Overview of NCAR Dropsonde technologies for targeted observations in severe systems and for research

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CIMO TECO
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NCAR Dropsonde Technology

<table>
<thead>
<tr>
<th></th>
<th>RD94</th>
<th>Mini Dropsonde NRD94</th>
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<tbody>
<tr>
<td>Sensors</td>
<td>PTH &amp; Winds</td>
<td>PTH &amp; Winds</td>
</tr>
<tr>
<td>Mass</td>
<td>320 g</td>
<td>167 g</td>
</tr>
<tr>
<td>Size</td>
<td>16” x 2.75”</td>
<td>12”x 1.75”</td>
</tr>
<tr>
<td>Fall Speed</td>
<td>~11 m/s at surface</td>
<td>~11 m/s at surface</td>
</tr>
</tbody>
</table>
Platforms

- NOAA WP-3: Manual system, hurricane eye penetration
- NOAA Gulfstream-IV (G-IV): Manual system
- NOAA Twin Otter: Manual system
- NASA Global Hawk (AV6) Unmanned Aircraft System: Automated system 90 sondes
- NCAR Gulfstream-V (G-V): Automated system 40 sonde or manual system
- NCAR C-130: Manual system
- FAAM BAe 146-301: Manual system
- AWI Basler BT-67: Manual system
- DLR Gulfstream-V (G-V): Manual system
- DOTSTAR Astra SPX: Manual system
- HKO GFS Challenger 605: Manual system
- ....
- Long Duration Balloons: Driftsonde automated system 54 sondes per platform
Dropsonde Sensors

- GPS Receiver
- Lithium Battery (on backside)
- 400 MHz Transmitter
- Vaisala RS92 Pressure Sensor
- Vaisala RS92 Humidity Sensors
- Vaisala RS80 Temperature Sensor

Vaisala RD94 dropsonde produced and sold by Vaisala in license from NCAR

NCAR NRD94 currently produced at NCAR
### Nominal Sensor Characteristics

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Range</th>
<th>Repeatability</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure</td>
<td>1080-10 hPa</td>
<td>± 0.5 hPa</td>
<td>0.1 hPa</td>
</tr>
<tr>
<td>Temperature</td>
<td>-90 to +60 C</td>
<td>± 0.2 C</td>
<td>0.1 C</td>
</tr>
<tr>
<td>Humidity</td>
<td>1-100%</td>
<td>± 5%</td>
<td>1.1%</td>
</tr>
<tr>
<td>Wind Speed</td>
<td>0-200 m/s</td>
<td>± 0.5 m/s</td>
<td>0.1 m/s</td>
</tr>
</tbody>
</table>
Dropsonde release from NOAA Twin Otter
(166.3625 E, 70.0614 N)

Video by courtesy of Jeff Smith, NOAA/AOC
Dropsonde release from NOAA Twin Otter
(166.3625 E, 70.0614 N)

Image by courtesy of Jeff Smith, NOAA/AOC
Hurricane Patricia
23 October 2015

Hurricane Eye Penetration by NOAA WP-3

Data by courtesy of Jeff Smith, NOAA/AOC
Hurricane Hermine

NOAA Hurricane Surveillance using NASA Global Hawk UAS

NOAA Sensing Hazards with Operational Unmanned Technology (SHOUT) campaign
Hurricane Hermine

Up to 90 profiles per research flight

NOAA Sensing Hazards with Operational Unmanned Technology (SHOUT) campaign
Driftsonde drops over Antarctica
650 profiles in 2.5 months

Concordiasi Long Duration Balloon Campaign
Sep – Dec 2010
Profile comparison during the El Nino Rapid Response Campaign 2016

Temperature

Temperature Difference

Coordinated Dropsonde-Radiosonde Comparison
18 Feb 2016

Observations with thanks to Ryan Spackman and Dan Wolfe (NOAA/ESRL)
Profile comparison during the El Nino Rapid Response Campaign

Relative Humidity

Relative Humidity Difference

Coordinated Dropsonde-Radiosonde Comparison
18 Feb 2016

Observations with thanks to Ryan Spackman and Dan Wolfe (NOAA/ESRL)
Profile comparison during the El Nino Rapid Response Campaign

Wind Speed

Wind Speed

Wind Speed Difference

Coordinated Dropsonde-Radiosonde Comparison
18 Feb 2016

Observations with thanks to Ryan Spackman and Dan Wolfe (NOAA/ESRL)
Outlook

• Implementation of native BUFR for operational high resolution data transmission
• Better quantification of measurement uncertainties
• Implementation of new PTU sensor module
• Adding new sensors for additional observations