Driftsonde System Overview

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Predictability research suggests that additional in-situ measurements in “Sensitive Regions” will improve predictions of high-impact weather events, these regions are often cloudy.

Sensitive regions for November 2001 based on 30-day average of the NRL NOGAPS model (color coded). The contours are the 500 hPa height field. Courtesy of Alan Thorpe, Rolf Langland, and Melvyn Shapiro from THORPEX planning presentations.
**Driftsonde Motivation**

**Satellite based measurements:**
- Infrared techniques have limits due to opaque cloud cover
- Microwave techniques have relatively course vertical resolution
- Horizontal winds are a challenge in deep cloud layers.

**Driftsonde Goal**
Cost-effective observing system to fill critical gaps in data coverage over oceanic and remote artic and continental regions with high vertical resolution atmospheric profiles of:
- Wind
- Temperature
- Humidity
made by GPS Dropsondes.

New Satellite-based techniques (constituent track winds, water vapor tracking, Doppler lidar measurements in clear air) clearly have a need for in-situ measurements to evaluate and calibrate these satellite systems.
**Drifftsonde Operation**

**System requirements**
- Provide Soundings with Global coverage
- Cost effective (Complete system is expendable)
- Flight duration 4-6 days
- Altitude 100-50 mb
- Deploy Dropsondes on command (Targeting) or automatically (Timed)
- Payload of minimum 20 dropsondes (4/day for 5 days)
- Real-time position tracking - ATC monitoring

**Engineering Challenges**
- Cost, disposable sounding system
- **Reliable** global satellite communications (Orbcomm, Globalstar, Iridium)
- Harsh environment, temperature extremes (diurnal variations in radiation)
- Altitude control [zero-pressure balloon – ballasting algorithms]
- Integration issues (GPS, Iridium, Sonde Transmitters, Receivers)
- Flight train launch

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Driftsonde System

Zero-pressure Balloon
(20-40 sonde capacity)

Gondola

Iridium LEO Satellite

6 hours between drops

~16 km

50-100 mb

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Simulated Driftsonde sounding coverage at one assimilation time after 5 days of deployment from launch sites along the Asian Pacific rim

Initial Launch Time:
00 UTC 06 Feb 1999
13 launch sites

Drift Level: 100 mb

Deployment Interval:
12hr

Coverage at: 00UTC
11 Feb 1999

Analysis Dr. Rolf Langland, Dr. Melvyn Shapiro
**Driftsonde Components**

**Flight train**

1. Low cost polyethylene zero-pressure balloon (365 m³ & 2,265 m³)
2. Parachute
3. Radar reflector
4. Aircraft Transponder
5. Gondola
   - Embedded Computer
   - GPS Navigation System
   - Flight level PTH sensor
   - Ballast System
   - Lithium battery power system
   - Iridium, global coverage 2-way satellite system
   - Dropsondes

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## Driftsonde Flights
### Tillamook, OR

<table>
<thead>
<tr>
<th>Flt. No.</th>
<th>Date</th>
<th>Duration</th>
<th>Altitude</th>
<th>Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2/28/02</td>
<td>4 ¾ hrs</td>
<td>16.9 km</td>
<td>Engineering Tests; Orbcomm communications, thermal control &amp; evaluation, altitude control manual ballasting</td>
</tr>
<tr>
<td>2</td>
<td>11/14/02</td>
<td>5 hrs</td>
<td>16.4 km</td>
<td>Same as Flight 1</td>
</tr>
<tr>
<td>3</td>
<td>2/10/03</td>
<td>22 ½ hrs</td>
<td>16.4 km</td>
<td>Engineering Tests; Iridium communications, Drop sondes (data system on ground), automatic altitude control, diurnal test</td>
</tr>
<tr>
<td>4</td>
<td>8/19/03</td>
<td>11 ½ hrs</td>
<td>17.6 km</td>
<td>First test flight of complete sounding system in gondola, dropped 4 sondes</td>
</tr>
<tr>
<td>5</td>
<td>9/2/03</td>
<td>63 ½ hrs</td>
<td>24 km</td>
<td>Over the ocean test, dropped 8 sondes, all systems worked well</td>
</tr>
</tbody>
</table>
Flight #5  9/2/03

ALTITUDE AND BALLAST DUMPED VS TIME

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Driftsonde Future Efforts

Engineering
- Integrate Vaisala Radiosondes
- Super Pressure Balloon (eliminates ballasting & reduces balloon size)
- Develop ground operations software for command and tracking
- Small low cost Wind & Temperature only sonde
- Sonde payload up to 50 sondes
Miniature In-situ Sounding Technology (MIST Sonde)

GPS Wind & Temperature only sonde (credit card size)

Supported by NOAA/THORPEX
**Driftsonde Future Efforts**

**Possible Field Deployments**

- **AMMA 2006** Teaming with CNES launching from Chad
  - SOP 2 Zero-pressure balloon
  - SOP 3 CNES Super-pressure balloon 10-day flights, 40-50 sondes

- **International Polar Year**
Proposed Driftsonde Operation on French CNES Stratospheric Balloons for 2006

Trajectories: 1 balloon launch per day for 1 Sept – 15 Sept 2000

10-day duration (can go up to 20);

50 sondes per balloon