**Literature Review to 3Ms**

*COST-VALUE ESR-Workshop Norrköping, 16 June 2015*

***LITERATURE ON MULTIPLE CLIMATE MODELS***

Evans, J. P., F. Ji, G. Abramowitz, and M. Ekstr ̈om, 2013: Optimally choosing small ensemble members to produce robust climate simulations. Environmental Research Letters, 8 (4), 044 050

Knutti, R. and J. Seda ́ˇcek, 2013: Robustness and uncertainties in the new CMIP5 climate model projections. Nature Climate Change, 3 (4), 369–373.

Pennell, C. and T. Reichler, 2011: On the effective number of climate models. Journal of Climate, 24 (9), 2358–2367.

Sanderson, B. M., R. Knutti and P. Caldwell, Addressing interdependency in a multi-model ensemble. Part 1 - interpolation of model properties, 2015, Addressing interdependency in a multi-model ensemble by interpolation of model properties, Journal of Climate, doi: 10.1175/JCLI-D-14-00361.1,

Sanderson, B. M., R. Knutti and P. Caldwell, 2015, A representative democracy to reduce interdependency in a multi-model ensemble, Journal of Climate, doi: 10.1175/JCLI-D-14-00362.1

Zubler et al., submitted,climate change signals of cmip 5 over the alps impact of model selection ,Int. Journal of climate

Rowell, D.P. 2012, Sources of uncertainty in future changes in local precipitation, Climate Dynamics.

McSweeney, Carol F., Richard G. Jones, and Ben BB Booth. "Selecting ensemble members to provide regional climate change information." Journal of Climate 25.20 (2012): 7100-7121

***LITERATURE ON MULTIPLE STATISTICAL DOWNSCALING METHODS***

Räty et al. (2014) Projections of daily mean temperature variability in the future: cross-validation tests with ENSEMBLES regional climate simulations

* Intercomparison of bias correction and delta change methods for daily precipitation in European region, multiple RCMs, also uncertainty quantification

Räisänen and Räty (2013) Evaluation of delta change and bias correction methods for future daily precipitation: intermodel cross-validation using ENSEMBLES simulations

* intercomparison of bias correction and delta change methods for daily mean temperature in Europe, several RCMs, also uncertainty quantification

Chen et al. (2013) Finding appropriate bias correction methods in downscaling precipitation for hydrologic impact studies over North America

* comparison of the perfromance of 6 downscaling methods from the hydrological point of view (simulated discharge), 10 catchments, several RCMs

Dosio and Paruolo (2011) Bias correction of the ENSEMBLES high-resolution climate change projections for use by impact models: evaluation on the present climat

* comparison of the performance of different transfer function methods in present-day climate in European region

Dosio et al. (2012)Bias correction of the ENSEMBLES high resolution climate change projections for use by impact modelers: analysis of the climate change signal

* continuation of the previous study, now analysing the effect of bias correction on simulated climate changes in European region

Themesl et al. (2011) empirical-statistical downscaling and error correction of daily precipitation from regional climate model

* comparison of the performance of a set of empirical-statistical downscaling methods in Austrian region

Maraun et al. (2010) precipitation downscaling under climate change: recent developments to bridge the gap between dynamical models and the end user

* a comprehensive overview of different techniques for downscaling precipitation under climate change

Gutjahr and Heinemann (2013) Comparing precipitation bias correction methods for high-resolution regional climate simulations using COSMO-CLM – Effects on extreme values and climate change signal

* comparison of empirical and theoretical distribution fitting methods in Germany, single model study
* <http://onlinelibrary.wiley.com/doi/10.1002/2014JD022635/pdf>

Classic paper by Wilby, R. L., & Wigley, T. M. L. (1997). Downscaling general circulation model output: a review of methods and limitations. Progress in Physical Geography, 21(4), 530-548. Cited by: 912

Trigo, R. M., & Palutikof, J.P. (2001). Precipitation Scenarios over Iberia: A Comparison between Direct GCM Output and Different Downscaling Techniques. Journal of Climate (14) 4422-4446

Benestad R., (2001). Comparison between two empirical downscaling Strategies. Int. J. Climatol. 21: 1645–1668

R. E. Benestad,\* I. Hanssen-Bauer and E. J. Førland (2007), An evaluation of statistical models for downscaling precipitation and their ability to capture long-term trends, Int. J. Climatol. 27: 649–665

Huth, R., Mikšovský, J., Štěpánek, P., Belda, M., Farda, A., Chládová, Z., & Pišoft, P. (2015). Comparative validation of statistical and dynamical downscaling models on a dense grid in central Europe: temperature. Theoretical and Applied Climatology, 120(3-4), 533-553.

***Literature on multiple observational data***

Prein et al., Int. J. Climatology 2015 (submitted).

**HESS-special issue (2013): Precipitation uncertainty and variability: observations, ensemble simulation and downscaling**

Sunyer, et al. On the importance of observational data properties when assessing regional climate model performance of extreme precipitation, Hess 2013.

Kannan et al., Uncertainty resulting from multiple data usage in statistical downscaling, Geophys. Res. Letters, DOI: 10.1002/2014GL060089.

Gómez-Navarro, J. J., Montávez, J. P., Jerez, S., Jiménes-Guerrero, P., and Zorita, E.: What is the role of the observational dataset in the evaluation and scoring of climate models?, Geophys. Res. Lett., 39, L24701, doi:10.1029/2012GL054206, 2012.

Hofstra, N., New, M., andMcSweeney, C.: The influence of interpolation and station network density on the distributions and trends of climate variables in gridded daily data, Clim. Dynam, 35, 841– 858, doi:10.1007/s00382-009-0698-1, 2010.

Klein Tank, A. M. G., et al. Daily dataset of 20th-century surface air temperature and precipitation series for the European Climate Assessment, Int. J. Climatol., 22, 1441–1453, doi:10.1002/joc.773, 2002.

Klok, E. J. and Klein Tank, A. M. G.: Updated and extended European dataset of daily climate observations, Int. J. Climatol., 29, 1182–1191, doi:10.1002/joc.1779, 2009.

Tozer, C. R., Kiem, A. S., and Verdon-Kidd, D. C.: On the uncertainties associated with using gridded rainfall data as a proxy for observed, Hydrol. Earth Syst. Sci., 16, 1481–1499, doi:10.5194/hess-16-1481-2012, 2012.

Isotta et al., Evaluation of European regional reanalyses and downscalings for precipitation in the Alpine region, Met. Z., 2015, DOI: 10.1127/metz/2014/0584.

Rajczak et al., Projections of extreme precipitation events in regional climate simulations for Europe and the Alpine Region, J. Geophys. Res., VOL. 118, 3610–3626, doi:10.1002/jgrd.50297, 2013. (one Figure to biases in extremes based on two observational datasets).

Gutmann etal., An intercomparison of statistical downscaling methods used for water resource assessments in the United States, Water Resources Research, 2014.

***IMPACTS OF 3Ms ON CLIMATE IMPACTS***

Papers testing the effects of multiple downscaling methods on climate impact studies

Needs and results for downscaling will vary for different sorts of impact studies. Many downscaling techniques developed for hydrology- how do they work in other fields?

<http://onlinelibrary.wiley.com/doi/10.1002/wrcr.20331/full>

**Chen et al 2013**- Finding appropriate bias correction methods in downscaling precipitation for hydrologic impact studies over North America

* bias correction performance is location dependent and that a careful validation should always be performed, especially on studies over new regions

**Ghosh and Katkar 2012**. Modeling Uncertainty arising from multiple downscaling methods in assessing hydrological impacts of CC. – compares 3 models.

Brekke et al. 2014 . (AGU abstract). Or **Gutmann et al. 2014.** – Compare 4 downscaling methods through 3 panUSA hydrological models, also looked multiple obs data sets.

**Burger et al 2012**. Downscaling Extremes—An Intercomparison of Multiple Statistical Methods for Present Climate (5 methods compared for 6 stations, split sample validation, NOT Impacts)

**Snover et al. 2013**. Choosing and Using Climate-Change Scenarios for Ecological-Impact Assessments and Conservation Decisions- D*evised guidelines for choosing climate-change scenarios for ecological impact assessment that recognize irreducible uncertainty in climate projections and address common*

**Asseng et al. 2013.** Nature Climate Change. Uncertainty in simulating wheat yields under climate change. <http://www.nature.com/nclimate/journal/v3/n9/abs/nclimate1916.html> - *largest standardized model intercomparison for climate change impacts so far, compares multiple impact model with multiple downscaled scenarios – not sure how many DS techniques used.*

**Ruffault et al. 2014.** Projecting future drought in Mediterranean forests – bias correction of climate model matters! <http://link.springer.com/article/10.1007%2Fs00704-013-0992-z#page-1>

**Johnson et al. 2014** (not exact title: future droughts, bias correction – need to search for article again!)

**Pourmokhtarian et al. 2014**. (AGU abstract only) The Influence of Downscaling Models and Observations on Future Hydrochemistry Reponses of Forest Watersheds. <http://scholar.google.se/scholar?start=30&q=multiple+downscaling+climate+impacts&hl=en&as_sdt=0,5&as_ylo=2011>

**Dahne et al.2013 (IAHS red books)** -processing of climate projections for hydrological impact studies: how well is the reference state preserved? – Examines how BC impacts on internal variables of a hydrological model and also water quality

*Need to find more papers for impacts other than hydrology!*

Papers by Teutschbein et al., Maraun et al., Hagemann et al. ,