Constructing Data Albums for Significant Severe Weather Events

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Why Do We Need Data Albums?
- Important for generating case studies to enable researchers to improve prediction of convective thunderstorms that may result in damaging wind, hail, lightning, flooding and tornadoes.
- “One-stop shop” for information and data related to a specific science topic or event, such as severe weather events
- Links relevant data files from different instruments, online searches, news reports, official storm summaries, pictures, background information, damages, deaths, and injuries
- Aggregated data are organized in ways that can aid in the discovery of new trends through exploration
- Existing hurricane Data Album (Figs. 1 & 2) modified for severe weather

Ontology Development
- An ontology is a structured model of a specific topic showing key concepts and the relationships between them (Fig. 4)
- Can be thought of as similar to organizing the animal kingdom by phylum, species, etc.; however, instead using severe weather event keywords organized in the hierarchy.

Meteorological Datasets
- Meteorological products are used to refine search areas for NASA datasets and to determine the quality of pre-event forecasts
- Products brought in include Public Severe Weather Outlook (PWO), Convective Outlooks, Convective Weather Watches, Mesoscale Discussions, and Storm Reports disseminated by the Storm Prediction Center (see Fig. 5)

Social Media Archive
- Massive source of online data through news outlets and social media for investigating severe weather events
- YouTube Videos, Facebook, national and local news feeds online and recorded news broadcasts, Twitter, Flickr

NASA Datasets
- NASA collects many different Earth Science observations both from satellite and field campaigns for ground validation, which are stored in a clearinghouse called ECHO
- Only a small percentage of the datasets are relevant to severe weather phenomena
- Appropriate NASA datasets were selected based on their relevance to the severe weather phenomena for inclusion in a severe weather Data Album (Tables 1 & 2)
- Using the ontology and geolocation information in the SPC products; only the relevant NASA data are included in the Data Album

Severe Weather Data Album
- Home page (Fig. 5 left):
  - Statistical overview of weather events binned by date
  - By clicking on the year, month, and day, users can “dig down” to investigate severe weather events from a particular date
- Event page (Fig. 5 right):
  - Aids in answering the question: “Was this a good forecast?” by providing forecast products and NASA datasets
  - Interactive map with storm reports overlaying convective outlooks detailing the forecast process leading up to an event
  - Videos, pictures, and social media information during and after the event
  - Based on date and location of convective outlook, all NASA data relevant to severe storms is linked into the page

Noesis 2.0
- Open source, reusable aggregation software, which incorporates a variety of current web aggregation concepts to pull together data from:
  - Relevant NASA datasets are introduced through the Earth Observing System (EDS) Clearinghouse (ECHO; “2” in Fig. 3)
  - Web-based information from various online data formats, such as PDF and HTML (”3” in Fig. 3)
  - Social media information such as Twitter, Flickr, YouTube, etc. (“4” in Fig. 3)

Table 1: Recent NASA field campaigns relevant to severe weather

<table>
<thead>
<tr>
<th>Campaign</th>
<th>Location</th>
<th>Date</th>
<th>Relevance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Precipitation</td>
<td>Finland</td>
<td>Sept.-Dec. 2010</td>
<td>High latitude precipitation</td>
</tr>
<tr>
<td>Validation Experiment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(LPVEX)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mid-latitude Continental</td>
<td>Oklahoma</td>
<td>April-May 2011</td>
<td>Convective precipitation</td>
</tr>
<tr>
<td>Convective Clouds</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experiment (MCCE)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iowa Flood Study (IFloodSS)</td>
<td>Iowa</td>
<td>May-Jun. 2013</td>
<td>Heavy precipitation</td>
</tr>
</tbody>
</table>

Table 2: NASA satellite data relevant to severe weather

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Relevant Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMSU-A</td>
<td>T, RH profiles</td>
</tr>
<tr>
<td>AIRS</td>
<td>T, RH profiles</td>
</tr>
<tr>
<td>AMSR-E</td>
<td>Precipitation, WV</td>
</tr>
<tr>
<td>TRMM</td>
<td>Rain Rate</td>
</tr>
<tr>
<td>LIS</td>
<td>Total Lightning</td>
</tr>
<tr>
<td>MLS Aura</td>
<td>T, RH, cloud ice</td>
</tr>
<tr>
<td>OLS</td>
<td>Moonlit clouds</td>
</tr>
<tr>
<td>VIIRS</td>
<td>Clouds</td>
</tr>
<tr>
<td>CrIS</td>
<td>T, RH profiles</td>
</tr>
</tbody>
</table>

Summary
- Data Albums provide a one-stop-shop combining datasets from NASA, NWS, online new sources, and social media
- Data Albums will help meteorologists better understand severe weather events to improve predictive models
- Developed a new ontology for severe weather based on current hurricane Data Album
- Selected relevant NASA datasets for inclusion in Data Album

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