An update on the WGNE/WGCM Climate Model Metrics Panel

Members selected by relevant and diverse experience, and potential to liaison with key WCRP activities:

Beth Ebert (BMRC) – JWGV/WWRP, WMO forecast metrics

Veronika Eyring (DLR Germany) – WGCM/SPARC, CCMI, ESMs

Pierre Friedlingstein (U. Exeter) – IGBP, carbon cycle, ESMs

Peter Gleckler (PCMDI), chair – WGNE, atmosphere, ocean

Simon Marsland (CSIRO) – WGOMD, ocean

Robert Pincus (NOAA) – GEWEX/GCSS, clouds/radiation

Karl Taylor (PCMDI) – WGCM, CMIP5, atmosphere

Helene Hewitt (U.K. Met Office) – polar ocean and sea-ice

Metrics panel terms of reference (working version)

Identify a limited but diverse set of climate model performance metrics

- based on comparison with observations
- well established in literature, and preferably in widespread use
- easy to calculate, reproduce, interpret and be fairly robust
- covering a diverse suite of climate characteristics
  - large- to global-scale mean climate and some variability
  - atmosphere, oceans, land surface, and sea-ice

Coordinate with other WCRP/CLIVAR working groups

- identify metrics for more focused evaluation (e.g., variability modes, 'process' level)
- striving towards a community based activity by coalescing expertise

Justify and promote these basic metrics in an attempt to

- establish routine performance benchmarks
- facilitate further research of increasingly targeted metrics

What has happened since the last WGCM meeting?

- Panel efforts hampered by four members being preoccupied with the preparation of the AR5
- A good deal of early CMIP5 analysis has been accomplished with performance metrics (a few examples to follow)
- The panel's wiki was made public in April 2012
- The research community is clearly stimulated by the subject as evidenced in early CMIP5 research

First steps towards identifying routine metrics

Basic mean state and annual cycle:

- Large- to global- scale evaluation (global, tropical, NH/SH extra-tropics)
- 20 year climatologies: Annual and seasonal means
- Routine metrics: bias, centered RMSE, MAE, correlation, S.D.
- Field examples: OLR, T850, precip, SST, SSH, sea-ice extent
- Observations: multiple for most cases

Towards an extended set of metrics, coordinating with other working groups (in progress):

- ENSO (CLIVAR Pacific Panel)
- Monsoons (CLIVAR AAMP)
- MJO (YOTC Task force)
- CFMIP committee
- WGOMD
- Carbon cycle in emission-driven ESMs (ILAMB)
- Chemistry-Climate (CCMVal, CCMI) . . .

Revisiting Gleckler et al. (2008) portrait plot with CMIP5

Relative space-time global RMSE in climatological annual cycle

Examining redundancies in mean state metrics

Yokoi et al., 2011: *J. Appl.Metr.Clim*

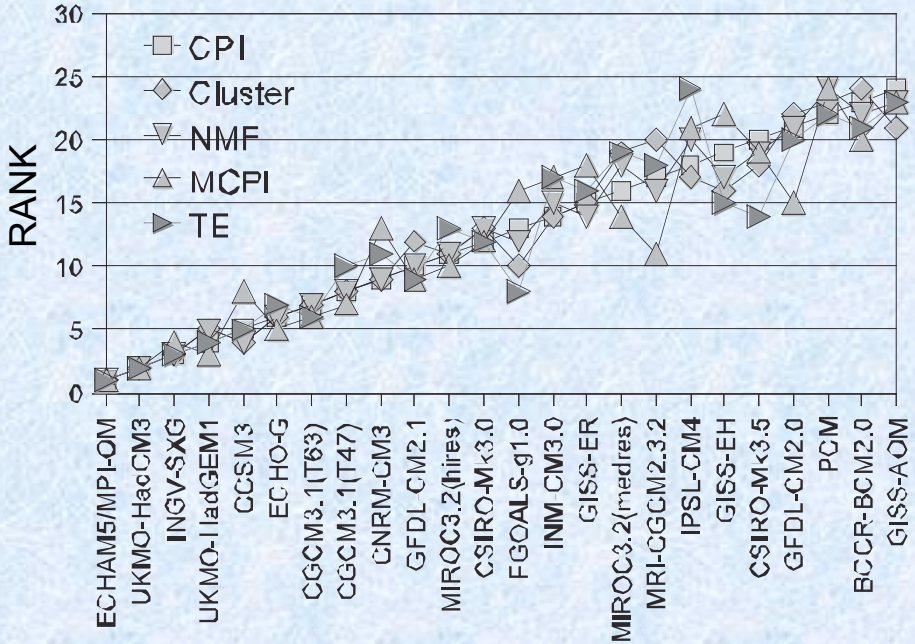
TABLE 2. Members of the seven clusters for the *K*-means clustering. The mean-bias metrics ($|b_m|$) and the centered-RMSE metrics (c_m) are indicated by italic and boldface type, respectively.

Cluster	Metrics
A	**U20c**, **U50c**, **U85c**, **V20c**, **V50c**, **V85c**, **T50c**, **T85c**, **Z50c**, **Z85c**, **Q50c**, **Q85c**, **Tsfc**, **SLPc**, **OLRc**, **CLDc**, **PRCc**
B	*U20b*, *U50b*, **Z20c**, *Q30b*, **Q30c**, *Q50b*, **SHFc**
C	*T50b*, *T85b*, *Z20b*, *Z50b*, *Tsfb*
D	*T20b*, **T20c**, **OSRc**, *CLDb*, **LHFc**
E	*OLRb*, *OSRb*, *PRCb*
F	*U85b*, *Z85b*, *SLPb*
G	*Q85b*, *SSTb*, **SSTc**

- Similar metrics to previous studies (e.g., Murphy et al. 2004, Gleckler et al 2008, Pincus, 2008)
- Compare results from two cluster analysis methods
- Methods yield similar results : ~7 clusters, with a mix of mean bias and centered-RMSE metrics

Summarizing mean climate performance

Nishii et al., 2012, *JAMS*



$$TE = \frac{1}{2}\iint \left\{ u'^2 + v'^2 + \frac{C_p}{T_r} T'^2 + RT_r \left(\frac{p'_s}{p_r}\right)^2 + \frac{L^2}{C_p T_r} q'^2 \right\} dA\, dp$$

An index based on total ATM "total energy" yields similar results to other, more comprehensive measures (e.g., CPI).

At this stage the panel is not advocating overall skill scores, but there is now evidence that at some level results are robust to how such indices are being constructed

Cloud related metrics?

Some examples:

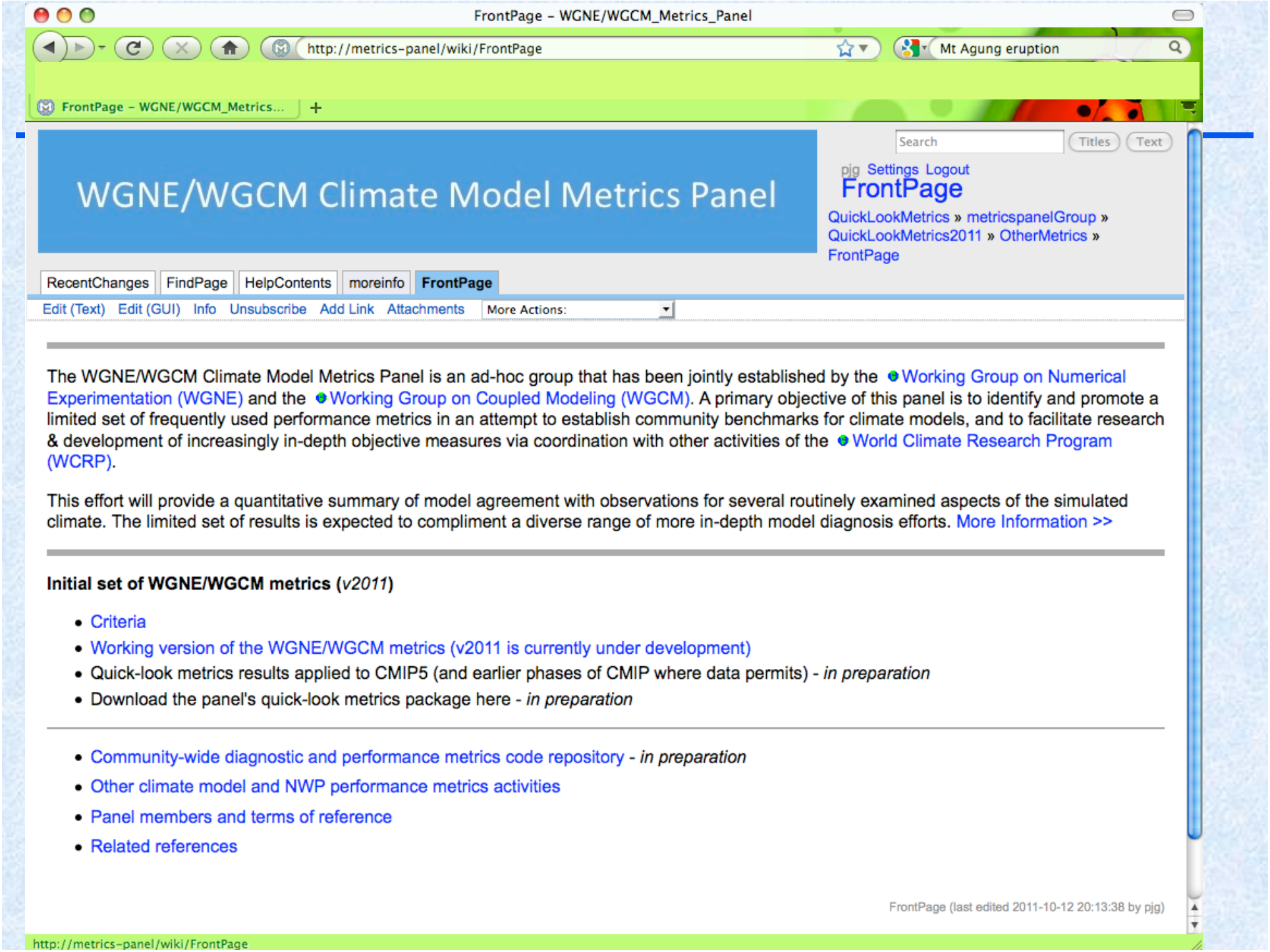
•Pincus et al. (2008)
CMIP3 cloud evaluation, low-order error measures, no obs proxy

•Williams and Webb (2009)
CFMIP2, evaluation using ISCCP proxy against observed canonical subsets

•Jiang et al (2012) and Li et al (2012)
CMIP5 LWP and IWP using A-train observations, no obs proxy

•Klein et al (*submitted*)
CFMIP1 + CFMIP2, evaluation of cloud-radiative impact using ISCCP proxy

Bottom line: Active area of research makes it difficult at this stage to identify metrics that meet the panel's criteria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The WGNE/WGCM Climate Model Metrics Panel is an ad-hoc group that has been jointly established by the Working Group on Numerical Experimentation (WGNE) and the Working Group on Coupled Modeling (WGCM). A primary objective of this panel is to identify and promote a limited set of frequently used performance metrics in an attempt to establish community benchmarks for climate models, and to facilitate research & development of increasingly in-depth objective measures via coordination with other activities of the World Climate Research Program (WCRP).
This effort will provide a quantitative summary of model agreement with observations for several routinely examined aspects of the simulated climate. The limited set of results is expected to compliment a diverse range of more in-depth model diagnosis efforts. More Information >>
Initial set of WGNE/WGCM metrics (v2011)
Criteria
Working version of the WGNE/WGCM metrics (v2011 is currently under development)
Quick-look metrics results applied to CMIP5 (and earlier phases of CMIP where data permits) - in preparation
Download the panel's quick-look metrics package here - in preparation
Community-wide diagnostic and performance metrics code repository - in preparation
Other climate model and NWP performance metrics activities
Panel members and terms of reference
Related references
FrontPage (last edited 2011-10-12 20:13:38 by pjg)
http://metrics-panel/wiki/FrontPage

Priorities for the panel during the coming year…

- Strengthen the wiki so that it becomes recognized as a useful resource
- Provide all modeling groups with a database/code of standard metrics results from all CMIP 3/5 models – this will enable groups, if interested, to incorporate into their development process an ability to examine how there model compares to others
- Prepare manuscript synthesizing metrics panel results for CMIP 3 & 5
- Advance the concept of a repository for metrics/analysis codes
- Consider a workshop dedicated to performance metrics, 6-18 months after the March 2013 WGNE systematic errors workshop?