## Eric C.J. Oliver and Keith R. Thompson



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1920

Location	Variable	Range	%
Booby Is. QL, Australia	precip.	1/8/1908 - 8/7/2001	96.3
Darwin P.O. NT, Australia	max. T	1/1/1885 - 31/1/1942	99.7
Darwin Airp. NT. Australia	max. T	1/1/1941 - 2/10/2010	99.0
Fairbanks AK, USA	min. T	1/8/1904 - 31/7/2010	99.4
Nome AK, USA	min. T	1/8/1906 - 31/7/2010	99.6
San Diego CA, USA	sea level	21/1/1906 - 31/12/2008	97.6

Daily temperature data had the seasonal cycle removed by harmonic regression. Hourly sea level data was detided, detrended, subsampled to daily values. had the inverse barometer effect and seasonal cycle removed. Daily precipitation amounts were transformed into a daily time series indicating the number of rainy days over a seven day span.

# A Reconstructed Madden-Julian Oscillation Index from 1905 to 2008





The reconstructed index  $(I_t^{(OT)})$  has the same spectral shape as  $I_t^{(WH)}$  and this shape is retained through the full record (1905-2008).

There is a slight **trend in variance** but we attribute this to changes in the observing system over time.

## Department of Oceanography, Dalhousie University, Halifax NS, Canada

$$p(x|\lambda) = \prod_{k=1}^{K} \prod_{j=1}^{n} p(x_j^{(k)}|x_{j-1}^{(k)}, \lambda) = \left(\frac{1}{2\pi\sigma^2}\right)^{nK} \exp\left(-\frac{1}{2\sigma^2} \sum_{k=1}^{K} \sum_{j=1}^{n} (x_j^{(k)} - Ax_{j-1}^{(k)})^{\mathrm{T}} (x_j^{(k)} - Ax_{j-1}^{(k)})\right)$$

accurate (nonlinear, nongaussian) statistical model for its behaviour.

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Wheeler and Hendon (2004), MWR **132** [4] Oliver and Thompson (2010), JGR [2] Whitaker et al. (2004), MWR [5] Vecchi and Bond (2004), GRL [3] Compo (2006), BAMS [6] Lin et al. (2008), MWR