Creating the HadSST gridded *in situ* SST analysis

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Reducing scatter in HadSST

- Create 1° area pentad anomalies; remove bucket bias.
- Do neighbour and extreme checks.
- Convert to residuals from large-scale first guess field. Variance of residuals is V.
- Aggregate to months and 5° areas (2° or 4° for HadISST); count obs. (n).
- Estimate random error $E = 0.75(A^2 + B^2)/n$
  A ~ sampling error from climatological variances of 1° area pentad anomalies within 2° or 4° or 5° areas; B ~ measurement error (Kent et al. 1999)
- Scale down the residuals by a factor $K = \{(V-E)/V\}^{0.5}$ to make their variance equivalent to the estimated true subregional-scale variance. K is zero if E exceeds V.
- Add back the large scale first-guess field.

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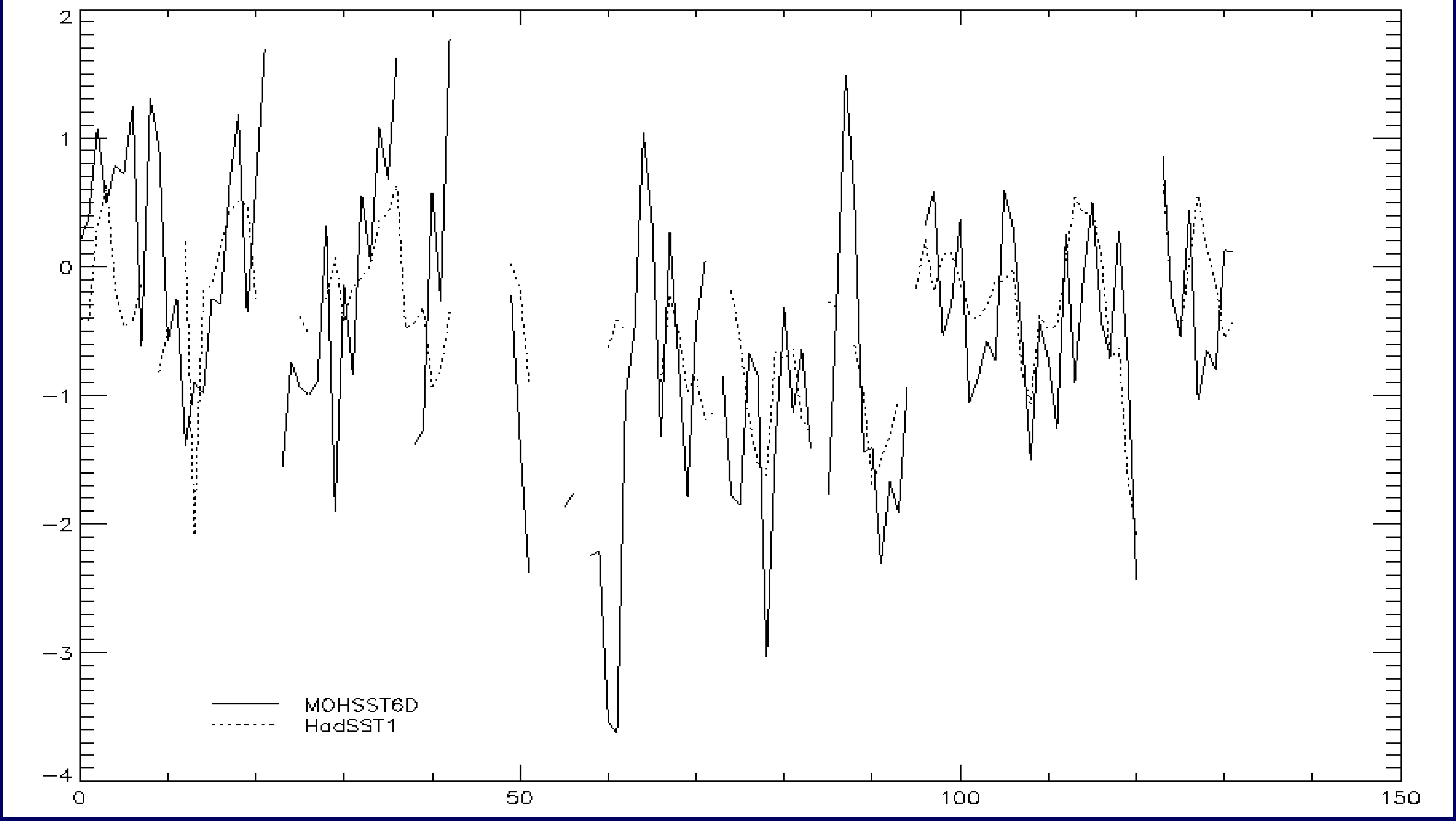
Examples of how scatter is reduced in HadSST

- We have estimated random error $E = 0.75(A^2 + B^2)/n$ and scaled down the residuals by $K = \{(V-E)/V\}^{0.5}$. K is zero if E exceeds V.

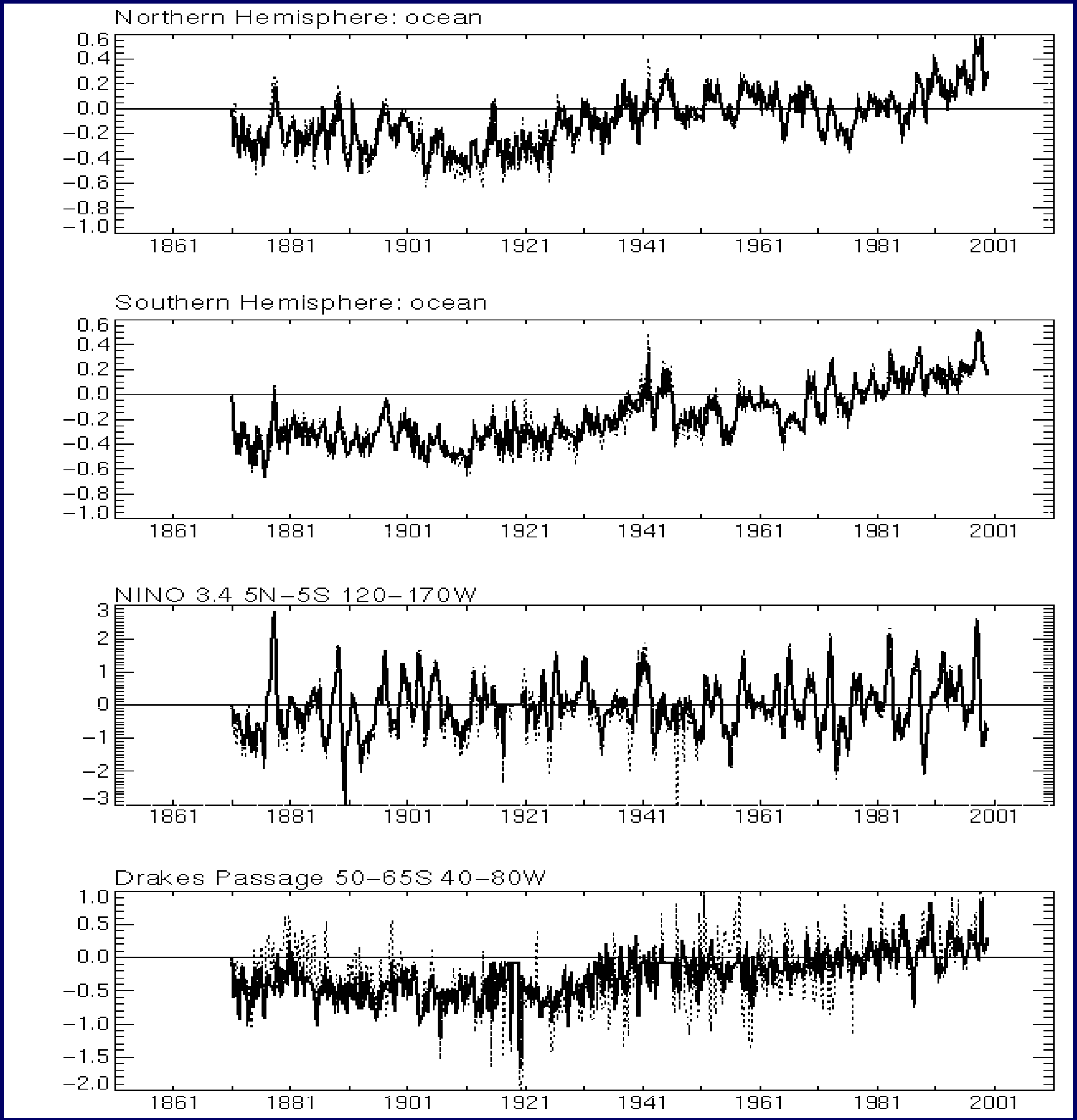
- Typical value of $0.75\ (A^2+B^2)$ is 2 $(°C)^2$. Typical value of V is 0.2 $(°C)^2$. So if e.g. the initial gridded anomaly is 5°C and the first-guess value is 1°C:

n	E $(°C)^2$	K	HadSST anomaly (°C)
1	2	0	1+ K(5-1) = 1
10	0.2	0	1+ K(5-1) = 1
11	0.18	0.30	1+ K(5-1) = 2.2
12	0.167	0.41	1+ K(5-1) = 2.6
20	0.1	0.71	1+ K(5-1) = 3.8
200	0.01	0.975	1+ K(5-1) = 4.9

Average SST anomaly (°C, relative to 1961-90) for 30°- 35°N, 125°-135°E, 1870-1880: HadSST (dots) and MOHSST6D (solid). From Jones et al. (2001).



HadSST(solid) and MOHSST6D (dots) SST anomalies relative to 1961-90. From Jones et al. (2001).



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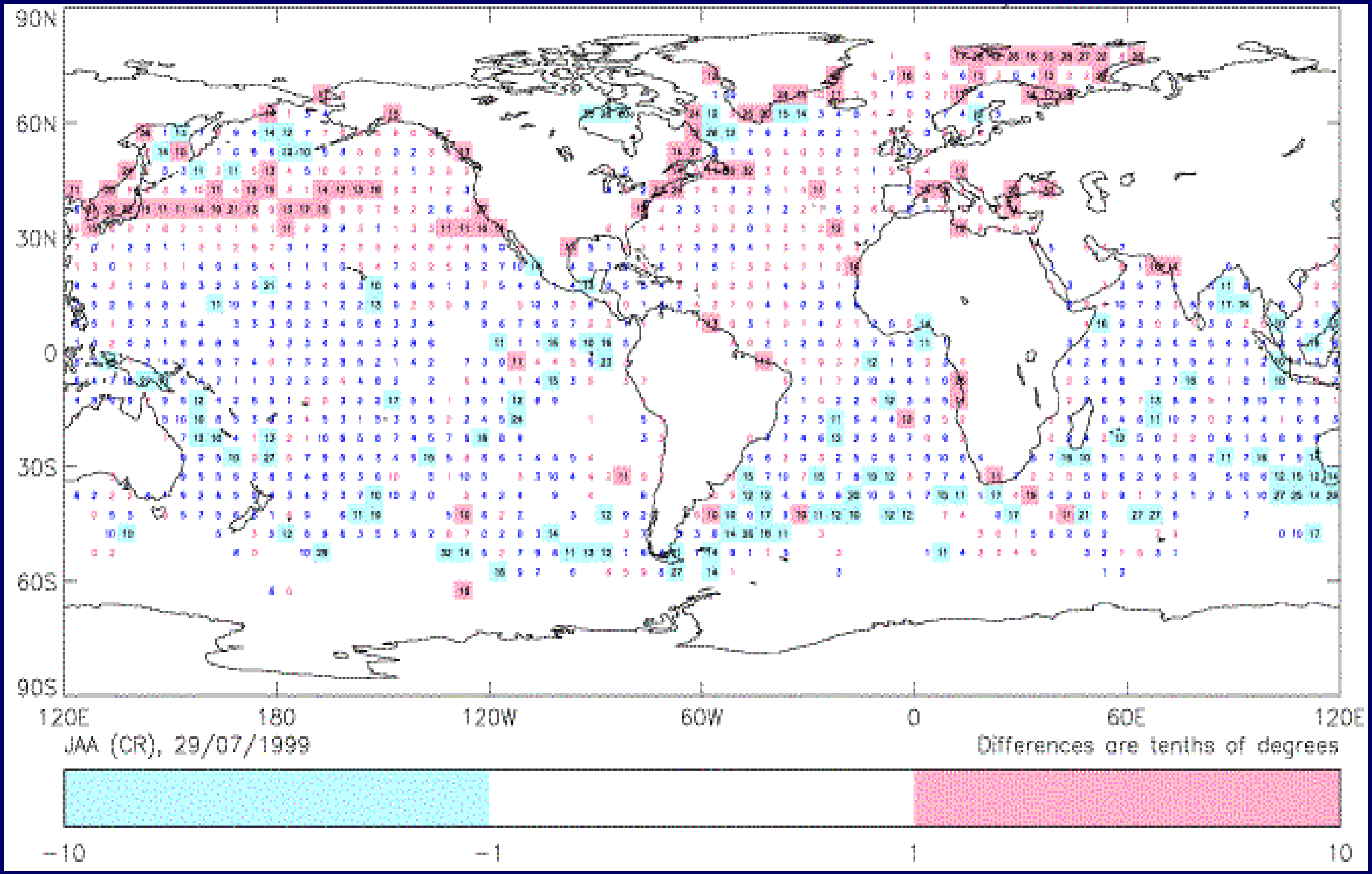
Normalised and Winsorised ATSR minus MOHSST6D SST (°C), July 1996.



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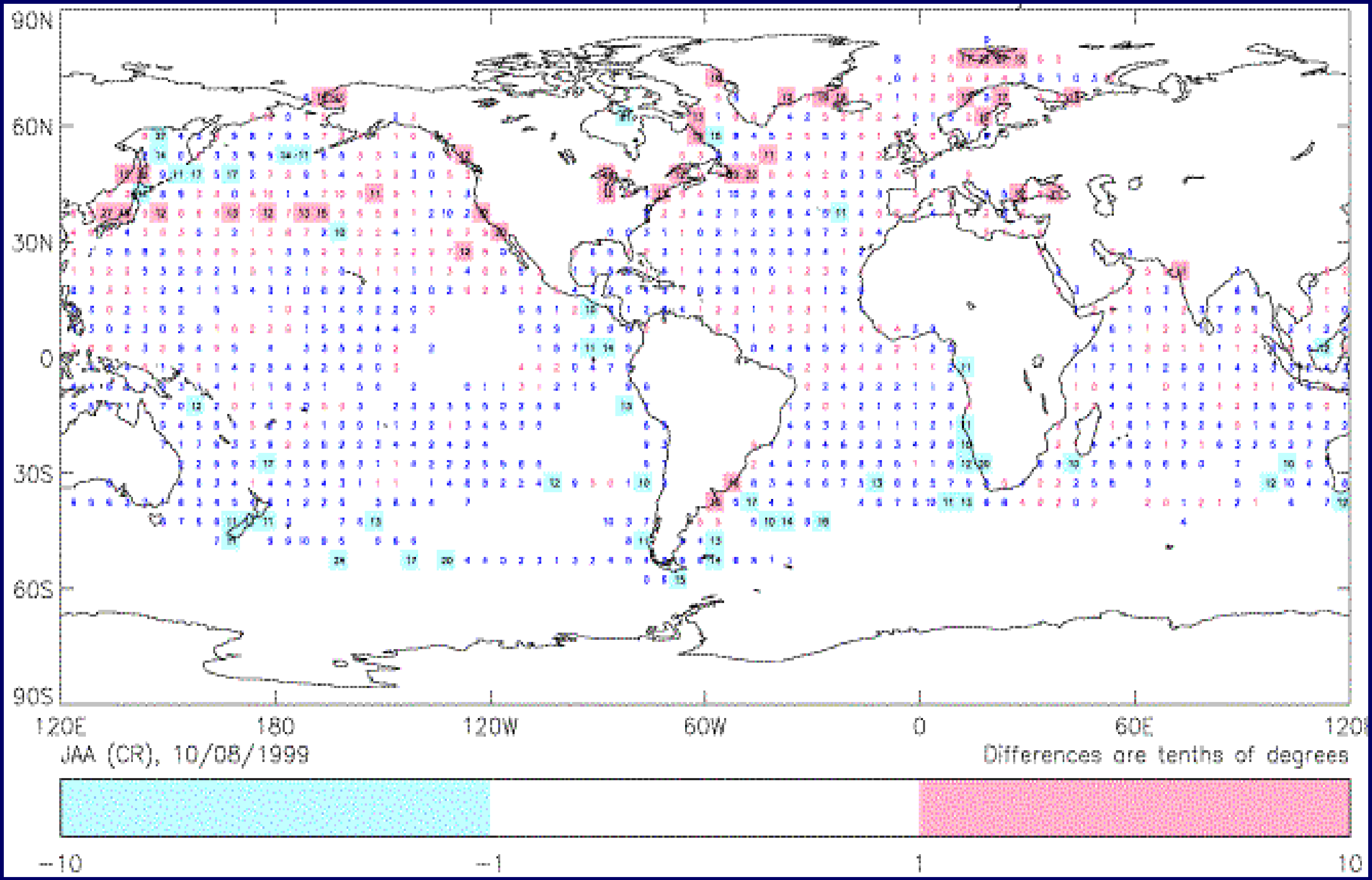
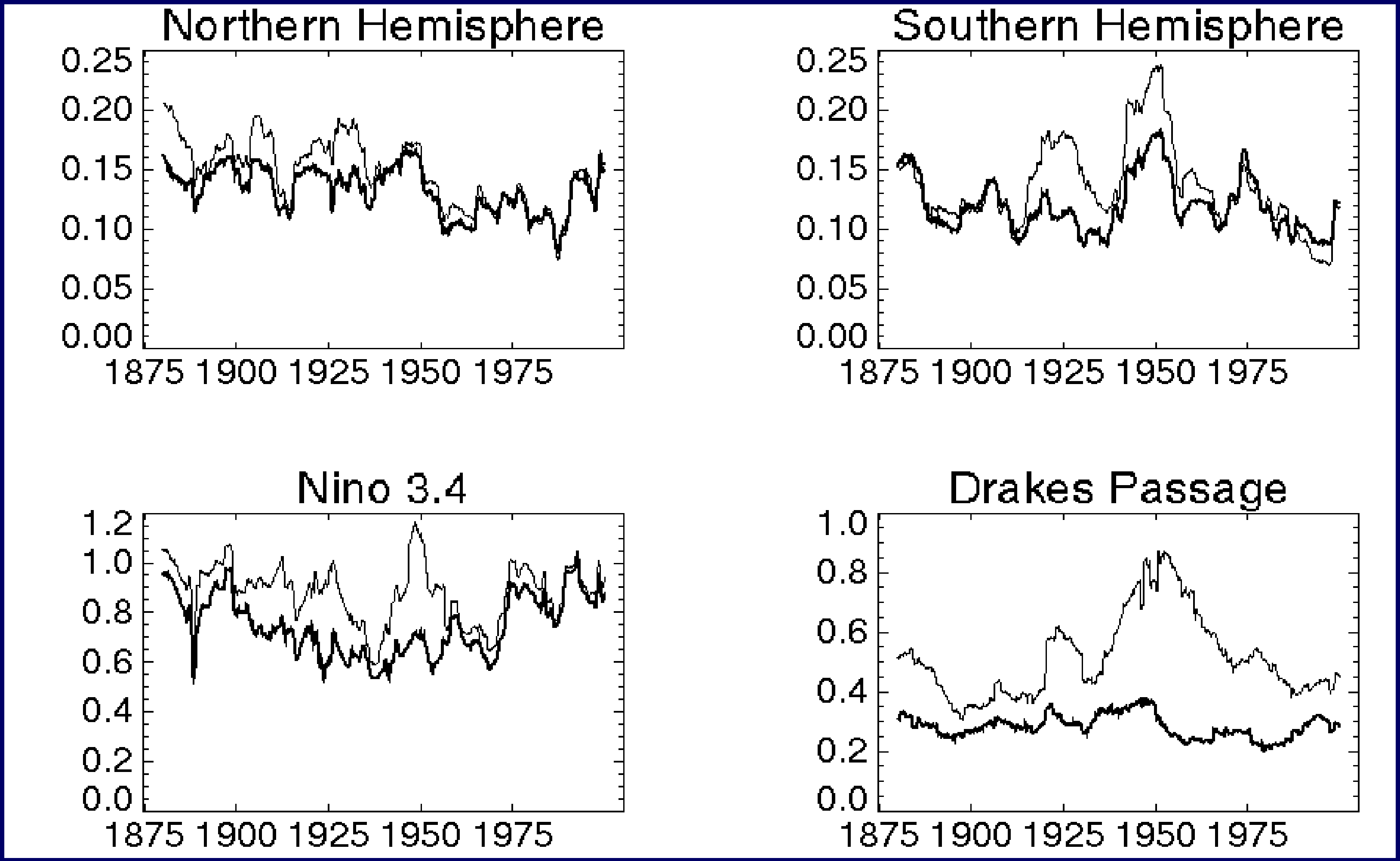
Normalised and Winsorised ATSR minus HadSST SST (°C), July 1996.



Running standard deviations over 120 months of SST anomalies (°C, relative to 1961-90). HadSST (heavy line); MOHSST6D (light line). From Jones et al. (2001).



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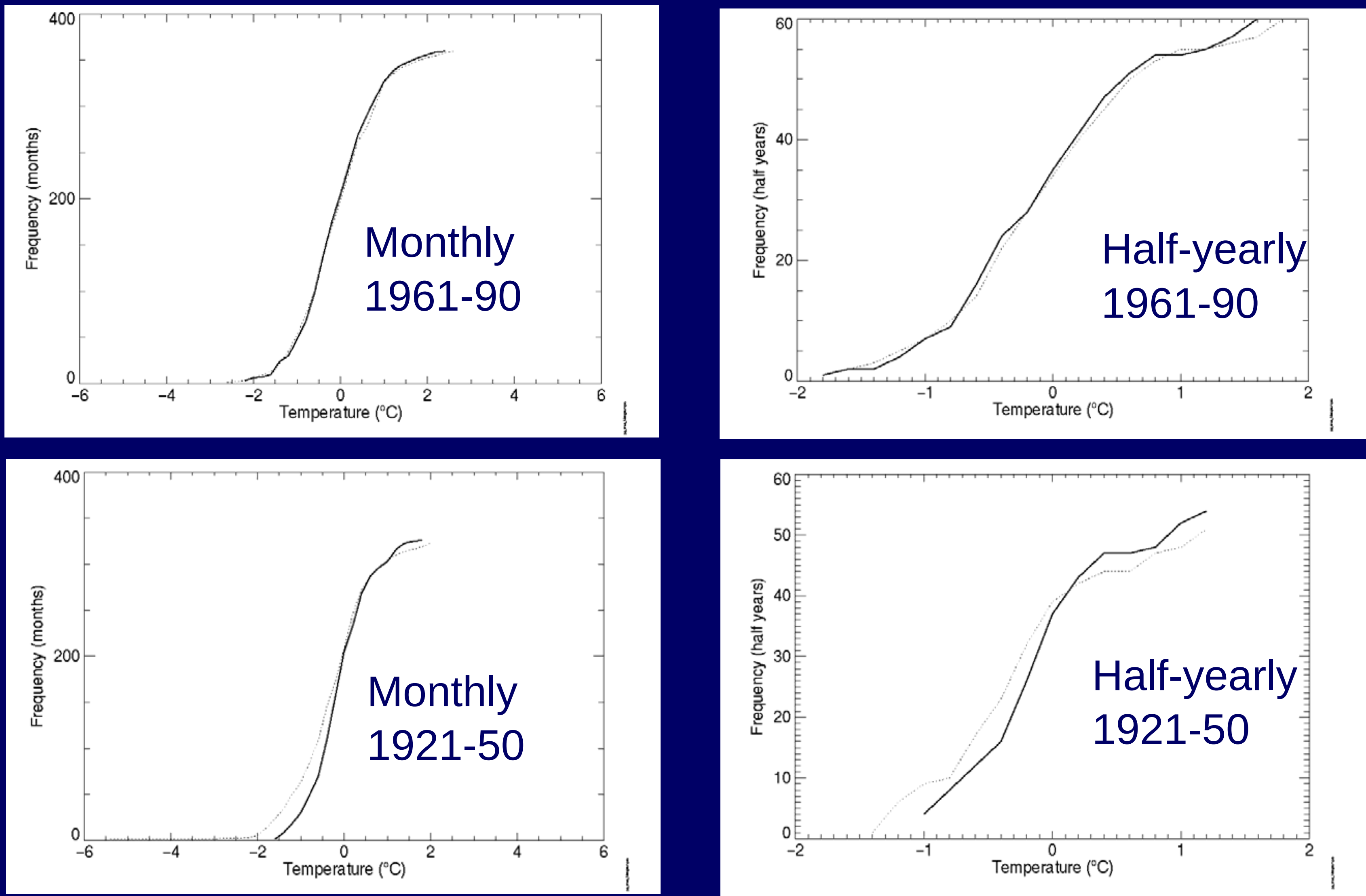
Cumulative frequencies of SST anomalies (°C, relative to 1961-90), Ni_o 3.4 area: HadSST (solid); MOHSST6D (dotted). From Jones et al. (2001).



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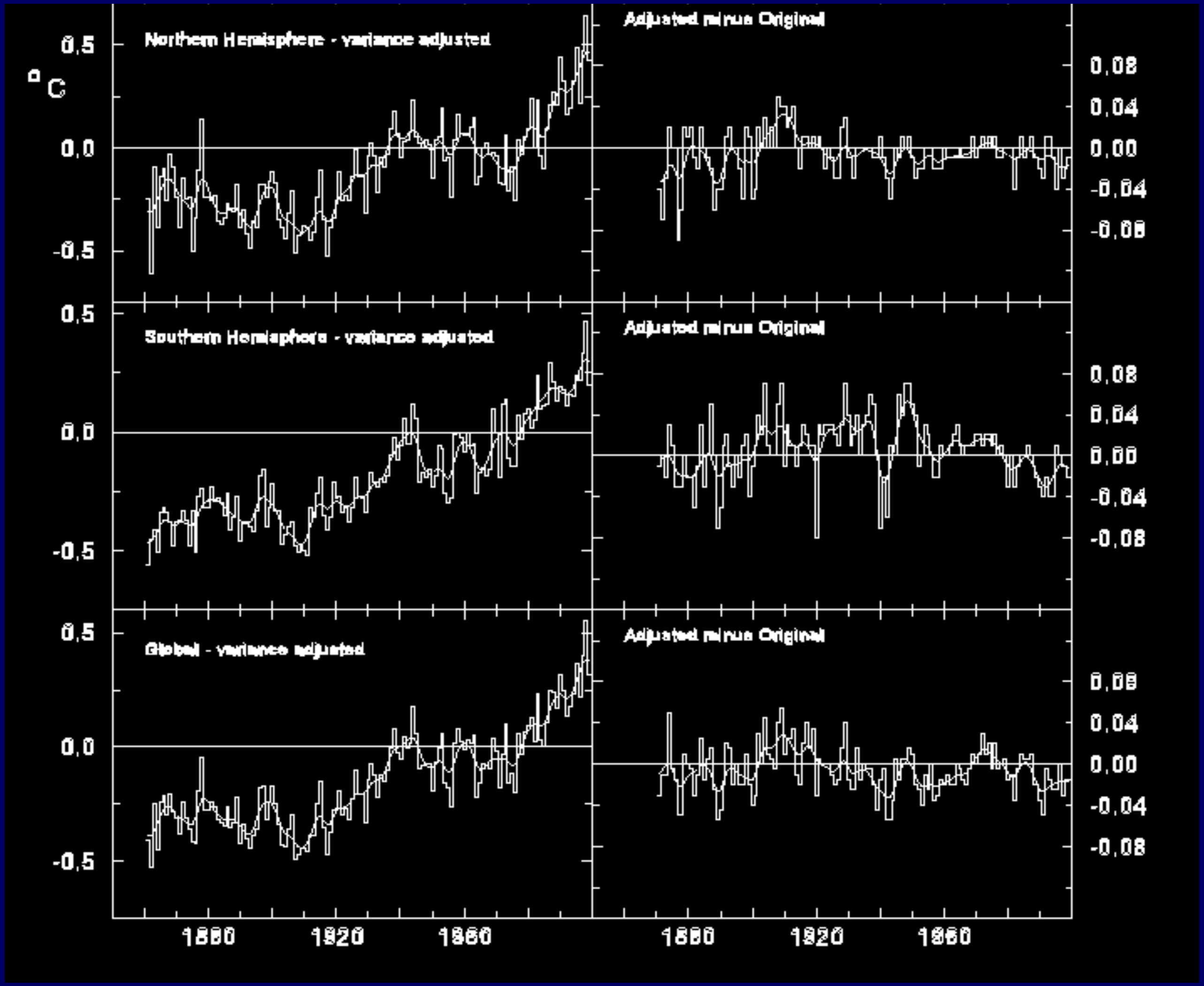
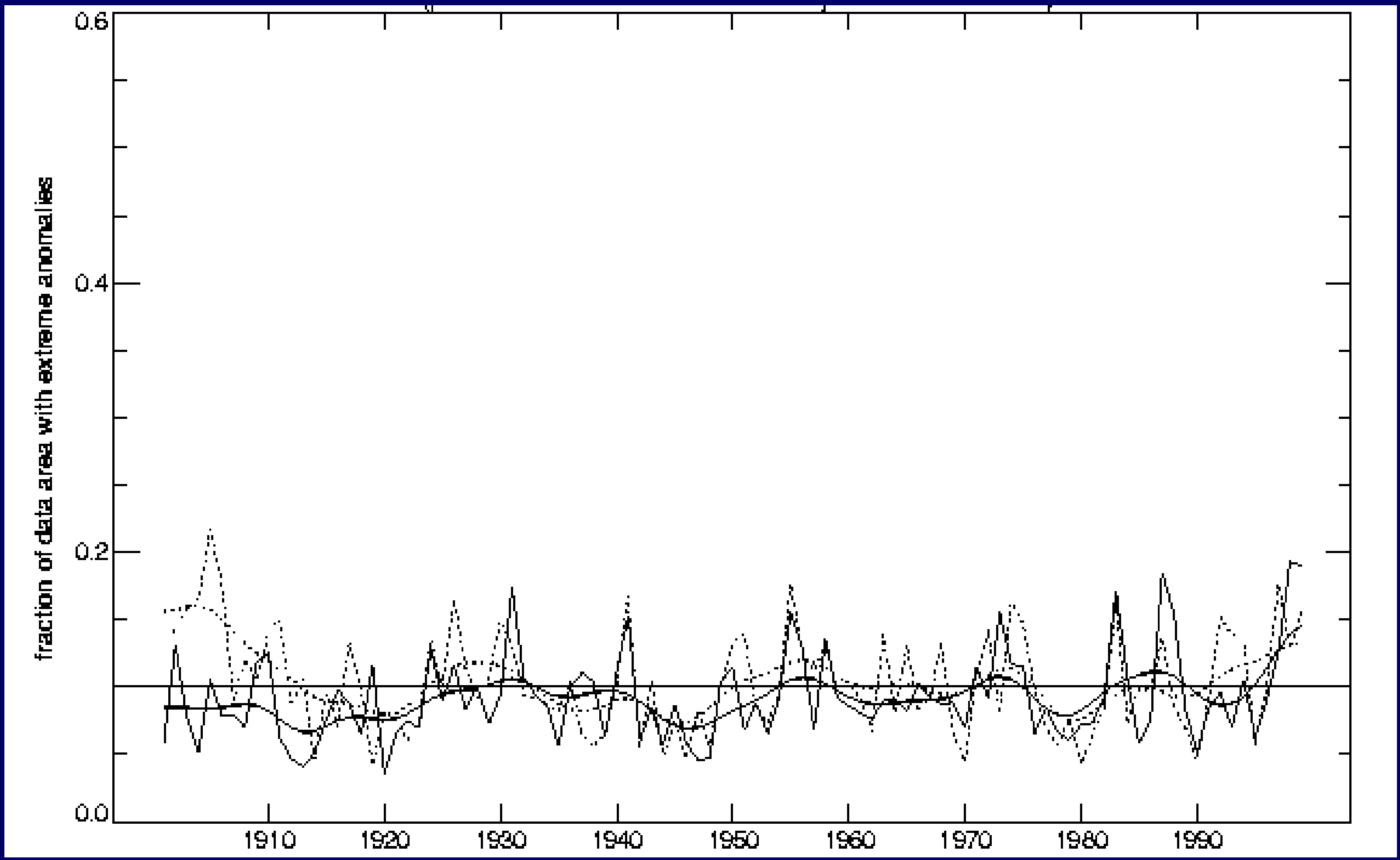
Hemispheric and global SST with land surface air temperature anomalies (°C, relative to 1961-90) based on variance-corrected data, and differences from original series based on uncorrected data. From Jones et al. (2001).



Fraction of global ocean data area with annual SST >90th percentile (solid) or <10th percentile (dotted). Anomalies adjusted by subtracting the annual global SST anomaly.
From Horton et al., 2001.



Conclusions

* Adjustment of sea surface temperatures to compensate for sampling density has removed many outliers in data-sparse areas and made HadSST more reliable than MOHSST.

* HadSST is much better than MOHSST for analysis of extreme sea surface temperatures.

* The construction of HadSST and a related analysis of land surface air temperatures is in P. D. Jones et al., J. Geophys. Res., 106, 3371-3380 (2001).

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