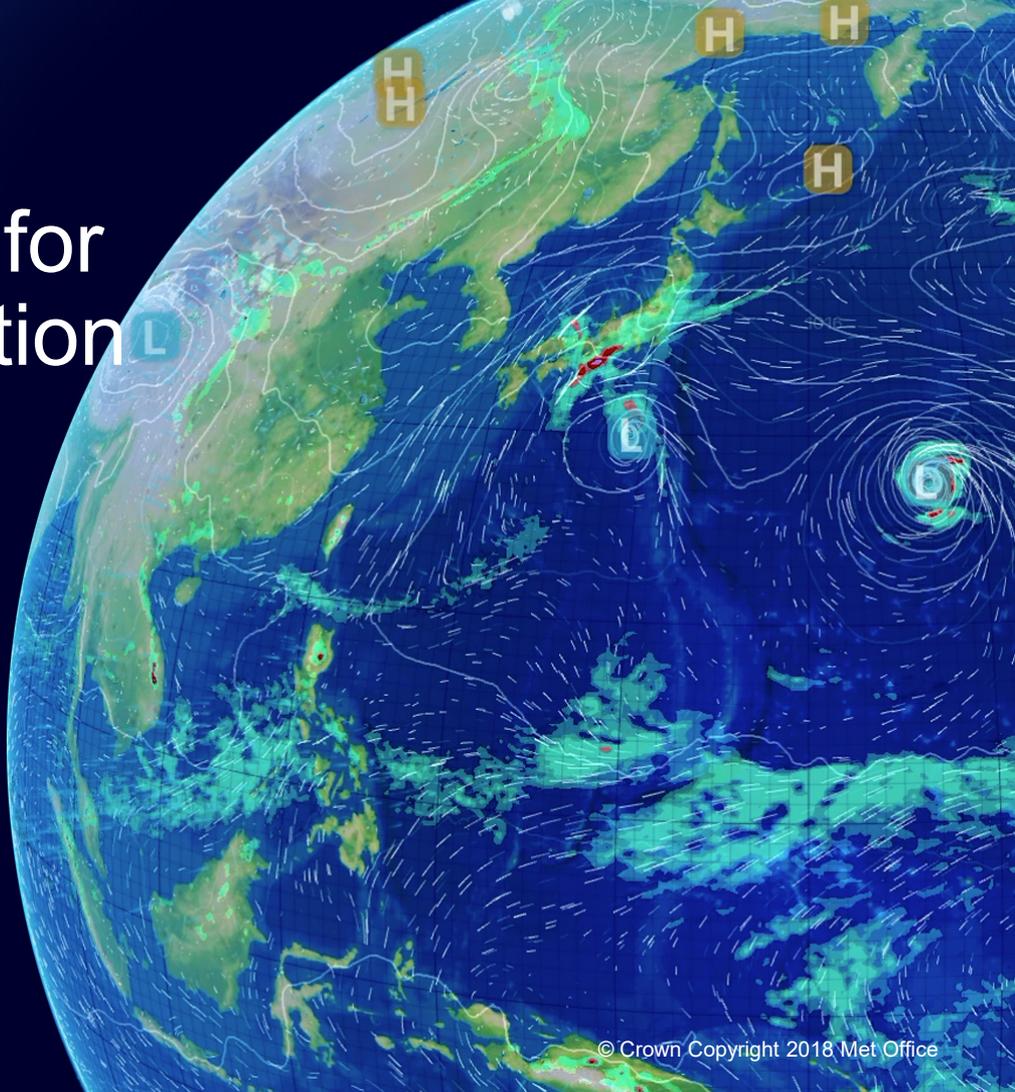


Observation selection for variational bias correction

Ruth Taylor

ITSC-22, Saint-Sauveur, Québec

5th November 2019



Motivation: use of observations in more situations, many of which are more challenging for radiative transfer.

- e.g. all-sky (Brett Candy **5.01**; Stefano Migliorini **5p.01**)
- wider variety of surface types (Stuart Newman **12p.07**)
- IR radiances used above low cloud

Will extra observations adversely affect the bias correction?

- ***exclude affected observations when analysing bias correction coefficients***

VarBC:

operational since 2016 (Global); 2017 (limited-area UKV)

$\mathbf{b}(\mathbf{x}) = s + \sum \beta p(\mathbf{x})$: sums over predictors $p(\mathbf{x})$ with coefficients β for a channel

Predictors: constant

two air masses (850 - 300 hPa & 200 - 50 hPa thicknesses)

scan bias

orbital angle (SSMIS)

$$J(\boldsymbol{\delta}, \boldsymbol{\beta}') = \frac{1}{2} \boldsymbol{\delta}^T \mathbf{B}_x^{-1} \boldsymbol{\delta} + \frac{1}{2} \boldsymbol{\beta}'^T \mathbf{B}_\beta^{-1} \boldsymbol{\beta}' \\ + \frac{1}{2} (H(\mathbf{x}_b + \boldsymbol{\delta}) + \sum \beta' p - \mathbf{y})^T \mathbf{R}^{-1} (H(\mathbf{x}_b + \boldsymbol{\delta}) + \sum \beta' p - \mathbf{y})$$

Default: every observation which is assimilated has a bias correction which can vary, and can influence the analysis.

$$J(\boldsymbol{\delta}, \boldsymbol{\beta}') = \frac{1}{2} \boldsymbol{\delta}^T \mathbf{B}_x^{-1} \boldsymbol{\delta} + \frac{1}{2} \boldsymbol{\beta}'^T \mathbf{B}_\beta^{-1} \boldsymbol{\beta}' \\ + \frac{1}{2} (H(\mathbf{x}_b + \boldsymbol{\delta}) + \sum \boldsymbol{\beta}' p - \mathbf{y})^T \mathbf{R}^{-1} (H(\mathbf{x}_b + \boldsymbol{\delta}) + \sum \boldsymbol{\beta}' p - \mathbf{y})$$

Prevent bias of certain observations from adapting during minimisation:

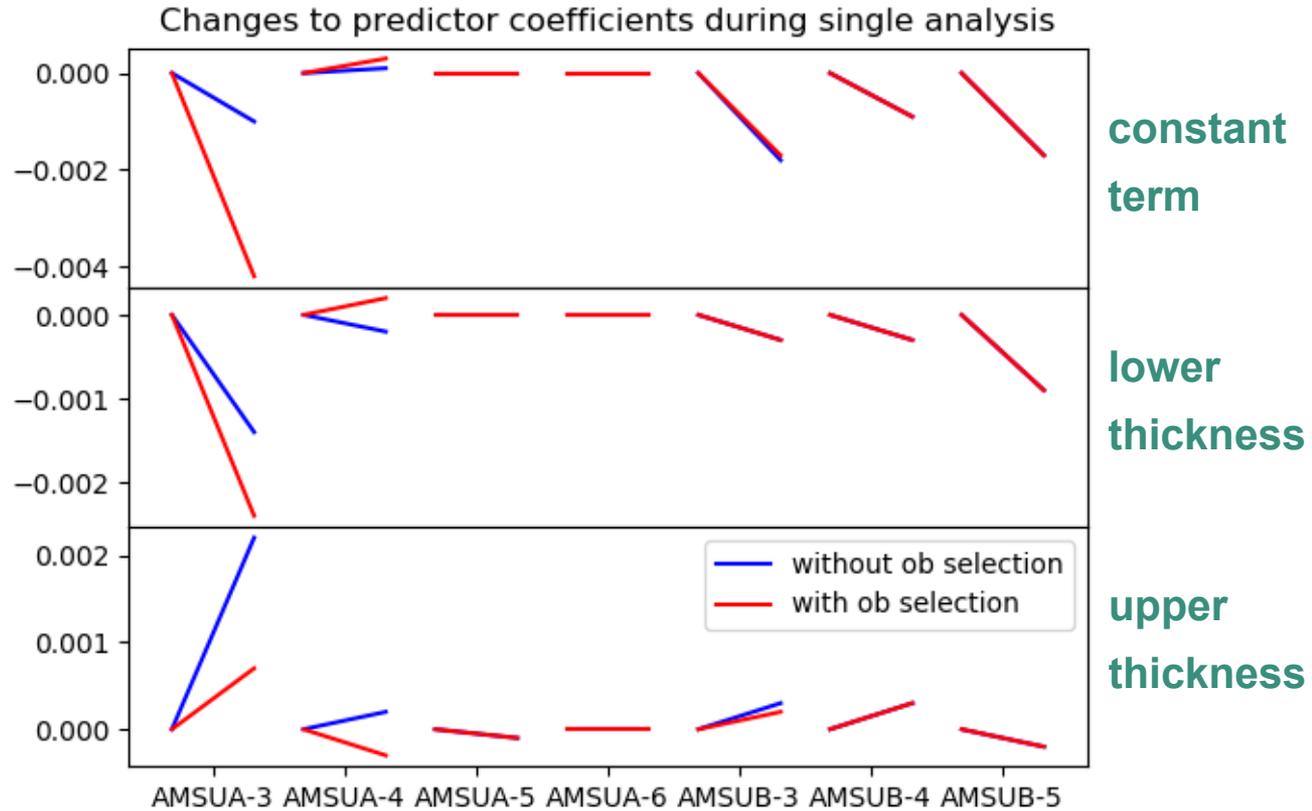
→ *drop terms in gradient calculation*

Observations are still bias-corrected ... and correction can be updated after analysis.

(Consider effect on \mathbf{B}_β^{-1} ...)

Single analysis:

Selection using same “all sky” test as used for AMSU-A channels 4 & 5



- Further diagnostic work needed
- Check influence on \mathbf{B}_β^{-1} (adaptation rate, preconditioning)
- Extend selection mechanisms
currently using QC tests; consider variable thresholds
- Trial in conjunction with changes to observation use ... watch this space!