CMIP6: Toward understanding past, present and future climate

a distributed organization:

1. Establish a set of CMIP **ongoing** model development evaluation and characterization experiments to gain basic information about model performance and sensitivity (CMIP)
   - done by most groups as part of the development cycle.
   - revisited whenever a new model was developed
   - The basis for the Model Intercomparison Projects
   - Evolve only slowly (10-15 yr time scales)
   - CMIP Panel continues to manage the details of these experiments

2. Organize sets of experiments to address science questions within the context of the WCRP Grand Challenges and AIMES input specific to CMIP6:

-Systematic biases

-Response to forcings

-Variability, predictability and future scenarios

3. Around these experiments build CMIP6 with additional, specialized intercomparisons ("MIPs") that would make use of the same standards and infrastructure.
   - Individual MIPs work with CMIP Panel to coordinate details of experimental design and variable lists and etc.; each MIP would designate which experiments would contribute to the CMIP6 science questions and thus target for wider participation of many modeling groups, and they could have other specialized experiments for their own communities
   - CMIP Panel has oversight and identifies the elements of the MIP experiments that are part of CMIP6

Framing CMIP6 within the WCRP Grand Challenges and AIMES

Clouds, Circulation and Climate Sensitivity
Changes in Cryosphere
Climate Extremes
Regional Climate Information
Regional Sea-level Rise
Water Availability
e.g. Carbon cycle grand challenge

communication

•CMIP Panel facilitates communication between MIP co-chairs and the model group contacts to help with coordination between MIPs, and between the MIPs and the modeling groups

CMIP Panel:

−Coordinate diagnosis and evaluation simulations with the community

−approve experiments and variable lists etc. that are to be part of CMIP6

−Coordinate with WCRP Grand Challenges

MIPs:

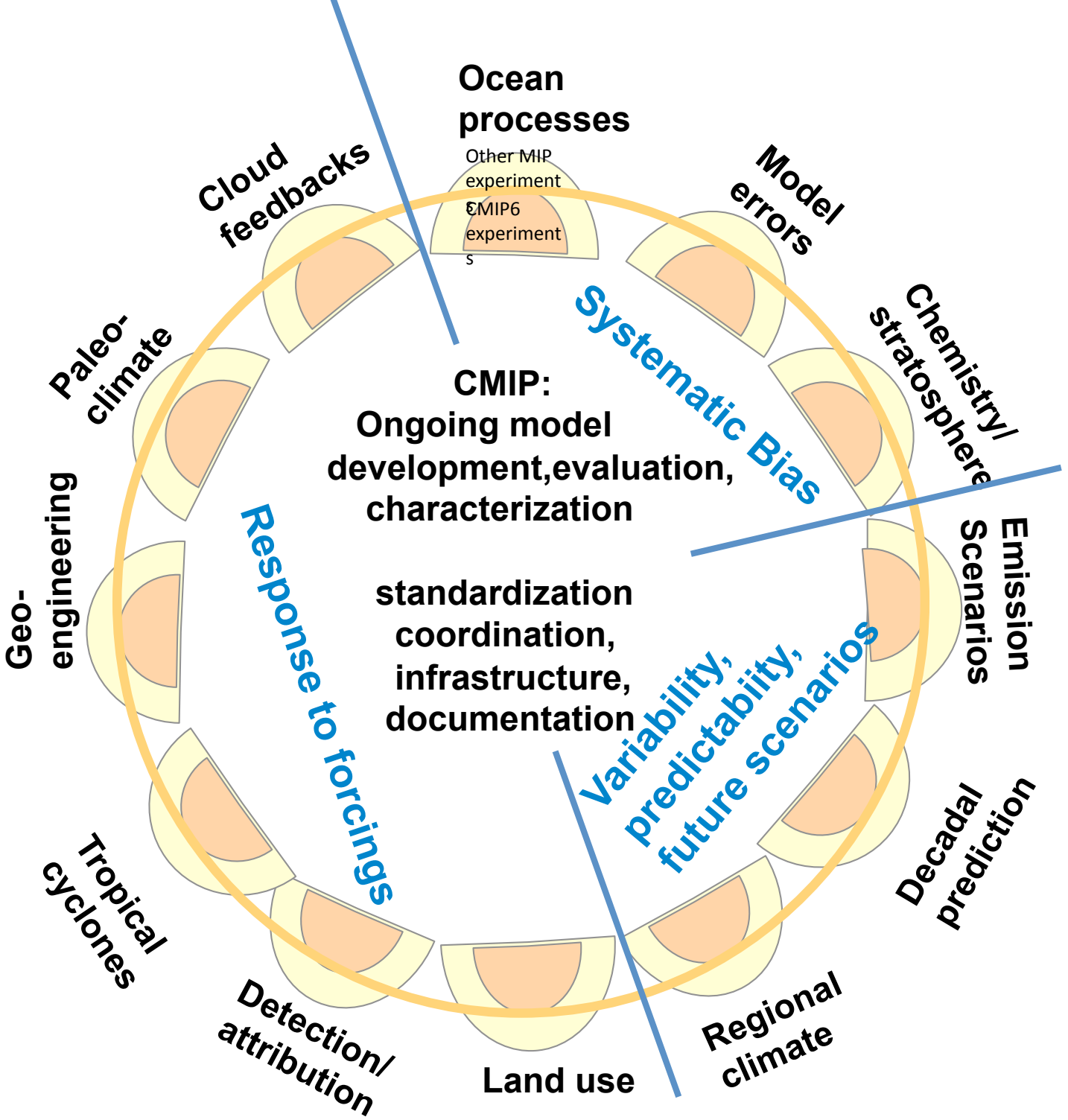
−Address WCRP Grand Challenges and science questions

−Suggest model simulations to address these science questions

−Work with CMIP Panel for output list for CMIP6 data request, and supply rationalization for relevance of experiments to address science questions

−MIPs determine which experiments are run when

C4MIP?


Ocean processes
Other MIP experiment s
CMIP6 experiment s
Cloud feedbacks
Model errors
Chemistry/ stratosphere
Emission Scenarios
Decadal prediction
Regional climate
Land use
Detection/ attribution
Tropical cyclones
Geo-engineering
Paleo-climate
CMIP:
Ongoing model development,evaluation, characterization
standardization coordination, infrastructure, documentation
Systematic Bias
Variability, predictability, future scenarios
Response to forcings

Ongoing model development, evaluation, and characterization experiments

*AMIP (~1979-2010), Pre-industrial control, 1%/yr CO_2 to quadrupling, Instantaneous 4xCO2, Historical simulation-> RCP8.5 as is
(concentrations for AOGCMs, emissions/concentrations for ESMs?)

(note: Radiative forcing experiments to be included in single forcing runs)

Ongoing model development, evaluation, and characterization experiments

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Scenario MIP

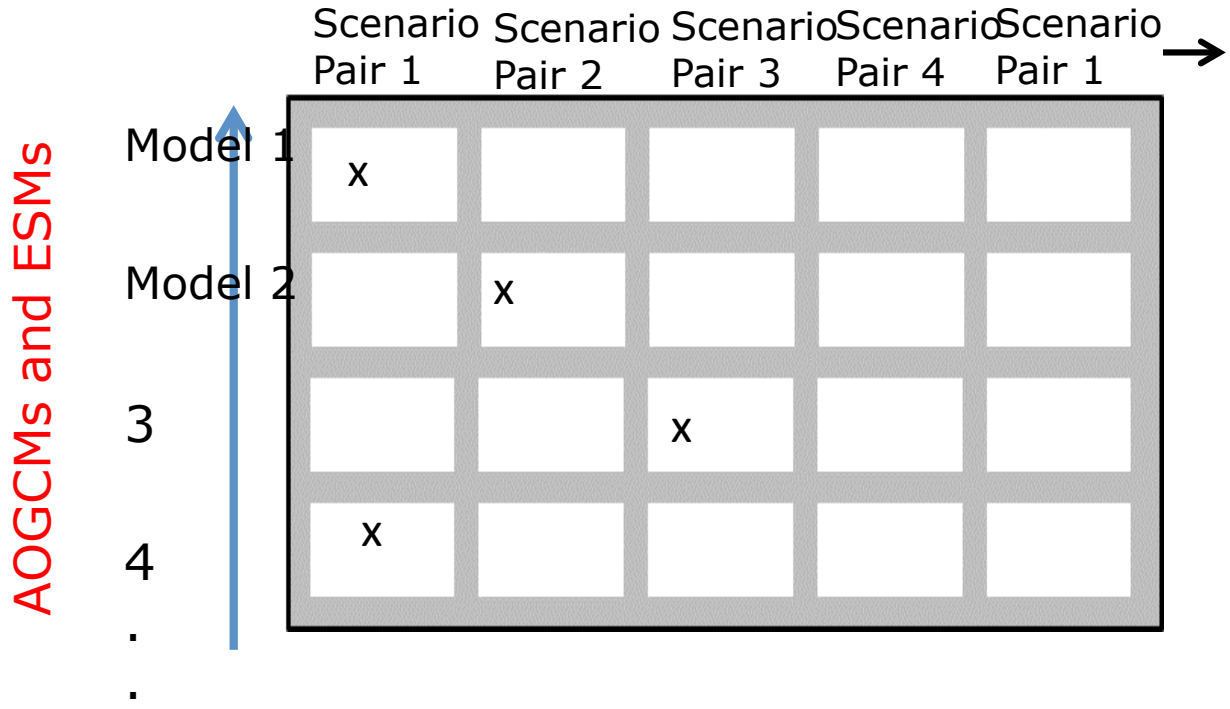
A **pair of two new scenarios** (high/low) run by all models with new 20th century (to 2015) and 21st century forcings
(new emissions and concentrations need to be generated)

*Scenario MIP matrix, modeling groups that subscribe run a
pair of two additional new scenarios (models selected to sample scenario pair space)

*Need to do proof-of-concept for scenario MIP matrix
Subsample CMIP5 models to see if a carefully chosen sample can produce information in the full multi-model ensemble

Sample different combinations of scenario pairs and AOGCMs/ESMs (sampled in an appropriate way, e.g. climate sensitivity, enough realizations)

Paired non-mitigation/mitigation scenarios



IAM and climate modeling community decides which scenario pairs make most sense:

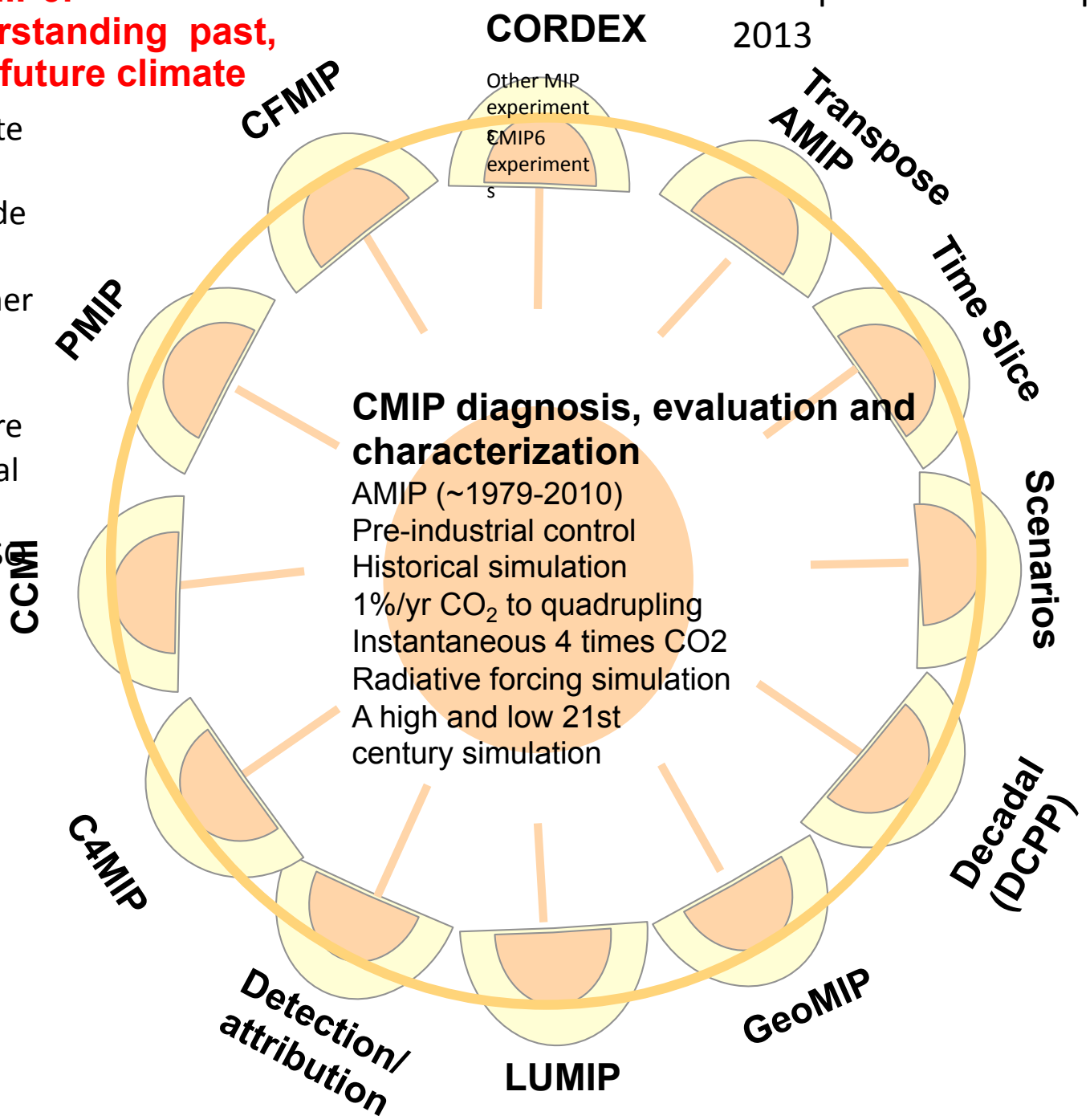
1. baseline/mitigation scenario pairs for research on benefits of mitigation related to land use change, short lived climate forcers, etc.
2. An overshoot scenario

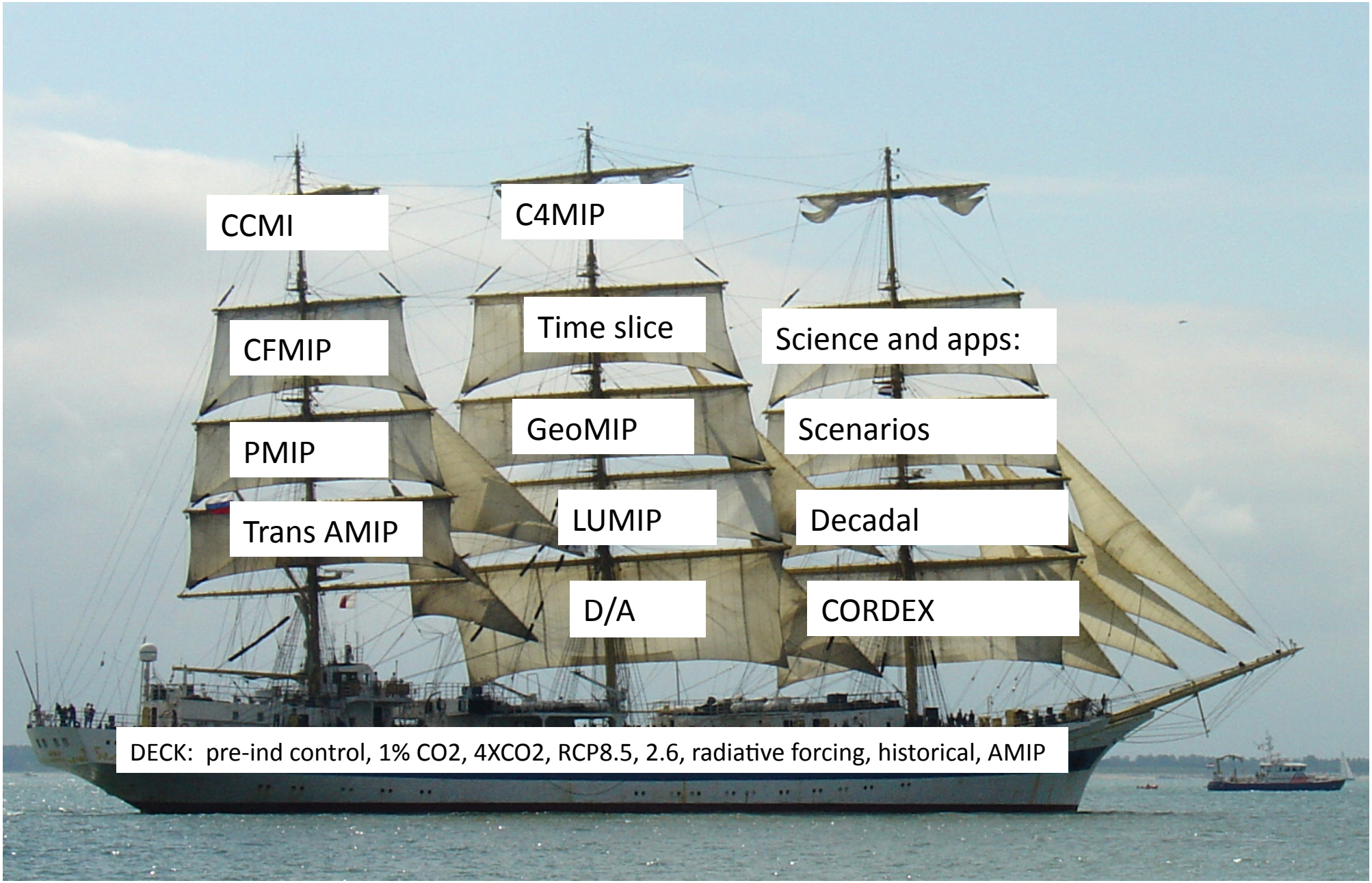
Extra slides from Oct. 2, 2013

CMIP and CMIP6: Toward understanding past, present, and future climate

Final product from Aspen, 2013

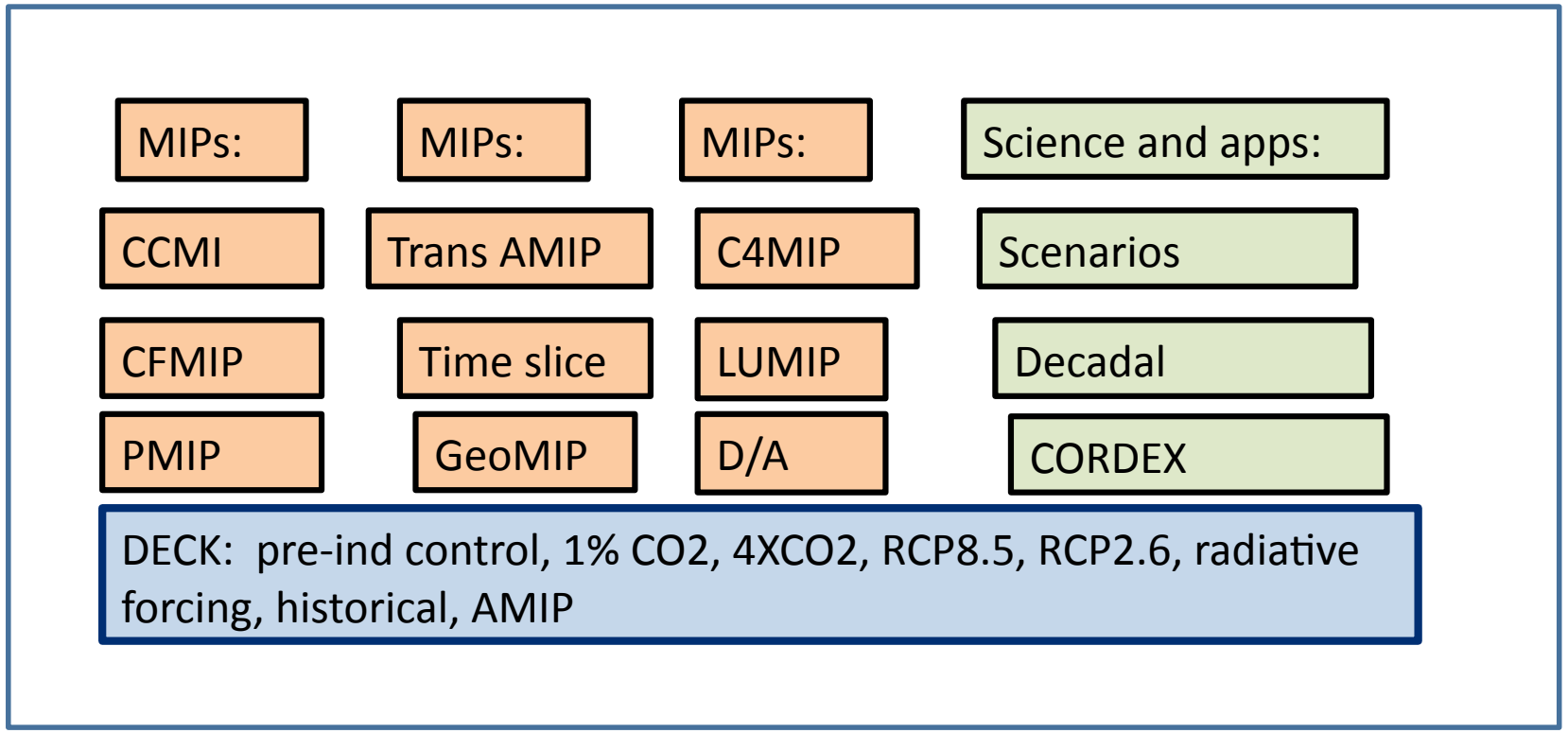
The MIPs designate which are CMIP6 experiments (inside the orange circle) and which are other experiments not part of CMIP6 (yellow)…and there could be additional MIPs (e.g. CORE-forced ocean, ENSO etc.)

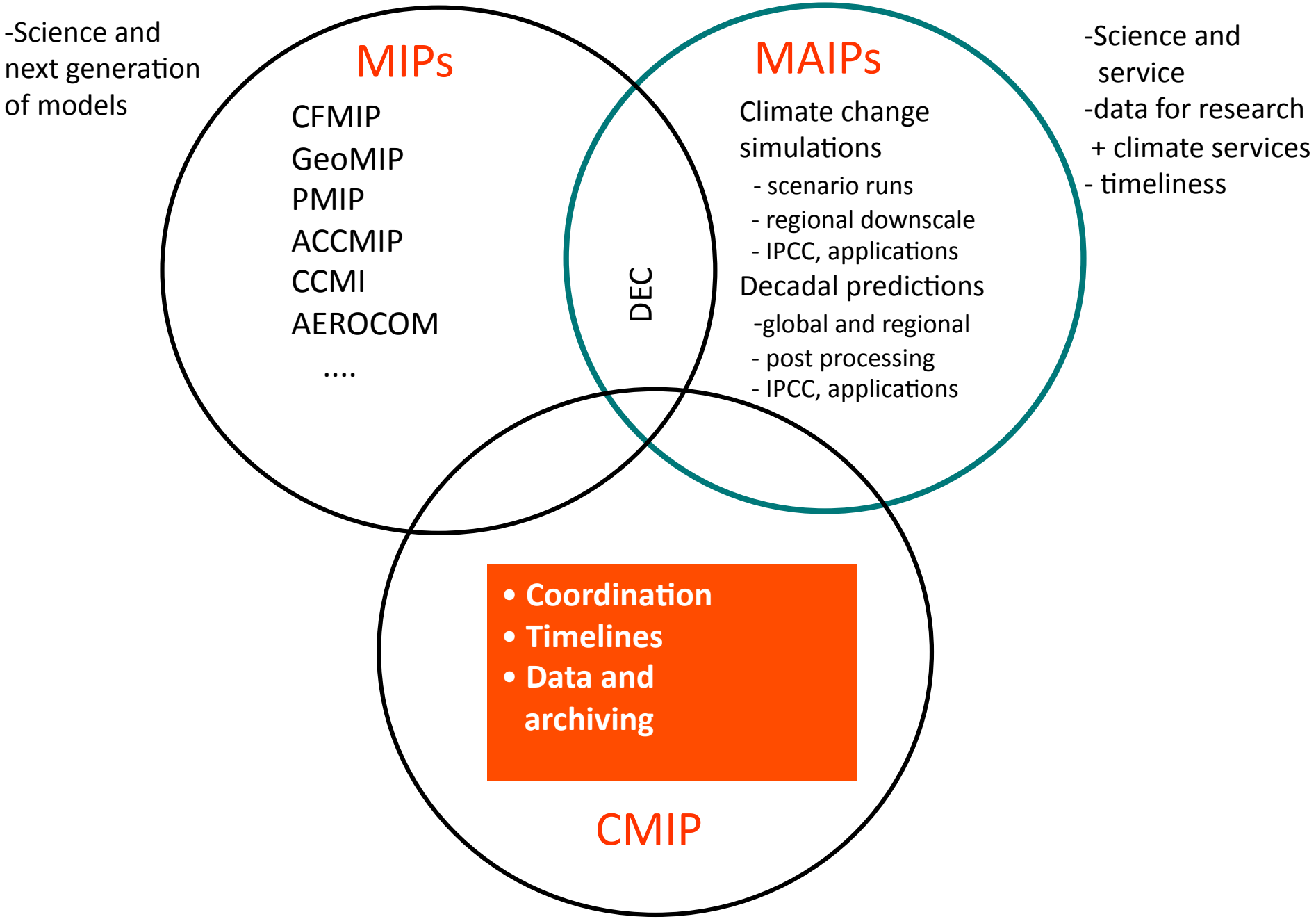


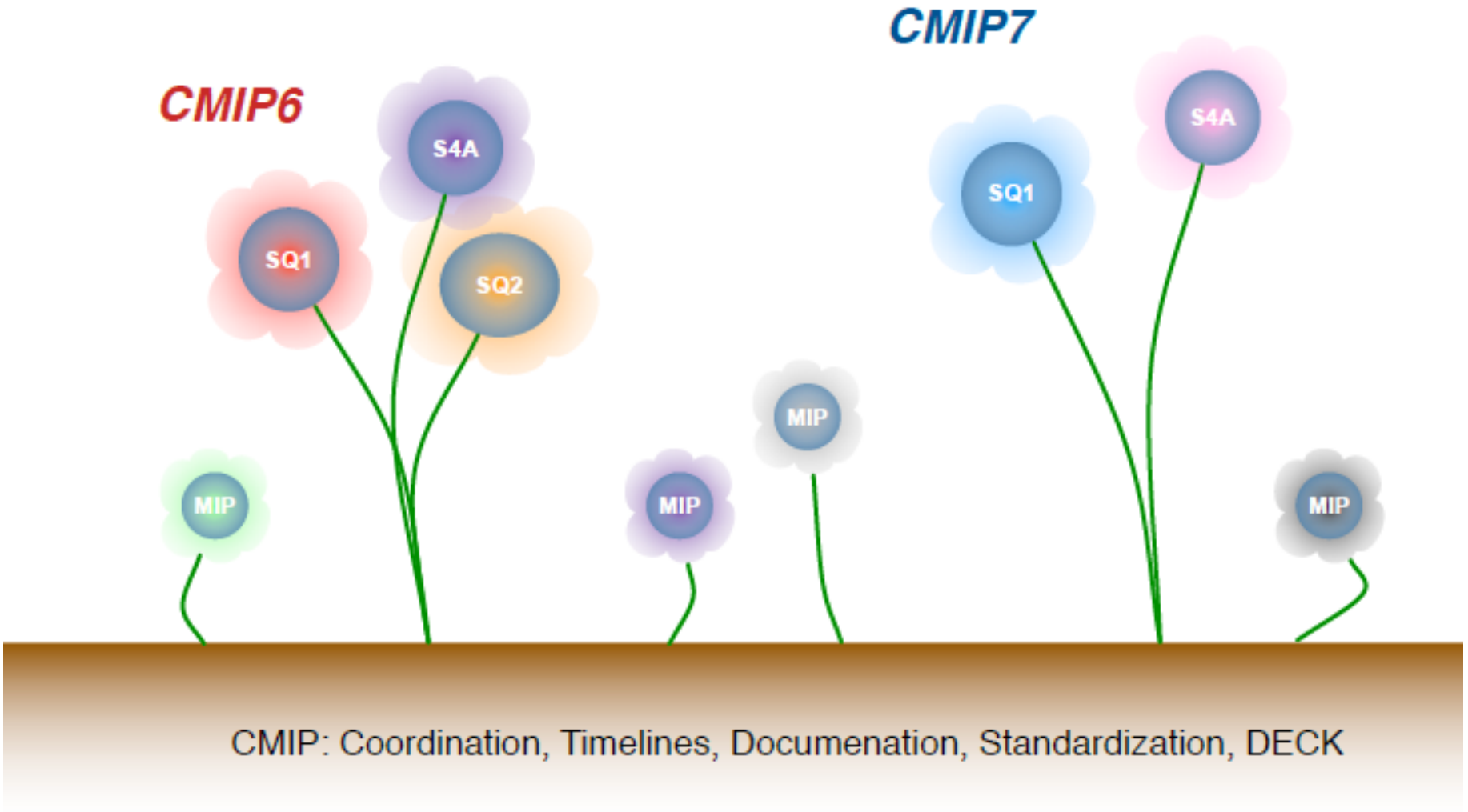

CCMI
C4MIP
CFMIP
Time slice
Science and apps:
PMIP
GeoMIP
Scenarios
Trans AMIP
LUMIP
Decadal
D/A
CORDEX
DECK: pre-ind control, 1% CO2, 4XCO2, RCP8.5, 2.6, radiative forcing, historical, AMIP

CMIP6: Toward understanding past, present and future climate

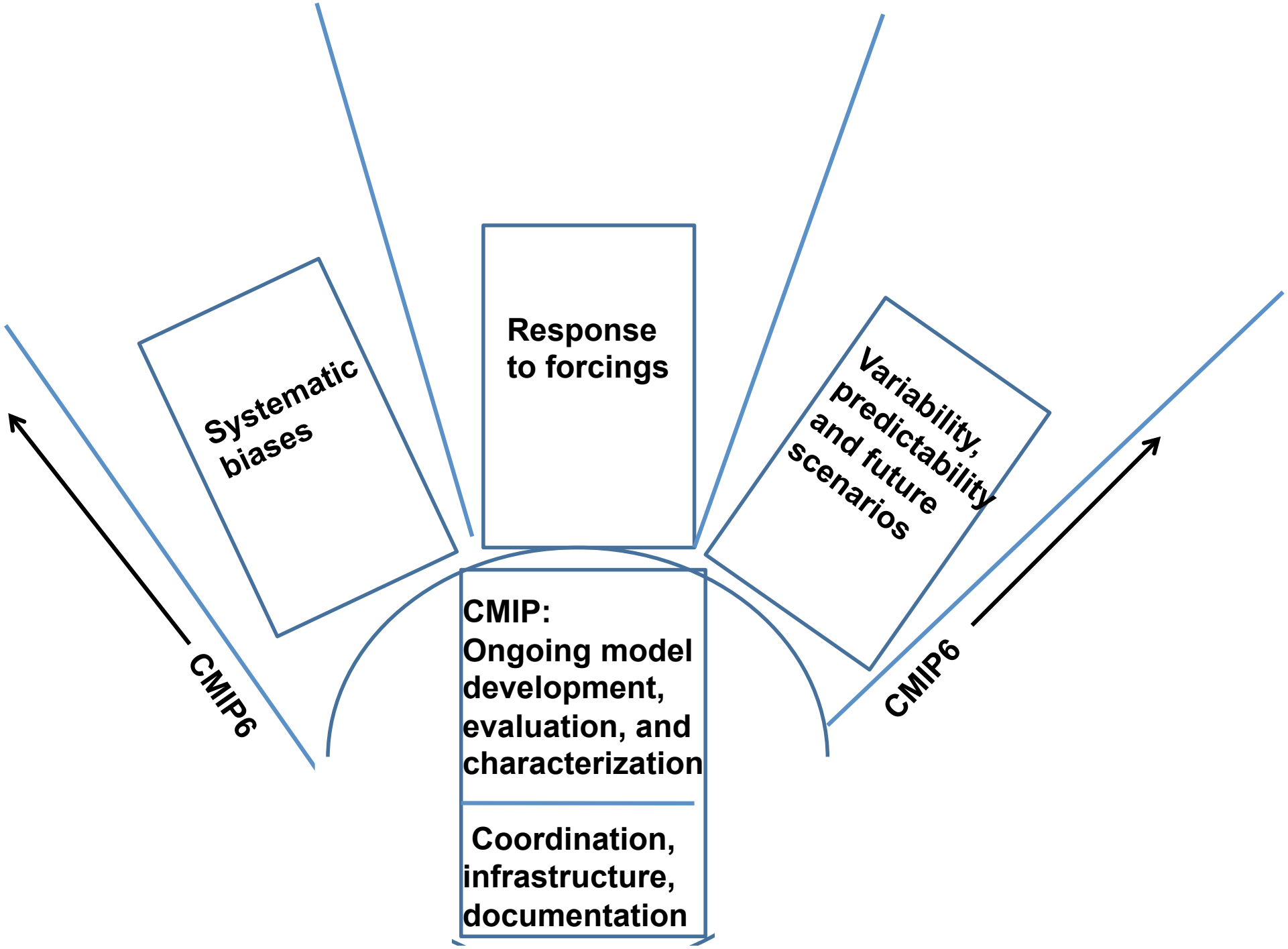
(Diagnosis, Evaluation and Characterization of Klima: DECK)

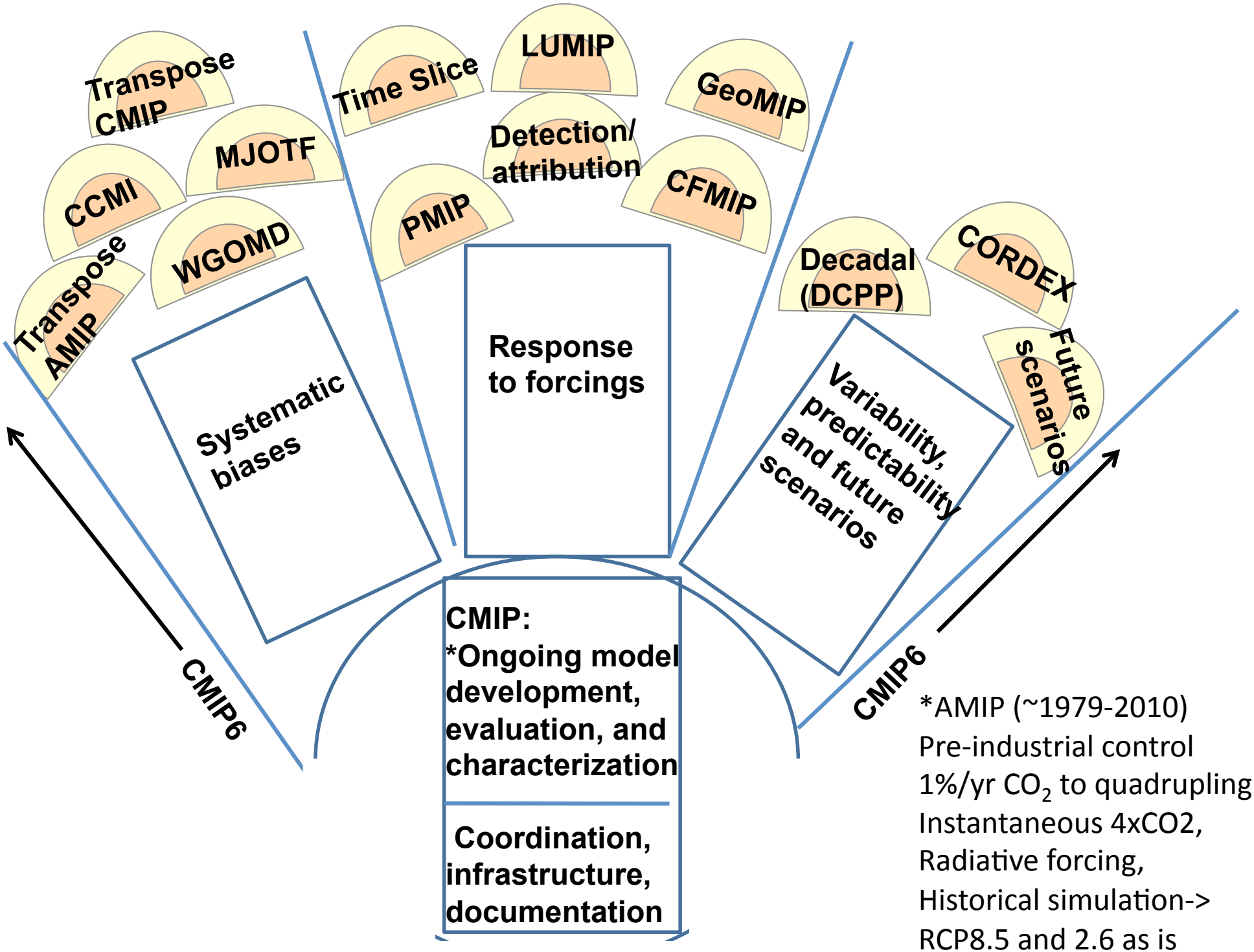



-Science and next generation of models
MIPs
CFMIP
GeoMIP
PMIP
ACCMIP
CCMI
AEROCOM
....
DEC
MAIPs
Climate change simulations
- scenario runs
- regional downscale
- IPCC, applications
Decadal predictions
-global and regional
- post processing
- IPCC, applications
-Science and service
-data for research + climate services
- timeliness
• Coordination
• Timelines
• Data and archiving
CMIP



SQ1: Interpretation of systematic biases in coupled models;
SQ2: Understanding the impact of forcings on the climate of the 20th and 21st century;
S4A: Science for applications


Systematic biases
Response to forcings
Variability, predictability and future scenarios
CMIP6
CMIP6
CMIP:
Ongoing model development, evaluation, and characterization
Coordination, infrastructure, documentation



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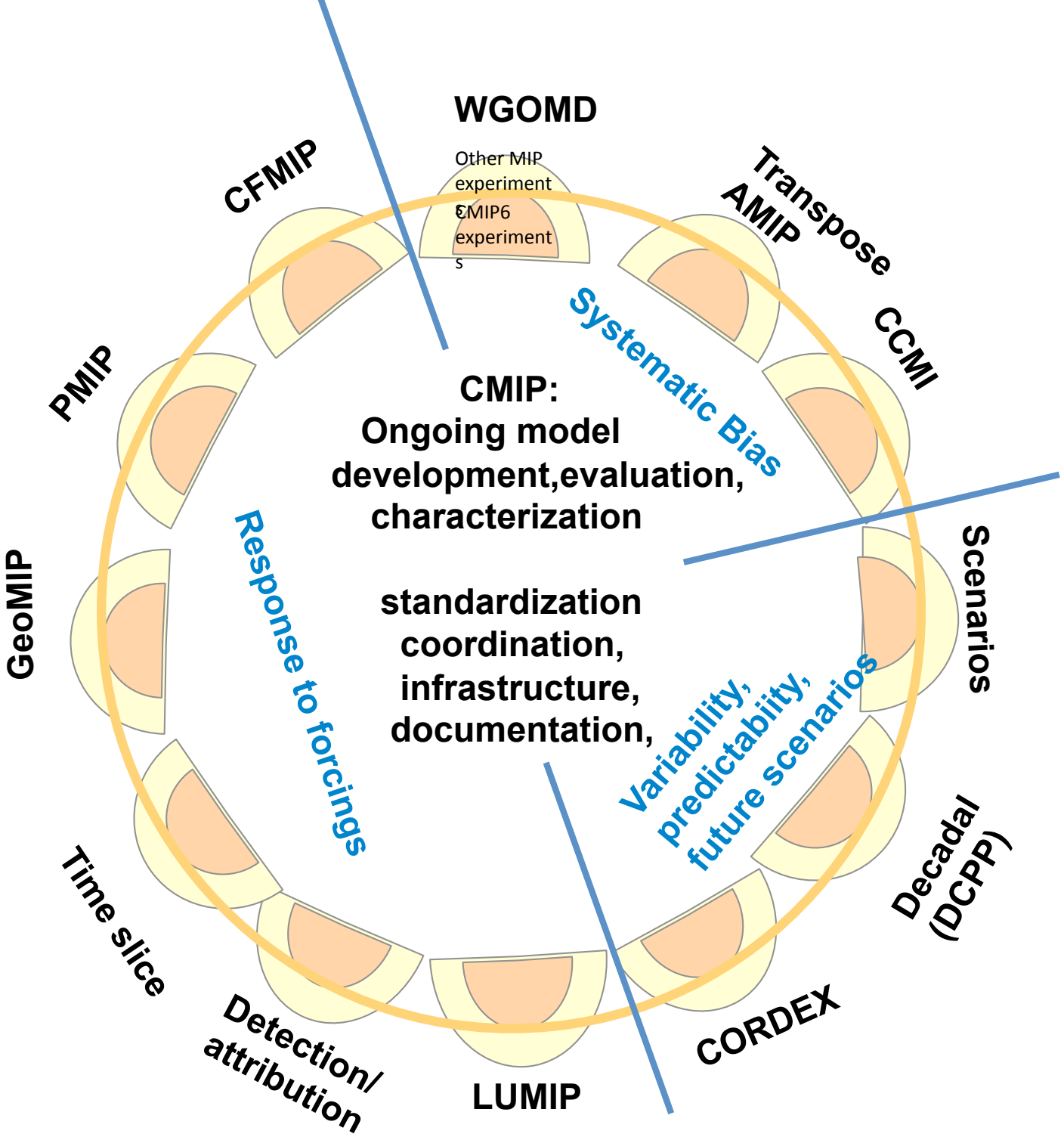
1%/yr CO_2 to quadrupling
Instantaneous 4xCO2,
Radiative forcing,
Historical simulation->
RCP8.5 and 2.6 as is


WGOMD
Other MIP experiment s
CMIP6 experiment s
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Transpose AMIP
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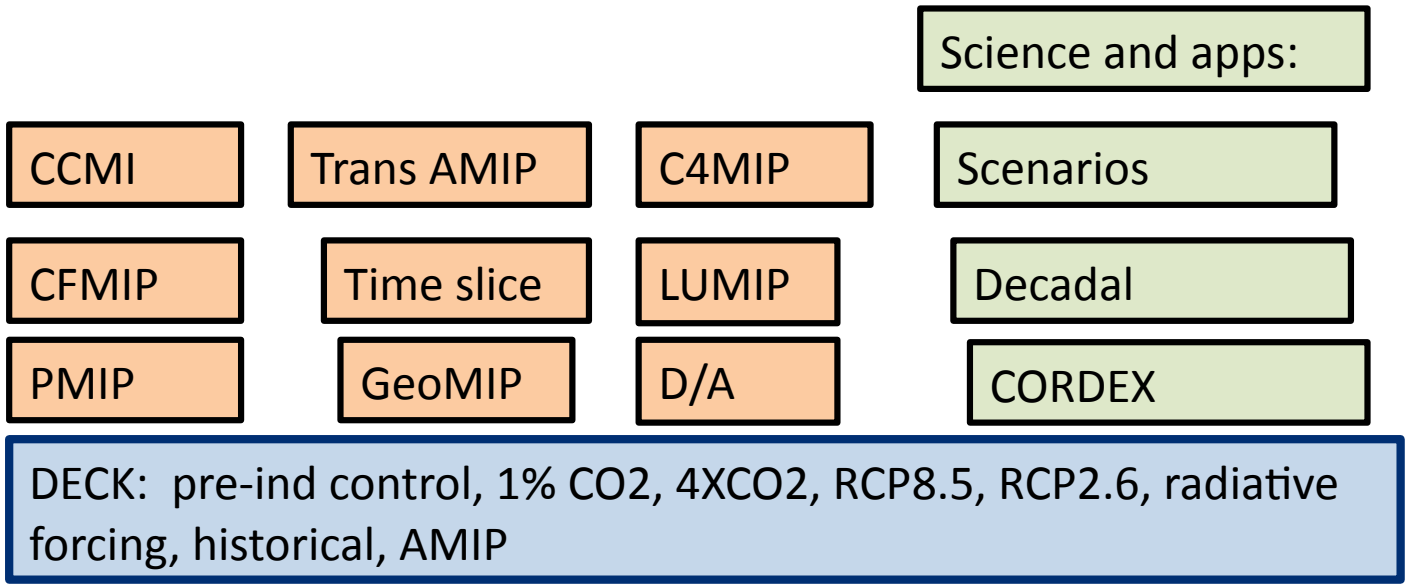

Science Foci for CMIP6

Grand Challenges

1.Interpretation of systematic biases in coupled models

- WGOMD (forced ocean experiments)
- Process outputs
- TAMIP/TCMIP

2. Understanding of the impact of forcings on the climate of the 20th and 21st century

- Radiative Forcing (AMIP type)
- Individual Forcings (prescribed concentration of CO2, aerosol, ozone? specified land use, solar?)

MIPs