Leader: **Andrew Molthan**
Google docs note taker: **----** *(determine in group)*
Presentor brief summary: **----** *(determine in group)*
Logistics:

- Spend 5-minute max to do a quick introduction among all in your group (name, what institute do you work for)
- Determine who takes notes and who will present a summary of the outcome of this breakout this afternoon.
- Make small subgroups (3-5 people) and answer each of the questions below. Take for each question ~15-20 minutes in your small subgroup and brief back to larger breakout group (~3-5min each subgroup) for the note taker to capture into google doc.

Long-term? What are we talking about, etc.

TASKS - Earth Observations (EO)

Many airborne or satellite based flood Earth Observation (EO) products are developed over the years and often are freely available to **determine Flood Risk**. Some products might be more useful than others, and probably some there are some data gaps as well. To better understand what is available, useful, or missing, we would like to get your opinion on the following:

1. **What global / regional / local EO data is out there to determine Flood Risk for a certain area?** This can either be free available data or commercially available data.
   What's available right now and what good is it?
   What is meant by risk? Before + Near real time + post observation

   USGS product in development: Dynamic Surface Water Extent (DSWE), inundation f every pixel in all Landsat scenes back to 1980s to reconstruct historic innundation events

   Snow cover & freeze/thaw states
   Categories of data:
   Satellite
   - Optical
   - Multi-spectral
   - SAR
   - Radiometry
   - Altimetry
   - GNSS
     - TRMM/GPM

   Commercial EO satellites e.g. Planet, DigitalGlobe, others forthcoming, etc.
   Airborne
   - SAR

   In-situ
   Citizen observations

- Global Scale
  - Landsat
  - Sentinel 1 and 2

    - RADARSAT - MDA
    - COSMOS SkyNet
    - Commercial - Planet/DG/Airbus
- National Scale
    - MODIS
    - SMAP
    - GOES
    - Sentinel 1
- Local Scale
    - Aerial - post-disaster and used to calibrate
    - UAV
    - NOAA flown missions
    - DEMs into hydrologic models

More available in US and Europe than developed countries, e.g., high-res DEMs

Think about NASA's Sensorweb technologies to better utilize satellite, airborne, UAS, and surface EO data by digging down through EO resolutions to provide the best resolution useful to the user so they don't get products that are not useful.

2. **What EO data is mostly used or useful, also in terms of urban areas?** And if some products are used in the past but not anymore, why isn't this used anymore? Also are there different datasets for different regions / continents?
[PUT NOTES HERE]

Biggest gaps are for real-time data - satellite data lags
Need to be able to quickly process data down to interpretable scale for public understanding
Many satellites not high-resolution enough for very local applications

Population Density Data: Human Settlement Layer, Nighttime Lights Data

DEMs: LIDAR, VRICON, ASTER, SRTM, TanDEM-X/ TerraSar (DLR), JAXA, ALOS World 3D, MERIT (corrected DEMs using additional layers to process for masking/ removing errors from urban or other features), national elevation dataset
Urban infrastructure needs more data to understand risks. USGS, USDA, NOAA funding the 3DEP program is an essential part of understanding infrastructure.
Then understand coastal areas too for inundation understanding, storm surge, and coastal subsidence/erosion.
Citizen observation good for real-time, from-the-ground information, rural but especially also urban areas

Radar best for cloud cover during storms, but less accurate in urban areas. Airborne SAR would be good.

Gaps: resolution of many global socio-economic datasets (e.g., transportation, power facilities) is lower resolution than needed for locating flood extent

NWS flood forecast

3. **What key EO needs are there for the different communities, what is available and what is desirable but not out there yet** (first aid & response agencies, insurance companies, research, planners, …)?

[PUT NOTES HERE]

address: Minimum req for mapping global flood risk that meets user needs

address: what's needed to move from flood as a hazard to assessing flood risk

* what's the user question driving the need?

* think in terms of specifics: scenarios and solutions. When do users need data and where do they need it (urban/agricultural etc.)? When is it too late ... or low-res to be useful?

* which ones of the data sources above really address risk? wlll it really help us design something for the future.

latency:

- Emergency management: order of hours for first responders (raw products or simple derivatives)
- Insurance: approx 72 hrs (derived products: flood footprints, i.e. flood event extent and depths)
- Potential time savings: e.g. initially skip geolocation, atmospheric correction

Actionable data

Decisions different groups are making

Rescuing, population

Team Rubicon-Volunteer groups who collect citizen data->where to deploy crews->find the areas need the focus. Work closely with first responders to understand their needs and what they can provide to researchers during the development of their products.

Work with FEMA and Red Cross in a similar manner. Good communication with end users, develop low latency products that provide initial guidance for first responders.

Digital Globe-Worldview is a widely used dataset to understand building damage, and is easier to obtain shortly after a disaster. NASA's commercial data buy may be a way to obtain more commercial data and integrate that with NASA's research missions.

For a 10 year plan you need a phased approach.. First 3 years what is the goal and how do we better understand the needs? Second 3 years where do we go, what is the measure of success in terms of funding proposals to address what was discovered in the first 3 years? What research is needed, what are the best products that serve the user community best. Then for the last 4 years, develop the Flood Risk systems that serve users, even if they are regional, climate based, geography based and whether developed by individual governments, academia, or other. Make sure duplication is avoided to save investments.

Community needs:

-Real-time flood extent maps at all resolutions to help determine 1)funding needs, 2)severity of the event, 3)are locations accessible for response. Needs especially in countries/regions where there is not a local agency with capacity to do complex data analysis.

- A centralized place to obtain all relevant data products (at matching resolutions), and/or training to know which data/products are most useful for different types of use cases.

- Historical event maps to help understand risk thresholds for future events

- High resolution mapping depth as well as extent

Good products:

ACOE - trafficability map - shows what roads are open/flooded

New rapid revisit SAR private satellites (high resolution, smaller view extent) - Capella launching Feb 2019; Umbra, Iceye

4. ~~It could be that EO data is there but not in the right format (e.g. text but not a map / screenshot but not something that can be imported in GIS / online but not downloadable / etc), or not at the right time, or not n the right resolution.~~ ~~**What of the above examples or other examples, is the most pressing to address depending on the user?**~~

   What is your big idea about a creative way to address these needs collaboratively or in a new way that is not being done? what is required to make that happen?

   [PUT NOTES HERE]
   Address:* achievable short term goals - e.g. 3-5 years (small funds)?
   Address: What are the problems that require a longer time horizon or large coordinated community effort (e.g. 10 years, more partners)
   Address: * multi-year plan to achieve goals
   When does data come in too late to no longer be useful?
   what is too coarse to be useful in the right decision context?
   what data needs to be combined with other information and is not useful on its own?

   Open-access to high-resolution (high accuracy) global benchmark DEM (relevant for modelling, remote sensing and risk components)
   - How to get there? Document that specifies:
   - Different requirements in terms of resolution for different areas (urban, agricultural, etc.) to prioritise LiDAR
     - Need (e.g., insurance, urban) → quality of DEM necessary → What types of decisions/value can you derive from it, vertical accuracy (absolute/ relative)
     - E.g., 5m vertical accuracy is useless when you need to know 1m or 2m or 4m differences, so a 1m DEM would unlock a lot of potential value/decision making capability.
   - Geopolitical, security considerations?

   New high-res high temporal SAR satellites can look at urban areas in small swaths
   Visor could do real near-time airborne SAR (processing done on aircraft)

   How to collaborate better - **start with use cases** (based on type of decisions that need to be made) to identify the capabilities of each org to see what can come together to fully address that situation.**Data sharing connections:** Have capabilities in place for each partner to be able to connect quickly with each other.

   How could we have a global dataset of local building structures, e.g., what Google has on building footprints

   Global integration of climate change risks into flood risk products

Plenary discussion notes per question 1-4 (taken by John Galantowicz):

1.

- categorize facilities for short vs. long term risk assessment
- long period information -- 10/15/20 years vs. more recent commercial or other with shorter period of record.
- Need for intercalibration - extend back more recent/higher functioning data records using long-period records
- data latency issues: how do we speed that process up? computing? willingness? what are liability issues for scientist putting out data on time?

2.

- critical interconnection between modeling and data. Should/must be viewed together. Data will never be 100% temporally/spatially. Models are (at least) gap filling.
- urban areas: modeling has twists. gaps deal with "value" estimation (broadly speaking -- what would be lost) -- productivity. Also resilience to regular flooding (e.g., Bangladesh tolerance for 4-5 feet of flooding)

3.

- latency: consider differences between good enough and perfect. Expedite data with caveats is needed.
- application of globally available data sets to small states (e.g., Caribbean, small watersheds -- 2 hour watershed response period). Issue is, again, combination of modeling and observations to meet this need.
- insurance industry: no so much demand for quick respond. need max flood footprint/depth for the "event" -- after the fact. far more helpful than faster data.
- insurance ind: DEMs *vertical* accuracy as/more important than horizontal res.
- team rubicon (Florence): crowd sourcing as much data as possible. filter data down and narrow down where to deploy response teams. communication is key.

4.

Use cases by sector:
- invert questions: start with specific use cases. what data directly address problems specific to the use case? how to collaborate on use cases -- how to connect to each other to address the use case? APIs in place specific to use case. Wow, hyper-specific use cases! Start with real-world scenario then move to identify broader categories of use cases.
- need to decide why we care. what's the decision point? what are the different outcomes of the decision (probabilistically)? why are we spending money?

Obs. frequency:
- how to get to maximum extent. multiple obs gives you sense for how long, how many times location depicted as flooded. gives a measure of confidence/severity

Conceptual future use cases given advanced data etc:
- benefit of higher-accuracy DEM. need guidelines specifying need -> move to requirements definition. what decisions *could* we make if accuracy were better.

Communication:
- the way scientists distribute results: hope people find it (no, they don't usually). scientists need to find a way for data to be available/known to different communities. creative ways to communicate results graphically / in format + resolution selected by user. Standardization of
- Move toward data-agnostic "tool" to get the product you *need* from the products *available*

Data access without fast internet:
- think of users who need/must have limited/compressed data sets
- accessibility to data *before* an event

DEM DEM DEM
- global DEM is a patchwork and there isn't an obvious plan to complete it
- (Guy S. insists there is and perhaps we as a group don't have to prioritize it)

Profit/revenue potential -- insurance
- figure out how to make money. link preparedness to things that make money to be sustainable. make the modeling help them (insurance industry) so they can help us.
- more on insurance perspective.
1) globally, insurance req are extremely variable
2) chicken/egg: lots of data, a lot we want to use, but a lot we can't use commercially.
- penetration rate for insurance is extremely low (3% in NC).
- how can insurance have confidence given human interaction with data -- potential for manipulation. data integrity is paramount

Data mining:
- social media. traffic cameras.
- telecom providers: in context of licensing of foreign providers in developing countries, compel providers to provide civil defense functions. change of law needed in those countries.

- need to make bridge between science / decision makers / general population

Risks to data providers / requester
- someone who was disadvantaged by your product might sue you. OR a citizen scientist harmed in the act of getting data for your app ... may also like to sue you!

EO breakout rapporteurs:
Beth Tellman, Cloud to Street
John Galantowicz, AER
Jugen Wagemaker, FloodTags
Bastian Manz, Willis Towers
James Halgren, RTI International
Delwyn Moller, RSS (Remote Sensing Solutions)

REPORT BACK SYNTHESIS

PROBLEMS IDENTIFIED (Bastian + Beth)

1. Timing
    a. Latency- need for quick look products for humanitarian response because the data loses values quickly
    b. Infrequent observations dont match when floods occur. Satellites miss peak flooding or miss it totally for flash floods. (e.g. the Barbados story)

2. DEM accuracy

3. Data assimilation/curaration
    a. A place for people to access data and scientists to upload it
    b. Needs to be curated by resolution/type

4. Need to calibrate across time horizons

5. Lack of comparison between products. No know what is accurate.

6. Some things the private sector does WELL in making solutions- and some things the market does not solve.

NEED FOR USE CASE DATABASE/SYNTHESIS TO SEED SOLUTIONS (Jurgen)

1. Could source use cases collectively. Using a template like IBM RUP.

Could use it to find seed funding to show data value on a simualted or real event (like satellite testing with NASA)

2. Synthesize use cases to get a value proposition

3. Use where we can respond to most demand/value to develop collaborative solutions (and the actor that could solve each)