High-Resolution Model Fields of Wet-Troposphere Path Delay in Coastal Regions

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Example: wet delay correction

Maximum IWV Gradient:
4 mm IWV per 40 km

There are 6.36 mm of Ku-band radar correction for each 1 mm of IWV. Correction is 6 to 19 cm, but max. gradient in correction is 6.6 mm per km (μrad).

For comparison, 0.6 μrad of dynamic height gradient is 6 mm/sec geostrophic velocity at mid-latitudes.

COAMPS® is a registered trademark of the NRL
Mean 2-m RH & Buoy Obs

COAMPS 9-km Grid

Buoy 26 Time Series

<table>
<thead>
<tr>
<th>Buoy Statistics</th>
<th>Model-Buoy</th>
<th>Jan</th>
<th>Apr</th>
<th>Jul</th>
<th>Oct</th>
</tr>
</thead>
<tbody>
<tr>
<td>T_d (K)</td>
<td>-0.59</td>
<td>-0.34</td>
<td>0.44</td>
<td>-0.16</td>
<td>-0.86</td>
</tr>
<tr>
<td>RH (%)</td>
<td>-1.69</td>
<td>0.34</td>
<td>3.38</td>
<td>-0.86</td>
<td>12.8</td>
</tr>
</tbody>
</table>

Haack et al. *MWR* 2005
Air-sea Interaction COAMPS
4-year Summertime

COAMPS

QuikSCAT & AMSR

29-day Avg 5 Sept 04

Haack et al. JPO 2008
COAMPS 3-km Grid Water Vapor

IWVP (kg m\(^{-2}\)) \& Path Delay (cm)

Water Vapor (g kg\(^{-1}\))

Vector Scale
COAMPS Water Vapor Forecasts
9 Oct 2009 6-18 UTC

IWVP (kg m⁻²) → Path Delay (cm)

Water Vapor (g kg⁻¹) & Theta (K)
### Helo Comparisons Profiles

#### Specific Humidity (g/kg)

<table>
<thead>
<tr>
<th>Ht (m)</th>
<th>Helo</th>
<th>COAMPS</th>
<th>Unified Model</th>
<th>MM5</th>
<th>GEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5.9</td>
<td>6.4 / -0.5 / 1.2</td>
<td>7.2 / -1.4 / 1.8</td>
<td>7.3 / -1.4 / 2.1</td>
<td>6.8 / -0.9 / 1.4</td>
</tr>
<tr>
<td>45</td>
<td>6.7</td>
<td>7.0 / -0.3 / 0.8</td>
<td>7.6 / -1.3 / 1.5</td>
<td>7.4 / -0.8 / 1.8</td>
<td>7.0 / -0.4 / 0.9</td>
</tr>
<tr>
<td>5</td>
<td>7.3</td>
<td>7.4 / -0.1 / 0.5</td>
<td>7.9 / -0.7 / 1.1</td>
<td>7.5 / -0.3 / 1.5</td>
<td>7.1 / 0.1 / 0.6</td>
</tr>
</tbody>
</table>

#### Mean/Bias/RMSE

- **Mean**: Models are too moist (0.5 – 1.5 g kg⁻¹) and cold (0.2 – 4.0° K).
- **Bias**: Indicates systematic deviations from the reference data.
- **RMSE**: Represents the standard deviation of the differences between the values predicted by the models and the observed values.
NZ PROFILES
Potential Temperature and Specific Humidity

RMSE: ~1 g kg\(^{-1}\) ⇒ IWVP (mm) ⇒ PD < 1 cm

COAMPS
RAOB

IWVP (kg m\(^{-2}\)) ⇒ Path Delay (cm)
July Mean IWVP 2004

TMI, SSMI, AMSR Satellite Observations

Mean

COAMPS 3-hrly W Vapor Forecasts

STD

RMSE: IWVP < 1.5 mm  PD < 1 cm
1) Compute error in PD for estimate of mean error in model predicted IWVP

2) Compute difference in PD between near shore value and 50 km offshore along satellite track 221

3) Compute difference in PD between 50 km lengths of coast parallel track

4) Construct histograms of errors and differences

⇒ Model PD error less than 1 cm

Model PD error less than difference

Delta PD = 5 cm

Strub and James