tool of the Earth Science trade:
  - Greater accessibility
  - Higher Spatial Resolution: fill a gap between Satellites and manned aircraft and ground sensors
RPAS scientific use globally

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  - Access to what were otherwise inaccessible data

https://spectrum.ieee.org/automaton/robotics/drones/fliesabilitys-gimblodrone-exploring-ice-caves
https://www.nasa.gov/topics/earth/earthmonth/volcanic-plume-uavs.html
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    - **Lowered cost than traditional methods might incur**
An emerging tool of the trade globally

sUAS use in the Earth Sciences by domain

https://osf.io/ub84e/

Informal survey, Wyngaard, Barbieri, Bhakta SciDataCon16
An emerging tool of the trade globally

sUAS flight platforms in the Earth Sciences
37% of Science sUAS are custom made

sUAS sensory data output type in the Earth Sciences
66% of the data is imagery

Informal survey, Wyngaard, Barbieri, Bhakta SciDataCon16
Scientific use of sUAS globally

Drone Publications: Web of Science Search

Barbieri, Wyngaard, Thomer et al., in prep 2018
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Quick poll
Another poll of the room – what data do you collection/working with most?

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Swarming
Agricultural GHG mitigation qualification

compare with field points

Barbieri, Wyngaard et al., in prep
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How much do you prioritise using open source tools in your work

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The potential value of RPAS data
The potential value of RPAS data - Cautions

- Some cautions:
  - Vulnerable data sources
  - Pragmatic academic process
  - Potentially economically harmful human consequences
  - Human privacy and dignity concerns
  - Legal concerns (particularly airspace governance)
The potential value of RPAS data - Cautions

- RDA Ethics and Social Aspects of Data IG and the sUAS data IG
- WeRobotics code of conduct https://uavcode.org/
  - Humanitarian UAV Guidelines on Data Protection
  - Humanitarian UAV Guidelines on Community Engagement
  - Humanitarian UAV Guidelines on Effective Partnerships
  - Humanitarian UAV Guidelines on Conflict Sensitivity
The potential value of RPAS data - GHG data reuse example

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Potential Data-use4:
- Seeding data for a climate model
RPAS data and other opportunities

“In the same way that the internet democratised telecoms, I think drones will democratise geospatial information gathering and analysis. Everybody will soon have access to the tools that only satellite owners had just a few years ago.”

- Chris Anderson CEO 3DRobotics, 2017
RPAS data and other opportunities

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3DR solo

Ground Station

Modular Autopilot with triple sensor redundancy

Dronecode
RPAS data and other opportunities

Missing components:

- DJI/Apple-like ease of use
- An open source data infrastructure
RPAS data and other opportunities

Potential of an open RPAS ecosystem for research:

- FAIR RPAS data will enable more and better science
- Minimise data loss now and into the future (saves $)
- We’re lazy (or least I am) so it would limit wheel re-inventing
- If we can provide data requirements to RPAS platform, sensor, and sensor providers they can better build us tools which benefits both parties.
- A rigours common set of practices shield RPAS data from suspicion and challenges on the grounds of unspecified quality guarantees.
- It will lower the barrier to entry for those not yet using RPAS for research
- Citations
RPAS data and other opportunities

Potential of an open RPAS ecosystem for Non-Research Possibilities:

- Improved Government Policy
- Citizen driven development
- Entrepreneurship and therefore GDPs
- Saving lives, and the environment
What we’d need for normalised FAIR RPAS data

An open source drone data infrastructure enabling FAIR drone data

- **Common Guidelines for**
  - Sensor calibration and use procedures
  - (Meta)Data formats
  - Ontologies
  - Data analytics best practices

- **Software tools based on above**
  - Auto Q/C
  - Auto metadata capture
  - Auto analytics provenance capture
  - HPC: Open analytics processing tools integrated with QGIS et al
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Tweets including #drones4good and #dronesforgood in the last 7 days
Pre-challenge Summary

1. Drones as tools not toys are in our future (or rather are here already but in lower number than there will be)
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4. The open RPAS ecosystem is in need of an open data ecosystem
A challenge to the research community

Unfortunately this is a relatively time sensitive opening to some extent but it’s also a unique opportunity through the coincidence of:

- There’s no legacy to fight/account for/accommodate (yet!)
- There’s never been more community and funder momentum behind Open science, and FAIR data practices than now
- It’s now possible The data technologies community (repositories, use of semantic technologies, formats, workflows, provenance tracking, data citation support,…) is maturing and arguably mature enough to build the necessary infrastructure
There’s an emerging massively underutilised resource

We could choose to make it FAIR from the beginning if we want. As researchers we will be enabling:

- More science
- Better science
- Industry Tools optimised to our requirements
- More citations (we all need them!)
- Citizen science RPAS
There’s an emerging massively underutilised resource

And simultaneously putting in infrastructure that would also enable/facilitate growth to enable other/commensurate societal gains eg:

- Improved agriculture efficiencies in changing climatic ecosystems
- Citizen driven improvements on quality of life
- Improved government practices
- New industries...
Final thoughts:

- Open solutions end up as better solutions
- Community driven solutions see greater adoption
- This isn’t just about drone data
- There are many analogous communities and existing practice to draw on
- It’s a global issue (that’s a good thing in this context)
- For all of the above ideally 1 group shouldn’t win that $1M grant
- This is time sensitive