IPCC Coupled Model Output For Working Group 1

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Background

- At the request of the JSC / CLIVAR Working Group on Coupled Modeling, PCMDI is collecting coupled model output in support of WG1's needs for the IPCC's AR4.

- An unprecedented effort is being made by the modeling community to create a timely and valuable archive of recent model results.

  → A diverse set of scenarios.

  → Both atmospheric and oceanic fields, a few run at relatively high resolution (e.g., ~150 km).

  → A very wide variety of fields, sampled monthly, daily and 3-hourly.

  → A limited set of "extremes" indices.

  → A few multi-member ensembles.

 → A common structure and format across all models.

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IPCC requested simulations

- A pre-industrial control run of at least 100 years without anthropogenic or natural forcing

- Historical run: 20th Century simulation (20C3M)

- Future climate simulations (initial conditions from end of the 20th Century simulation):

  → "committed climate change": hold concentrations at year 2000 values

  → SRES A2 to 2100

  → SRES A1B to 2100 then fix concentrations (~720 ppm) for an additional century (with one realization extended to 2300)

  → As above but with SRES B1 (~550 ppm)

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Representative SRES CO_2 concentrations

SRES CO2 CONCENTRATIONS : ILLUSTRATIVE SCENARIOS AND FULL RANGE
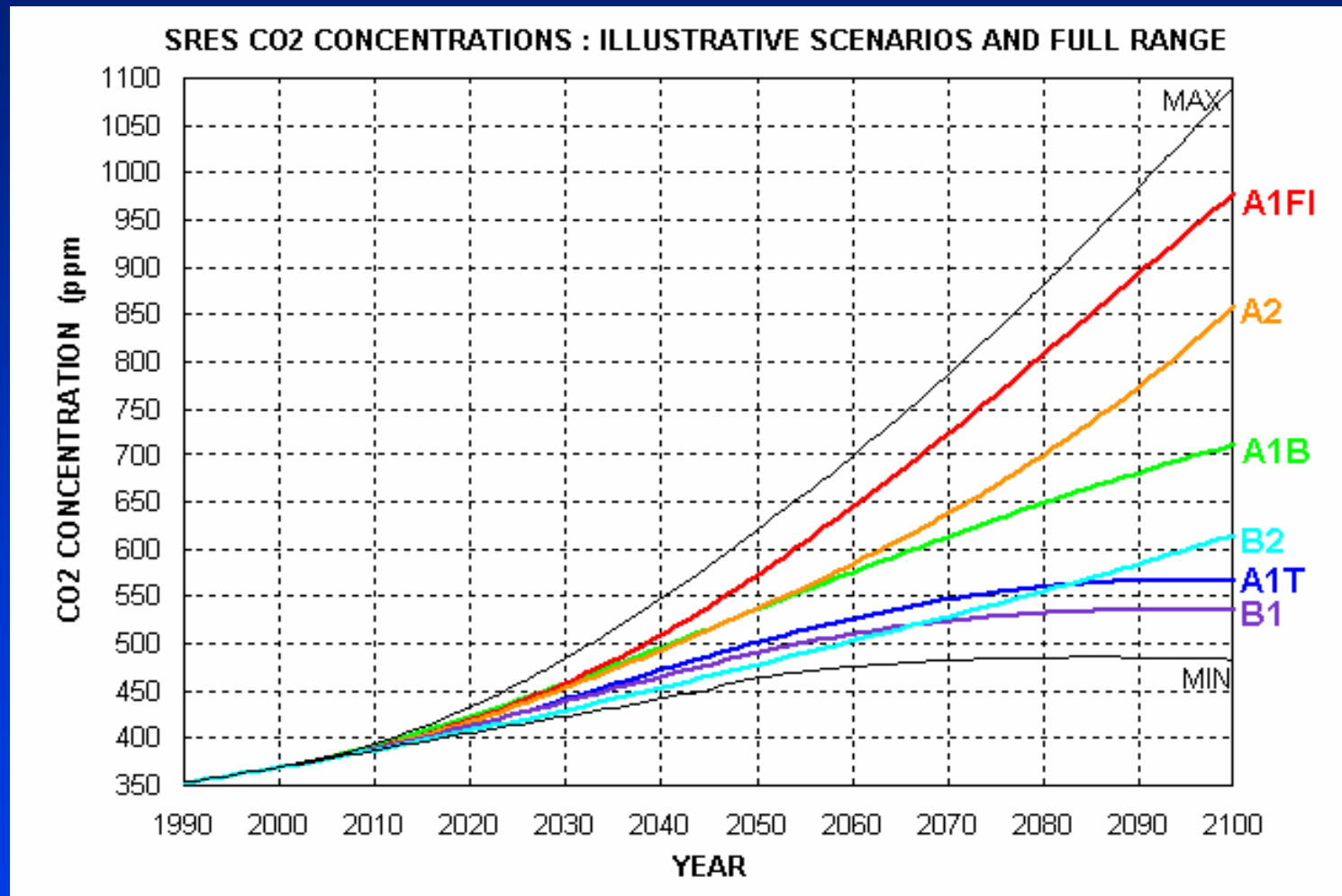
(T. Wigley)

IPCC requested simulations (cont.)

- Idealized experiments:

  → 1%/yr CO_2 run for 70 years (time of doubling), then an additional 150 years with doubled CO_2

  → 1%/yr CO_2 run for 140 years (time of quadrupling), then an additional 150 years with quadrupled CO_2

  → $2XCO_2$ step increase and then run to equilibrium (atmosphere/slab-ocean model)

  → Control simulations for the above (atmosphere/slab-ocean model)

- AMIP simulation
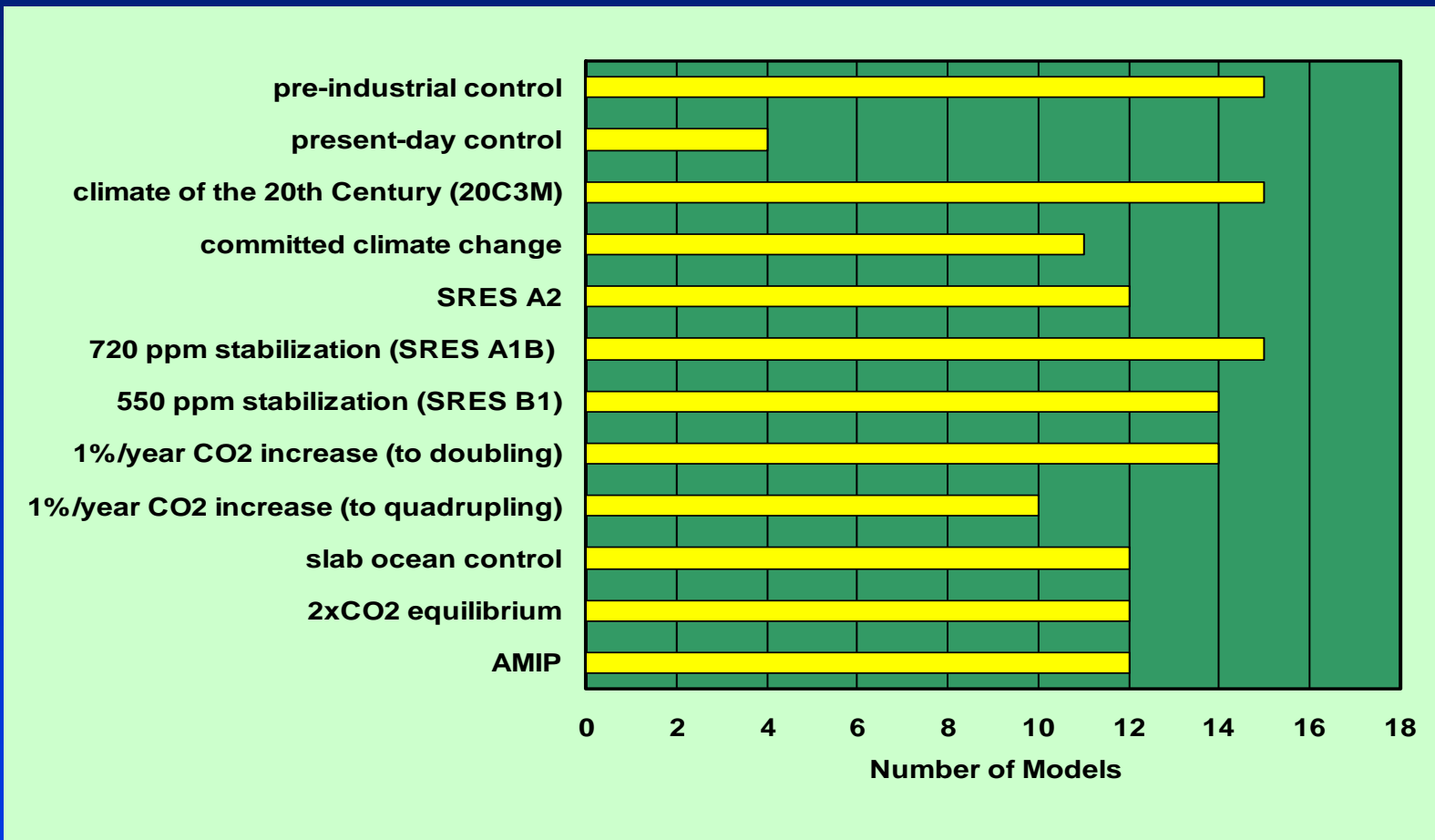
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Modeling groups promising to contribute IPCC output*

Table is incomplete because information from 3 groups has not yet been entered.

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Simulations promised by each modeling group*

Experiment	CCCma, Canada	CCSR/NIES/FRCGC, Japan (hi-res.)	CCSR/NIES/FRCGC, Japan (med-res.)	CSIRO, Australia	DKRZ, Germany	GFDL, USA	GISS, USA (AOM)	GISS, USA (ModelE)	IAP/LASG, China	INM RAS, Russia	IPSL/LMD/LSCE, France	MRI, Japan	NCAR, USA (CCSM3)	NCAR, USA (PCM1)	NCC, CMA, China	The Hadley Centre, UK (HadCM3)	The Hadley Centre, UK (HadGEM1)	UIB, Norway
pre-industrial control	1	1	1	0	1	1	2	0	0	1	1	1	1	1	1	1	1	1
present-day control	1	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0
climate of the 20th Century (20C3M)	1	1	3	0	3	1	2	0	0	1	1	5	5	4	4	2	2	2
committed climate change	1	0	1	0	3	1	0	0	0	0	1	1	5	4	0	1	1	1
SRES A2	3	0	3	0	3	1	0	0	0	1	2	5	5	4	1	1	1	0
720 ppm stabilization (SRES A1B)	3	1	3	0	3	1	2	0	0	1	1	6	5	4	1	1	1	1
550 ppm stabilization (SRES B1)	3	1	3	0	3	1	2	0	0	1	1	6	5	4	1	1	0	1
1%/year CO2 increase (to doubling)	1	1	3	0	1	1	0	0	0	1	1	1	1	1	1	1	1	1
1%/year CO2 increase (to quadrupling)	1	0	3	0	1	1	0	0	0	1	1	1	1	1	1	0	0	0
slab ocean control	1	1	1	0	1	1	0	0	0	1	1	1	1	1	0	0	1	1
2xCO2 equilibrium	1	1	1	0	1	1	0	0	0	1	1	1	1	1	0	0	1	1
AMIP	1	1	3	0	3	1	0	0	0	1	1	1	1	1	1	0	1	0

* The accounting shown here is incomplete, and in some cases may be incorrect; a '0' has been entered where no information is currently available.

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Model output collected at 4 different sampling intervals

- Monthly means for about 50 atmospheric fields, including:

  → Temperature, winds, specific & relative humidity, cloud fraction

  → Precipitation, surface temperature, surface pressure & wind stress

  → snow & ice cover, soil moisture, runoff

  → Radiation at surface, tropopause, and top of atmosphere

  → Evaporation and surface heat fluxes

- Monthly means for more than a dozen oceanic fields including:

  → Currents, temperature, salinity

  → "flux adjustments"

  → Heat transport, overturning stream function

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Output collected at 4 different sampling intervals (cont.)

- 18 daily mean atmospheric fields, typically for 20-year intensive "observing" periods, including:

  - → Temperature, winds, surface pressure and humidity
  - → max. and min. daily surface air temperature
  - → Precipitation
  - → Radiative fluxes

- 9 fields sampled at 3-hourly intervals, typically for 1-year intensive "observing" periods, including:

  - → Precipitation, surface temperature & pressure
  - → Surface heat fluxes

- 10 different extreme indices (Frisch et al., 2002) for annual periods (e.g., dry index, frost days, growing season, precipitation intensity index)

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Reporting periods for requested model output
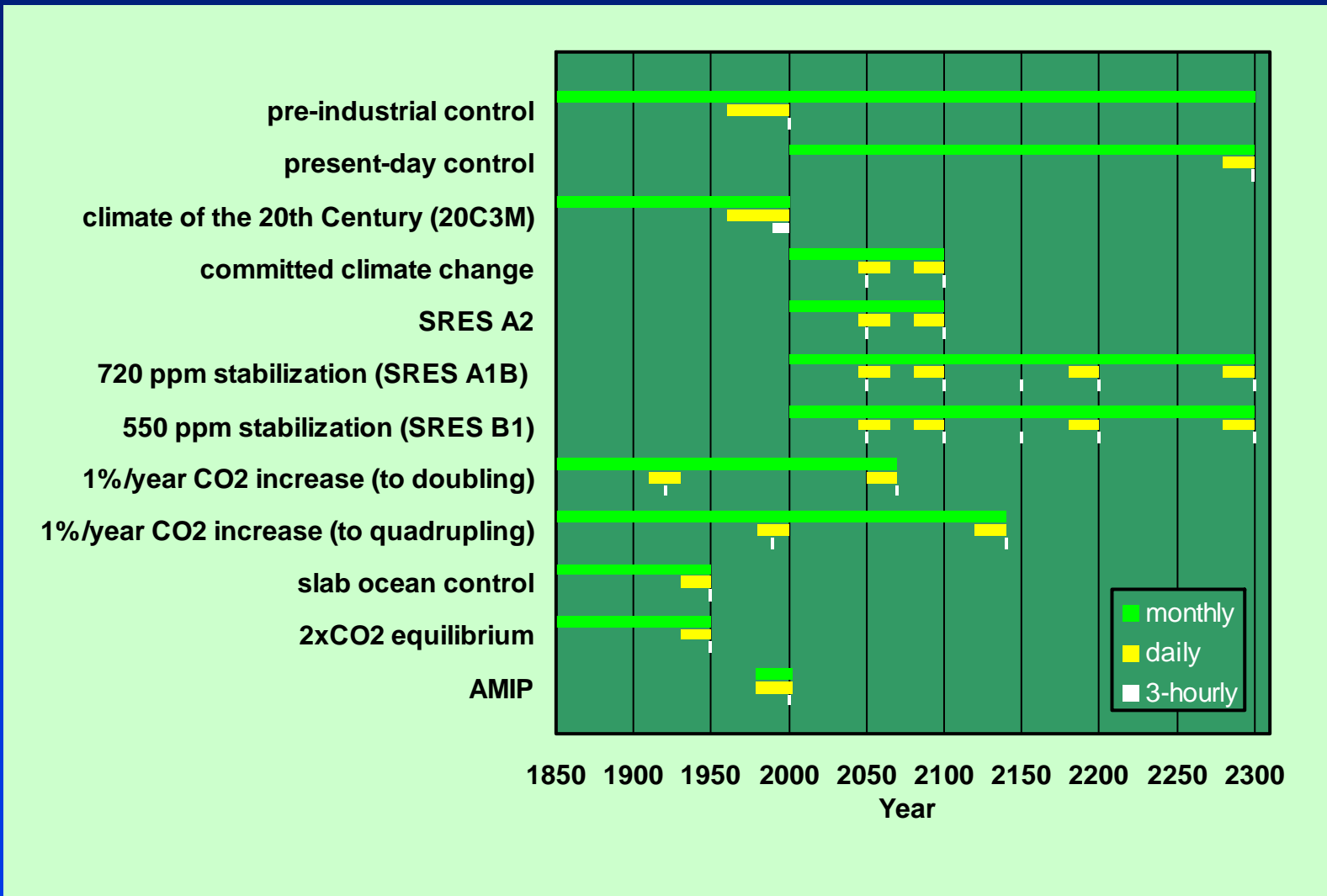
Requested IPCC model output structure and format

- Structure: Each file contains data from a single model/ simulation/realization/variable on a longitude/latitude grid

- CF-compliant netCDF files: consistent with the expected future format requirements of AMIP, CMIP, PMIP, CFMIP, etc.

- "Self-describing" files: contain considerable metatdata, including all needed grid information

- A model output code: CMOR developed by PCMDI to facilitate the rewriting of data to meet the IPCC WGCM requirements

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Metadata in each file includes:

- File (global) attributes, including:

    → Identification of modeling group, model, and contact

    → Identification of experiment and realization (ensemble member)

    → List of relevant published references

- Variable attributes, including:

    → CF-standard variable name and IPCC standard units

    → "Missing value" indicator

- Coordinate attributes, including:

    → CF-standard name and IPCC standard units

    → Calendar (for time coordinate)

    → Cell bounds (needed for precise calculation of area and time means)

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Data availability

- PCMDI has received sample output from 6 modeling groups and expects to receive the bulk of the data from about 17 groups over the next few months.

- PCMDI is making data available through the Earth System Grid–ESG (using ftp).

- 1-page statements of how the data will be used should already (by September 1) have been submitted to the WGCM Climate Simulation Panel (J. Meehl, chair).

- For more info., see
    www-pcmdi.llnl.gov/ipcc/about_ipcc.htm

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Relationship between PCMDI archive and the DDC

- PCMDI serves the needs of the WGCM and WG1.

- The DDC under the direction of the TCIGA serves a much broader IPCC community (WG2).

- The plan is to:

    → Secure permission from the modeling groups to transfer a subset of the model output from PCMDI to the DDC.

    → The DDC may process some of the data in a way that facilitates its use by the "impacts community".

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Summary

- Compared to previous coupled model "intercomparison" datasets, the model output being collected for IPCC WG1 will be:

    → more comprehensive

    → more uniformly structured

    → more completely "self-describing"

- It will provide a rich resource for model analysis and evaluation for years to come.

- The IPCC timeline may limit its use for AR4.

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