Upper Air Operations
(Singapore)

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• Located deep in the tropics (about 1°N of the equator)
• 710.3 sq km (49 km E-W; 26 km N-S)
Meteorological Sensor Network

- Aeronautical Met station
- WMO Synoptic/Climate station (also issues 06/18Z PILOT reports)

- Manned observation stations
- Weather Radar
- Lightning detector
- Automatic Weather Stations
- Upper Air Sounding System

Wind/Aerosol LIDARs
Wind Profiler
Lightning Detection System
Automatic Weather Stations
Weather Radar
Satellite Reception Systems
Upper Air Measurements in Singapore

• Radiosonde soundings started in Singapore in 1952

• The location for balloon release has been unchanged, except for a move to a new building (across the road from previous location) in 2012

• Current soundings:
  o Twice daily radiosonde 00 / 12UTC soundings are carried out at about 2330 UTC and 1045 UTC respectively – approval for release/ exact timings are dependent on air traffic clearance
  o Ozonesonde soundings – once per month
  o 06 / 18 UTC PILOT soundings carried out at the Changi Airport Met Station; Fully replaced with wind profiler readings (for PILOT) since Oct 2013

• History of sondes deployed:
  o Vaisala RS80 (1997-2008)
  o Vaisala RS92 (2008-2011)
  o Graw DFM-09 (2011-2015)
  o Vaisala RS41-SG (2015 onwards)
## Existing Sounding Equipment

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Model used</th>
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<tbody>
<tr>
<td>Ground system</td>
<td>Vaisala DigiCORA Sounding System MW41</td>
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<tr>
<td>Radiosonde</td>
<td>RS41-SG</td>
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<td></td>
<td>RS41-SG SPC6A ECC Ozonesonde</td>
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<tr>
<td>Ground check tool</td>
<td>Vaisala Ground Check Device RI41 Standard Humidity Chamber SHC-1</td>
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<td>Balloon</td>
<td>Totex TX1000 with internal parachute for Radiosondes; Totex TA1500 for Ozonesonde (external parachute) Helium is used as lifting gas</td>
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<td>Parachute</td>
<td>160-05/ 160V-05 (for Ozonesondes)</td>
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<td>Unwinder</td>
<td>RS41 Unwinder 55m</td>
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Upper Air Station (co-located with the Centre for Climate Research Singapore)
GRUAN implementation

• Daily RS41-SG data flow to GRUAN LC since Apr 2017; Implementation of ground checks using the Standard Humidity Chamber (April 2017)

• A 2 weeks on-site trial at proposed site was carried out for GNSS-PW measurements (April 2017) – trial was carried out as there was concern of blockage by the building to the east of the station. Analysis of the data quality by GFZ and GNSS-PW TT confirmed that the site is suitable.

• Procurement and operationalization of GNSS-PW instruments (targeted by end 2017)
Challenges

• Singapore is densely populated; Sondes have landed at the airports, private property etc

• Landings at the airport are problematic, as the airport operates 24 hours and experiences a high volume of traffic

• Air Traffic clearance is required for balloon releases; Difficulty introducing other balloon-borne sensors, apart from those already indicated in the Airport Information Publication

• Exploring the usage of tools for predicting drop locations – provide forewarning of drop locations; facilitate re-scheduling of non-routine launches (e.g., ozonesondes)