CRESCENDO Diagnostics for ESMValTool

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Outline

Overview

- ESMValTool 2 has been released
  (see Talks by Axel Lauer and Valeriu Predoi in Session D)
- CRESCENDO scientists have contributed to over 30 recipes
- Here, we show CRESCENDO diagnostic highlights in ESMValTool

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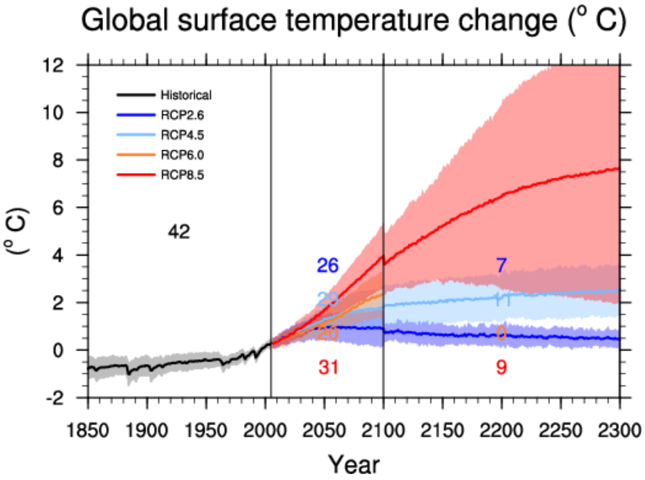
Notes

- Citations refer to original publications
- All ESMValTool diagnostics are
  - documented in the online documentation
  - scientifically described in
    - Eyring et al. 2020
    - Lauer et al. 2020
    - Weigel et al. 2020

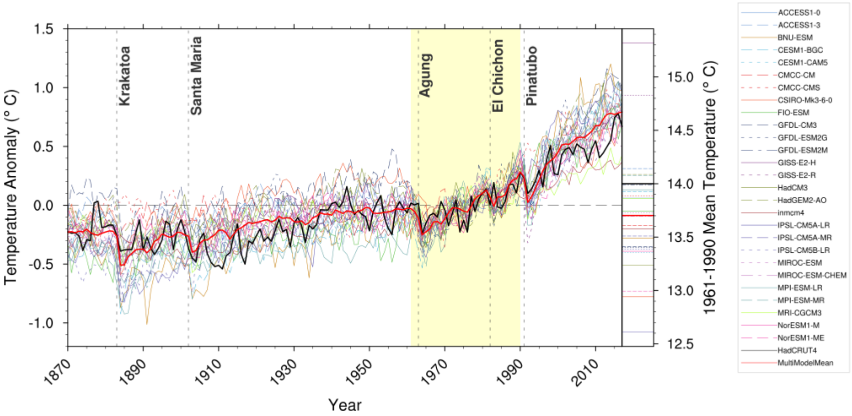
Outline

Global Temperature



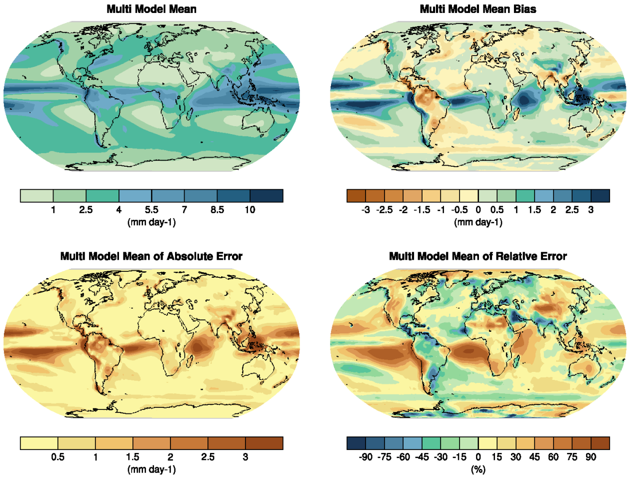
Collins et al. 2013

Global Temperature



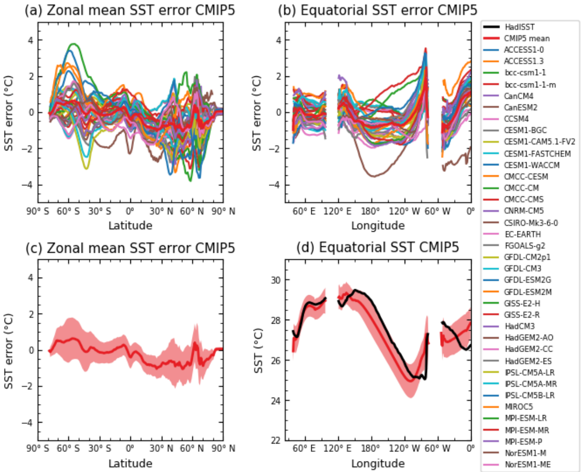
Flato et al. 2013

Precipitation



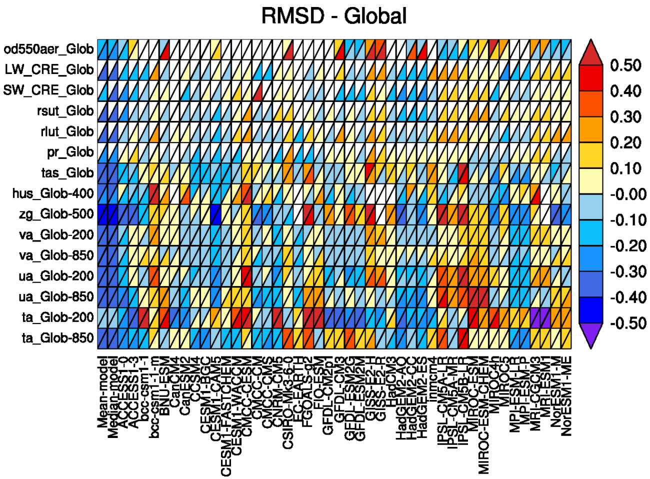
Flato et al. 2013

Sea Surface Temperature



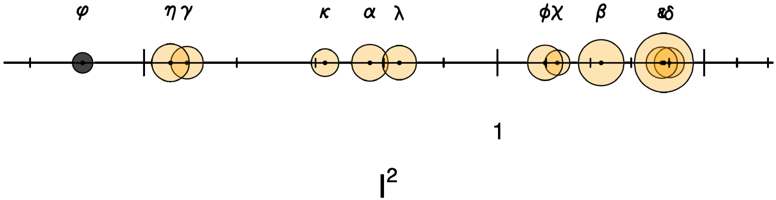
Flato et al. 2013

Comparative Model Performance



Gleckler, Taylor, and Doutriaux 2008

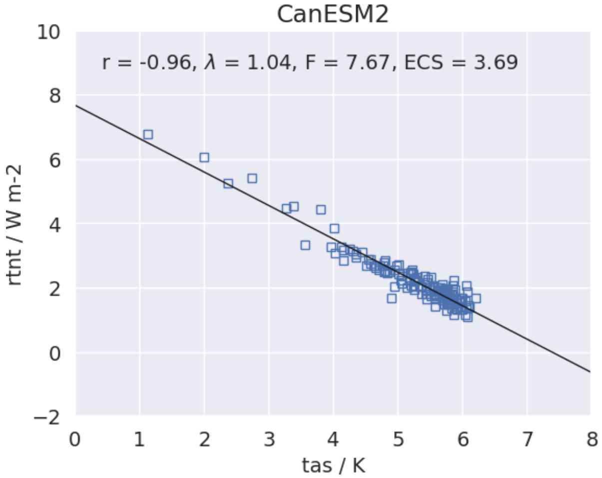
Single Model Performance



α: CNRM-CM5
β: CSIRO-Mk3-6-0
χ: GFDL-ESM2G
δ: MIROC-ESM
ε: MIROC-ESM-CHEM
ϕ: MIROC5
γ: MPI-ESM-LR
η: MPI-ESM-MR
ι: MRI-CGCM3
φ: multi-model-mean
κ: NorESM1-M
λ: NorESM1-ME

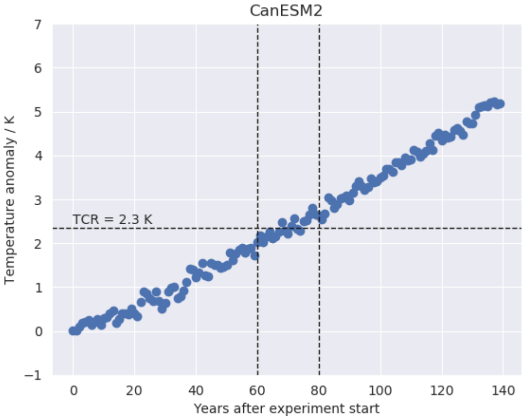
Reichler and Kim 2008

Equilibrium Climate Sensitivity



Gregory 2004

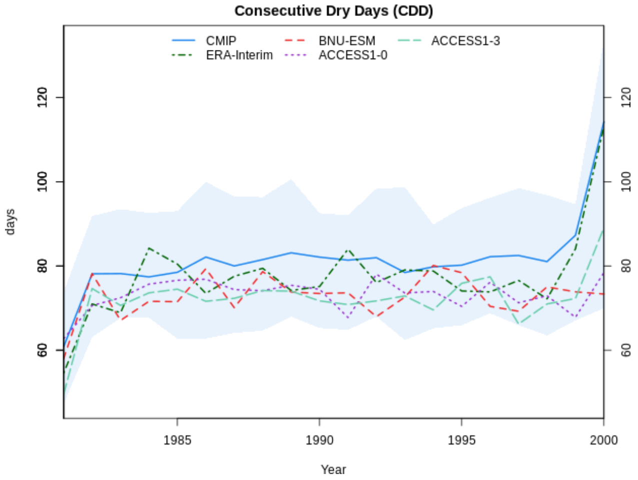
Transient Climate Response



Gregory and Forster 2008

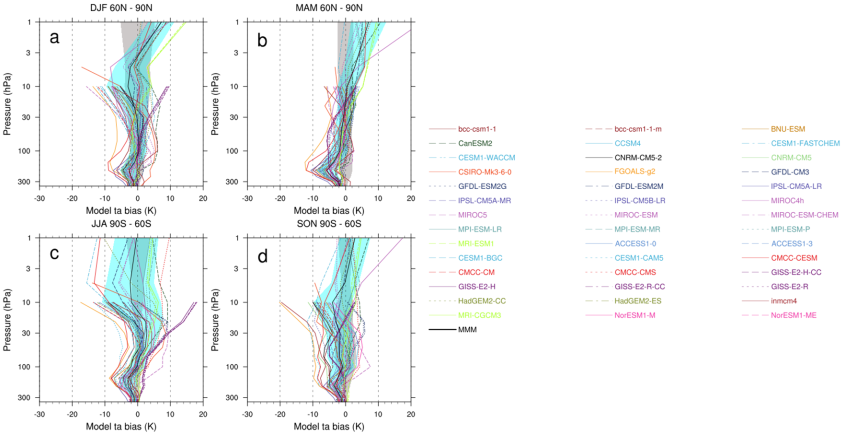
For more on quantifying progress across CMIP phases, see presentation by Lisa Bock, Session D, Tuesday afternoon

Extreme Events



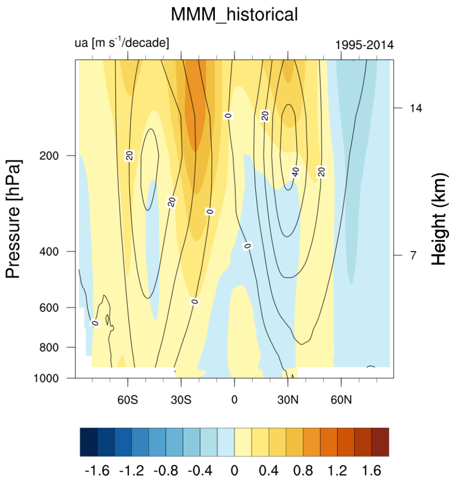
Zhang et al. 2011

Upper Atmosphere Temperature



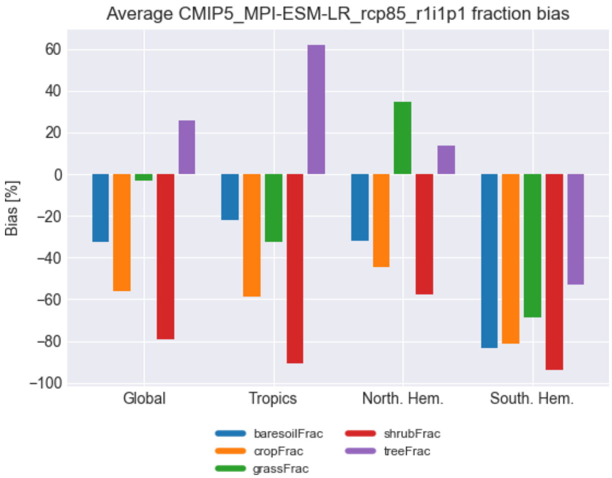
V. Eyring, Butchart, et al. 2006

Upper Atmosphere Winds

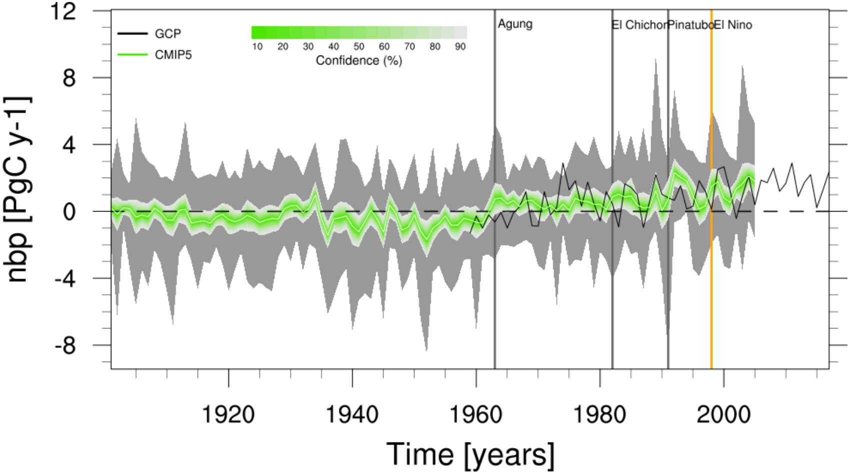


V. Eyring, Arblaster, et al. 2013

Landcover

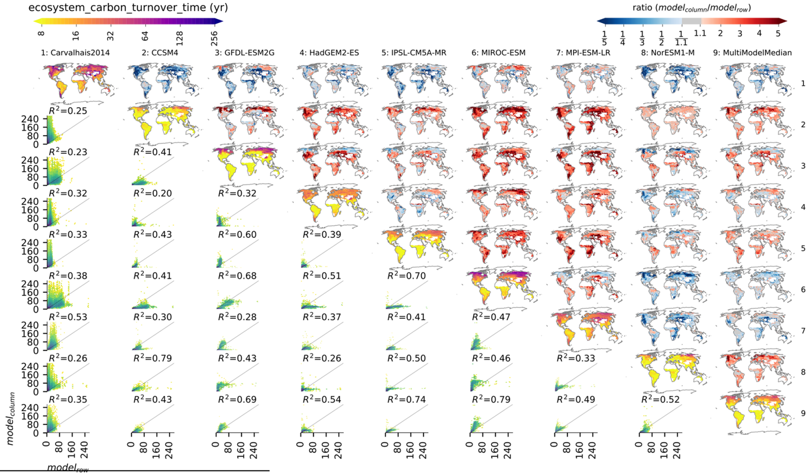

Average CMIP5_MPI-ESM-LR_rcp85_r1i1p1 fraction bias
Bias [%]
60
40
20
0
−20
−40
−60
−80
−100
Global
Tropics
North. Hem.
South. Hem.
baresoilFrac
cropFrac
grassFrac
shrubFrac
treeFrac

Land Surface Carbon (Net Biome Productivity)



Anav et al. 2013

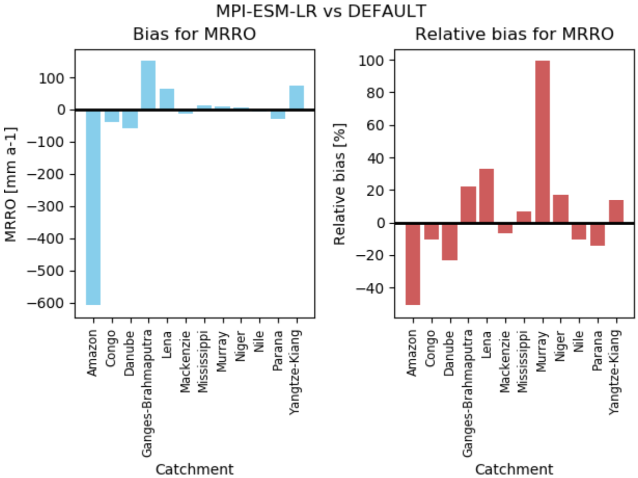
Land Carbon Turnover



See presentation by Sujan Koirala, Session B, Monday afternoon

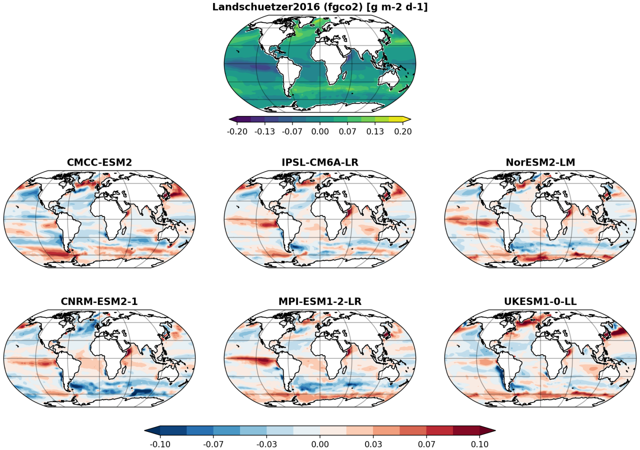
Carvalhais et al. 2014

River Runoff



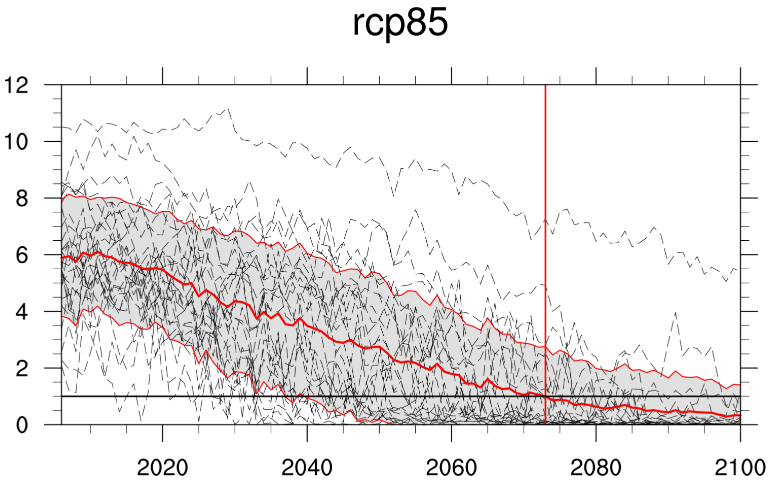
Hagemann, Loew, and Andersson 2013

Ocean Biogeochemistry



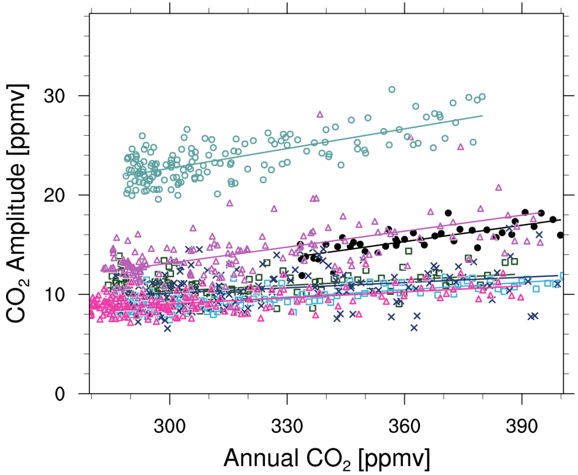
Landschützer, Gruber, and Bakker 2016

Seaice



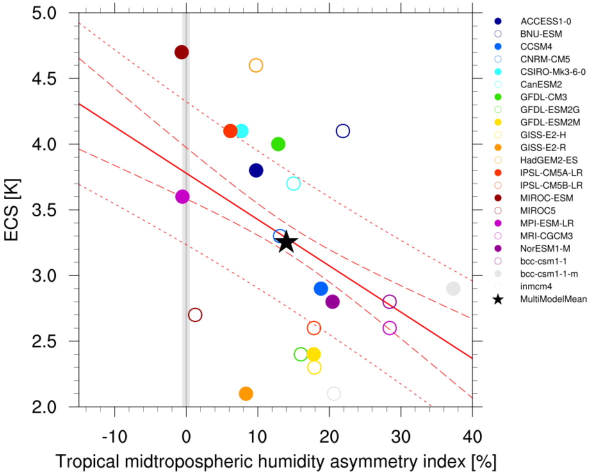
Massonnet et al. 2012

Emergent Constraints for CO2



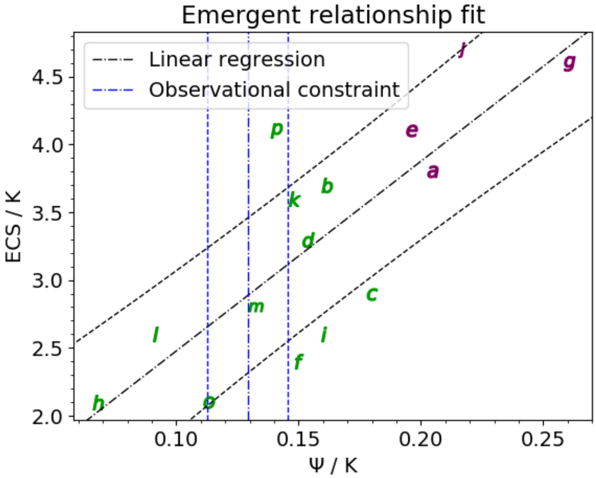
Wenzel et al. 2016

Emergent Constraints for ECS



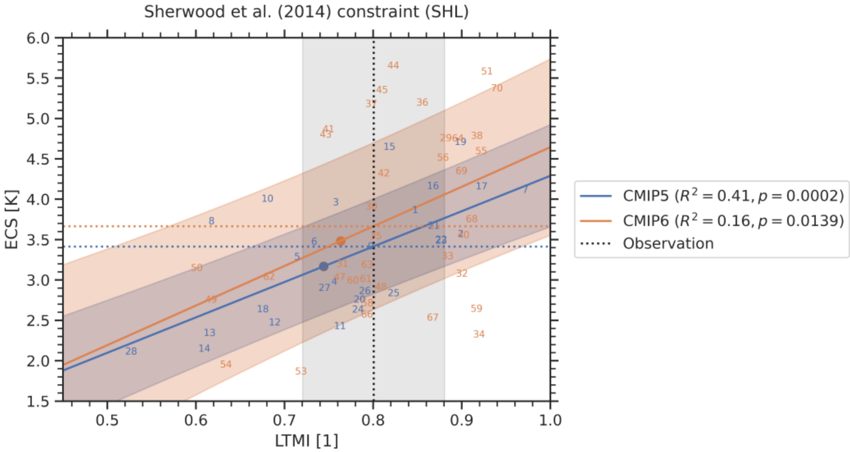
Tian 2015

Emergent Constraints for ECS



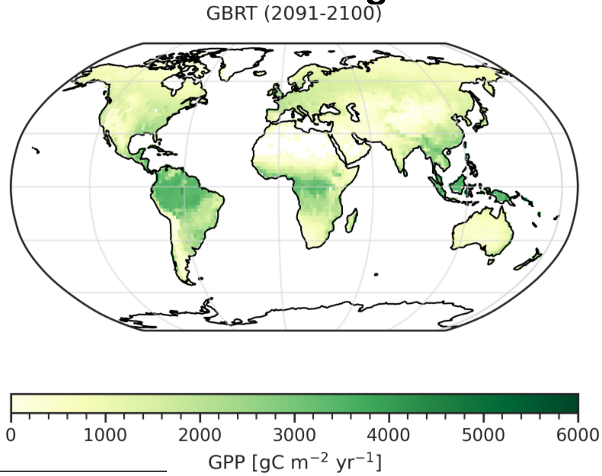
Cox, Huntingford, and Williamson 2018

Emergent Constraints for ECS



M. Schlund et al. 2020

Constraining with Machine Learning



See presentation by Manuel Schlund, Session E, Wednesday morning
Manuel Schlund et al. 2020

Outline

Summary

- CRESCENDO has contributed many diagnostics to ESMValTool
- They span all realms of the Earth System
- Both routine evaluation and new science is facilitated
- More diagnostics are already being integrated

Fin

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