

HadISDH.marine Update Document

Kate Willett (MOHC), 19th July 2023

General Notes:

The HadISDH.marine.1.4.1.2022f contains all 12 months of 2022. There are no major changes (X). The change to using ICOADS.3.0.2 from 2015 onwards (as opposed to ICOADS.3.0.1) warrants incrementing the Y element. This new source presents a 20% increase in coverage (~1million extra observations per month) from essential climate variables (see <https://icoads.noaa.gov/>). ICOADS.3.0.2 includes BUFR reports in addition to TAC reports whereas ICOADS.3.0.1 does not use the BUFR reports. Where both types are reported for an observation the BUFR is usually prioritised. For the surface humidity processed as part of HadISDH.marine, which only uses the ship observations, there is an overall increase, especially from 2020 onwards which has led to a deviation in the global, hemispheric and tropical regional mean timeseries from 2020 onwards. In terms of long-term trends this new version shows slightly stronger negative trends in relative humidity and slightly smaller positive trends in specific humidity.

Note that there was an interim HadISDH.marine version 1.4.0.2022f which also used the new ICOADS.3.0.2. However, this version resulted in a significant reduction in observations making it through the processing chain and considerable deviations in regional mean timeseries from 2015 onwards. We discovered that this was due to the presence of Attachment 8 in the ICOADS.3.0.2 IMMA files. This caused problems within the HadISDH code used to read in the data, resulting in far fewer observations being processed. This has now been fixed with the HadISDH code now able to read observations that have Attachment 8. Its not clear whether observations with Attachment 8 (a suite of metadata that isn't used for HadISDH) were failing to be processed in earlier versions but to a lesser degree. There are small increases in gridboxes containing observations (<10 per year per 5 degree latitude band) throughout the timeseries, and a few latitudes/years show small decreases. This could be down to the code fix applied to cope with Attachment 8. Alternatively, it could be because of the additional observations between 2015-2020 which will influence the 1991-2020 climatological values (and their spatial coverage), that are iteratively built and used to quality control the observations. This could enable more historical observations to pass through the quality control.

The move to ICOADS.3.0.2 and resulting increase in gridbox coverage slightly improves the generally very limited spatial coverage situation. However, the ability of HadISDH.marine to represent 'global' surface humidity is still very questionable given that so little of the tropics and Southern Hemisphere has long-term observational coverage.

A second change is the formula for calculating wet bulb temperature from dewpoint temperature and marine air temperature. Errors were found when the air temperature was very high but dewpoint temperature very low, resulting in spuriously high wet bulb temperatures. The Stull (2011) formula is now used as this has a far wider range of applicability. See the [blogpost](#) for details.

This mostly affects the wet bulb temperature fields although differences are very small, and far less than 1 degree for the most part. Differences are larger over warm, dry air conditions, which are less of a problem over ocean. The calculated wet bulb temperature is used to decide whether to calculate vapour pressure with respect to ice or water and so this new formula can lead to very small changes in vapour pressure and variables that use vapour pressure in their calculation (specific humidity and relative humidity). Stull (2011) tends to give higher wet bulb temperatures overall which will result in fewer uses of the calculations with respect to ice and therefore fractionally higher vapour pressures and related values. As it is consistently used across the time period it should not impact long-term trends in anomalies.

Keep up to date with subsequent changes and analyses at <https://hadisdh.blogspot.com/2023/05/2022-ipdate-from-hadisdhmarinev1402022f.html> and

<https://hadisdh.blogspot.com/2023/07/2022-update-from-hadisdhmarine1412022f.html>.

Version Number X.Y.Z.0000p/f:

1.4.1.2022f

Major Changes X:

- None

Minor Changes Y:

- Change of source dataset from 2015 onwards from ICOADS3.0.1 to ICOADS3.0.2 which increases coverage, especially from 2020 onwards.
- Change of wet bulb temperature formula to [Stull \(2011; <https://journals.ametsoc.org/view/journals/apme/50/11/jamc-d-11-0143.1.xml>\)](#) - see [blogpost](#) (<https://hadisdh.blogspot.com/2023/01/new-wetbulb-temperature-algorithm-for.html>).

Bug fixes / historical data updates Z:

- Change in spatial coverage, ability to cope with reports containing Attachment 8, and regional average time series from 2015 onwards caused by new data source ICOADS3.0.2. (no increment applied as this is covered by increment Y)

Start Date DD.MM.YYYY: 1973-01-01

End Date DD.MM.YYYY: 2022-12-31

Hadisdh Data Format (Baseline documentation): <https://zenodo.org/record/7963175>

Reference: No change

- Willett, K. M., Dunn, R. J. H., Kennedy, J. J., and Berry, D. I. 2020: Development of the HadISDH marine humidity climate monitoring dataset. Earth System Science Data. 12, 2853-2880, doi.org/10.5194/essd-12-2853-2020.
- Freeman, E., S.D. Woodruff, S.J. Worley, S.J. Lubker, E.C. Kent, W.E. Angel, D.I. Berry, P. Brohan, R. Eastman, L. Gates, W. Gloeden, Z. Ji, J. Lawrimore, N.A. Rayner, G. Rosenhagen, and S. R. Smith, 2016: ICOADS Release 3.0: A major update to the historical marine climate record. Int. J. Climatol. (doi:10.1002/joc.4775).

Other notes: The HadISDH update/analyses blog is here:

<https://hadisdh.blogspot.com/2023/05/2022-ipdate-from-hadisdhmarinev1402022f.html> and <https://hadisdh.blogspot.com/2023/07/2022-update-from-hadisdhmarine1412022f.html>.