Creating a Global Humidity Dataset – Progress with the Marine Component

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1. PROJECT SUMMARY

AIM:
Create a global gridded monthly mean dataset of surface vapour pressure, relative humidity and specific humidity anomalies from 1973 to the present

MOTIVATION:
Water vapour is the most important greenhouse gas and has significant implications for the global energy balance and hydrological cycle. It likely plays a key role in modulating the climate's response to external forcings through feedback processes. The accurate quantification of recent changes in water vapour content is imperative to our ability to further understand, and reduce uncertainties surrounding future climate.

THE PLAN:
ICOADS and NCEP MARINE DATA GRIDDED TO MONTHLY MEAN 5x5 FIELDS

BLENDED GLOBAL PRODUCT IN e and RH

Comparison with model output from HadGem including detection and attribution tests

2. METHOD

INPUTS

\[ \begin{align*}
T & \quad T_{\text{dw}} \\
\text{e} & \quad q \\
p & \quad \text{(1013 mb)}
\end{align*} \]

OUTPUTS

\[ \begin{align*}
\text{RH}
\end{align*} \]

QUALITY CONTROL

The bias of daytime marine air temperature due to solar exposure of thermometers has been found to have a negligible effect on humidity. Thus humidity observations during day and night can be used. The uncorrected air temperature should be used for humidity calculations (Kent & Taylor, 1996). Other quality control issues include:

- OUTLIERS - remove outliers from climatology
- BAD T or T_{\text{dw}} - remove values where T or T_{\text{dw}} do not exist or where T > T_{\text{dw}} or where 7 T = 7 or where 7 T = 'OUTLIERS' or 'BUDDY'
- BAD RH - remove values where RH < 60% (a constant open water source should inhibit drying beyond this) or RH > 100%
- FOG - remove values where fog is present but RH < 90%
- WINDS - fog values with very low/high wind speeds for later investigation into integrity of humidity values
- BUDDY - 'buddy' checking
- BAD INFO - location, date, time checking

3. CLIMATOLOGIES

First cut climatologies have been derived from NCEP Reanalyses for 1974-2001. This period is chosen for consistency with the land data. These climatologies appear to underestimate humidity compared to the data in some coastal regions, especially the Persian Gulf.

Climatologies derived from actual data will be used later on to produce the end product.

4. QC TEST RESULTS

QC results for the ICOADS dataset 1973-1997 relative to vapour pressure

<table>
<thead>
<tr>
<th>QC TEST</th>
<th>% of all Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAD T or T_{\text{dw}}</td>
<td>96.1</td>
</tr>
<tr>
<td>BAD INFO</td>
<td>1.8</td>
</tr>
<tr>
<td>OUTLIERS</td>
<td>1.6</td>
</tr>
<tr>
<td>BUDDY</td>
<td>19.4</td>
</tr>
<tr>
<td>BAD RH</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Total good Observations = 34.5

5. 'GOOD' DATA AND FUTURE WORK

Further work will include:

- creating a climatology from the actual ICOADS data and using that as an outlier check rather than NCEP – this will hopefully rectify the possible under-representation in NCEP of humidity in the Persian Gulf.
- some comparison of different versions of grids to investigate uncertainty due to decisions made regarding data to keep / remove and observation density per grid.
- the addition of NCEP data from 1997 to present to extend the dataset.

FUTURE WORK?

The effect of ship heights / types: the later start of this dataset (1973) precludes any major changes but differences in source heights could be large. This and different platform types (buoys etc...) may introduce biases in specific regions.

Wind, especially very low wind speeds may impede evaporation of the wet-bulb and so could introduce bias and should be investigated more.

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References:
Kent, E.C. & Taylor, P.K., (1996), Accuracy of humidity measurement on ships: Consideration of solar radiation effects, K.Willett@uea.ac.uk.