Copernicus and H2020 Program: Diagnostics Needs and Overview

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Separation of concerns

- User needs state-of-the-art:
  - **Science** of model evaluation
  - **Software** tools for model evaluation
- Different experts -> different governance & maintenance
- Otherwise one of them becomes obsolete
  - High risk of mis-use
  - Loss of trust, wasted resources
- Articulation/modularity via clear interfaces
- e.g. lessons learned for CMIP, ESGF, ES-DOC,...
Science of model evaluation

• What is the scientific question?
• What are the related metrics (performance, process-based, teleconnections,...) ?
• What are the reference “observations” ?
  – Obs4MIPs,...

• Who has the knowledge for governance/trust ?
  – Climate scientists, observations experts
  – WCRP/CLIVAR/PAGES/... panels that gather scientific expertise on specific topics (climate sensitivity, ENSO, monsoons, THC, MJO, salinity, carbon cycle,...)
Software for model evaluation

• How to best compute the metrics (get data, run on computer, visualize,...)
• Challenging project: define workflow, process, development, modularity, funding, etc.
• « Time to solution » is high in the must have list
• Who has the knowledge for governance/trust?
  – IT and data experts
  – e.g. ENES, WIP, ESGF, ES-DOC...
  – Or any new team that uses the common framework
Model evaluation workflow

Climate information user

Science question
Choose metric(s) Choose model(s)
Run and view metric
Analyze results

Climate expert

Define metric
Def. observations
Document metric = f(question)
Program metric
Science governance

IT expert

Software infrastructure to run and view metric/diagnostic
Science provenance
User interface

IS-ENES 3 scope
ENSO and tropical Pacific metrics for CMIP6

On behalf of the CLIVAR Research Focus “ENSO in a changing climate”

- Despite 30 years of progress, ENSO continues to surprise us and challenge our assumptions - It remains a major unsolved climate puzzle
- It is the “elephant in the room” for regional impacts of climate change
- ENSO research very active field
  - diversity of events, extremes, role of atmosphere,…

Coupled GCMs are choice tools to understand ENSO

- ENSO simulation and prediction still suffer from long standing biases
- Little improvement from CMIP3 to CMIP5
- Beyond performance metrics, process-based metrics are required during model development phase
- Poster provides examples of the such metrics and how to develop their use in the community

CMIP5 workshop
Dubrovnik Oct. 2015
Comparison setup: IPSLCM6013_pd_20171204

Metrics for model tuning
Parallel Coordinates - PMP PCMDI
Atmosphere Surface - seasonal
NH Polar St. - Atmosphere Surface
SH Polar St. - Atmosphere Surface
Atmosphere Standard press. lev. - seasonal
NH Polar St. - Atmosphere Standard press. lev.
Atmosphere Zonal mean - seasonal
NEMO - general diagnostics
NEMO - T & S @depth
NEMO zonal means
Focus Atlantic - Atmosphere Surface
Focus North Atlantic for AMOC
PISCES
ENSO CLIVAR Diagnostics
ORCHIDEE
Turbulent Air-Sea Fluxes (GB2015)
Hotelling Test on tropical Turbulent Air-Sea Fluxes (GB2015)
CM6011 Essentials - Simulations comparator
Monsoons Diagnostics
Sweet spots for deep convection

Annual Max NH40 climato MLD (SigmaT 0.03) (m lotst)
Metrics for model tuning

- SST 50S/50N

![Graphs showing metrics for model tuning](Image)
Questions?