Theme 4: Flagship simulations for CMIP6

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Flagship simulations for CMIP6 and IPCC

Objectives:

- To deliver the core PRIMAVERA flagship simulations at low and high resolution, both coupled and forced AMIP-style, conforming to the HighResMIP experimental design.

- Coordinate the delivery and availability of core model datasets and documentation to all partners with WP9.

Stream 1 [M1-M18]
- Data will be used by WP2,3,10,11
- Input from WP1,9

Stream 2 [M24-M40]
Simulations with improved models and output.
- Data will be used by WP2,3,10,11
- Input from WP3, 10, 11

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HighResMIP

CMIP6 endorsed; ~17 particpating models

Protocol: Three Tiers

- Tier 1: AMIP 1950-2014
- Tier 2: COUPLED 1950-2050
- Tier 3: AMIP 2015-2050 (2100)

Motivation of these three Tiers

- Focus of HighResMIP is on the 1950-2050 period (Tier 2). This period includes significant past changes and the time horizon for the future is relevant for decision makers.

- The division of the AMIP runs in Tier 1 and Tier 2 is to enable that NWP centers can participate. Also to open the possibility for end of the century simulations .

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Institution	MO NCAS	KNMI IC3 CNR SMHI	CERFACS	MPI	AWI	CMCC	ECMWF
Model	MetUM NEMO	EcEarth NEMO	Arpege NEMO	ECHAM MPION	ECHAM FESOM	CCESM NEMO	IFS NEMO
Atmos. Res.	60-25 km	T255-799	T127-359	T63-255	T63-255	100-25km	T319-799
Ocean Res.	¼ °	¼ °	¼ °	0.4-¼ °	1-¼ ° Spat. Var.	¼ °	¼ °
Nodes	7834	2500	2000	6000		2000	
Model throughput Model years/day	1.1	3.0	5.0	6.5		0.5	
Core hours/model year	1710E+2	200E+2	96E+2	221E+2		960E+2	
Computer	Archer Cary	Cray Beslow	Bull	Bull		Sandy Bridge	
Archer Equivalent CPU cost per 100 yr (M c.h.)	17.09	3.75	1.22	6.19		13.80	
Data archive per 100 yr	155	39	85	225		91	

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Progress of model development

Institution	MO NCAS	KNMI IC3 CNR SMHI	CERFACS	MPI	AWI	CMCC	ECMWF
Model	MetUM NEMO	EcEarth NEMO	Arpege NEMO	ECHAM MPION	ECHAM FESOM	CCESM NEMO	IFS NEMO
Status coupled	Start testing	Start tuning Spring 2016	Start tuning spring	Tuning phase started			high res autumn 2016

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Issues

Technical

- Are the models ready in time?
- Are there sufficient computer resources to do the promised simulations?
  If not alternative solutions? (HiPRACE)
- Data storage and post processing
  HighResMIP, CMIP6 data requests
  JASMIN platform

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Issues

Scientific

Tuning

- Goal of HighResMIP is to investigate impact of increased resolution
- No tuning unless necessary (unrealistic large biases, etc). Changes should be documented
- Malcolm “It is not a beauty contest”

Forcing fields

- *SST-Sea Ice*. Daily high resolution ~0.25 produced by Met-Office. Still in development
- *Aerosols* concentrations, in line with CMIP6 protocol (RFMIP/Bjorn Stevens). Not yet ready
- *Land-surface* Climatological fields, seasonal cycle
- *Greenhouse gases* in line with CMIP6

Will these forcings be available in time?

PRIMAVERA should follow HighResMIP protocol

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Issues

Scientific

Ocean initialization

Different options

1. EN4 initial state (~1920) and short spin-up (Preferred option)
2. Ocean condition of historical DECK simulation
3. Use low resolution initial state

- Do we allow different choices?
- Need to test different options

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Relation to CMIP6

- High resolution runs are too expensive for the DECK runs
- Standard resolution version should do the DECK runs
- For the HighResMIP it is agreed that if the standard runs are not possible (because of lack of coupled model), results are visible as HighResMIP and not as CMIP6
- HighResMIP paper will appear in Geophysical Model Development (GMD) Submission date: March 15, 2016
  First draft in dropbox. Rein Haarsma and Malcolm Roberts are leading this. Co- authors are invited to contribute.

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PRIMAVERA, HighResMIP and HiPRACE

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Components (1):

- **PRIMAVERA**: the EU-H2020 scientific consortium
- **HighResMIP**: the CMIP6 protocol delivered by PRIMAVERA.
  - Subscribed by an international set of institutions, larger than the PRIMAVERA consortium

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Components (2):

- **HiPRACE**: a proposal to PRACE, led by IS-ENES2, to secure:
  - TIER-0 resources to enable HighResMIP (and possibly DCCP):
    - Order of **1 billion core hours over three years**
    - Select national facilities will likely provide equivalent amounts for individual efforts
  - Coordinated access and exploitation
  - Timely delivery to CMIP6 and publication for IPCC AR6

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Key questions

- Why HiPRACE? What could / should be done on national (TIER-1) facilities and why is 3-year access to TIER-0 required?
  - Ability to work together in a more coordinated and timely fashion
  - Go beyond minimal PRIMAVERA/HighResMIP requirements and ensure robustness of results
- Is the timing right?
  - Unless we start in Spring 2016, we will not meet the CMIP6 deadlines
- How can we match the time lines of WGCM with those of PRIMAVERA and those of PRACE?
  - Example: PRACE-2 only signed in Spring 2016…

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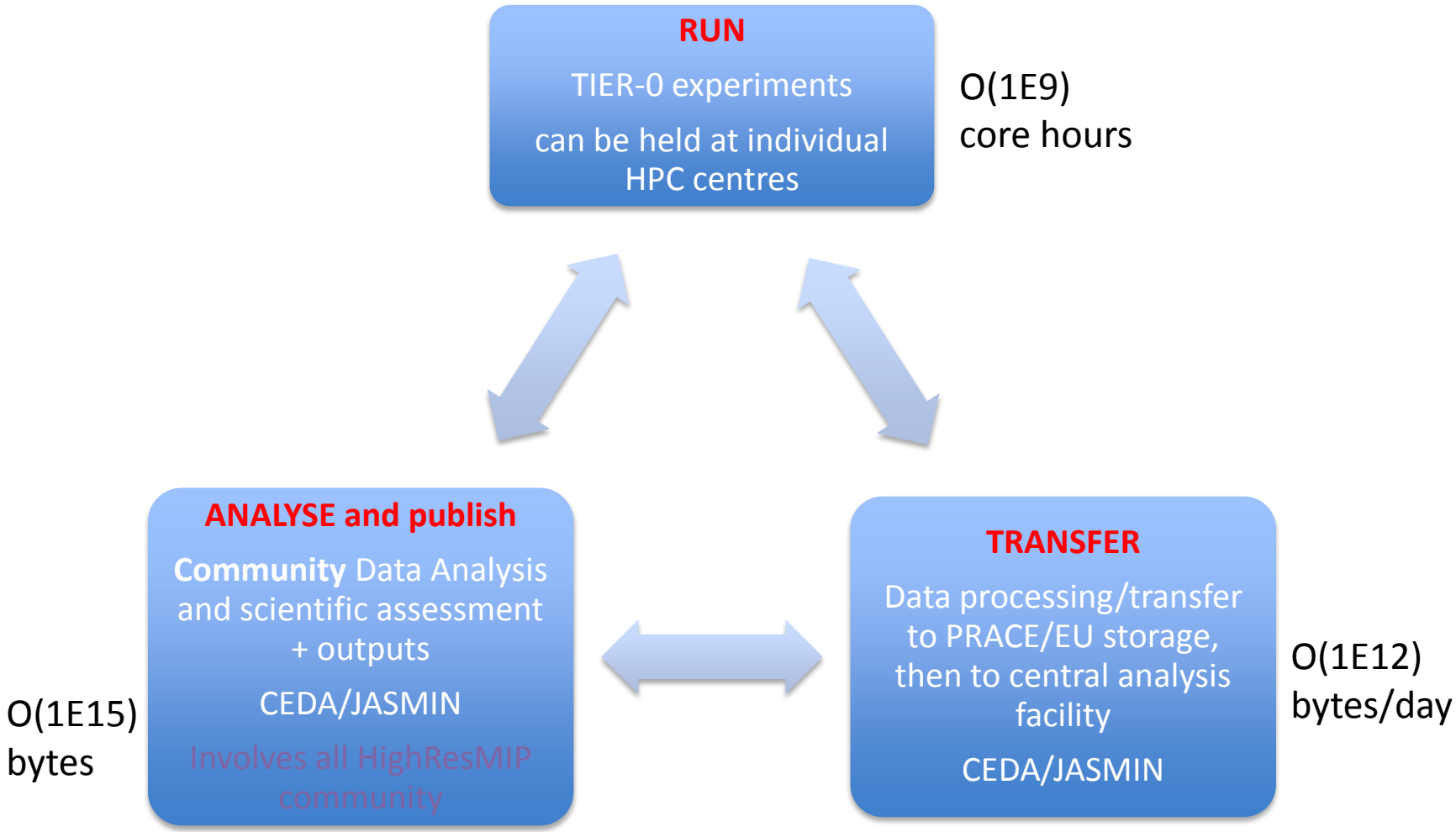
Resources needed to go from HPC to scientific outputs:

Working together to jointly exploit the PRIMAVERA/HighResMIP ensembles



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Time line: start with IPCC AR6 and work backwards

Currently collecting information on model performance and turnaround in order to plan start dates and delivery/avalability dates

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Supporting Theme 4: WP9

(and everyone else)

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WP9: HPC and data management (I)

- Plan HPC resources required and identify shortfalls (not provide HPC)
- Manage data
  - Arrange facilities and resources
  - Write Data Management Plan
  - Support data transfer (with WP6)
  - Data format and conversion procedures

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WP9: HPC and data management (II)

- Support you
  - Training on getting the most out of JASMIN
- Publish data sets (data DOIs & ESGF access)
- Support Open Research Data Pilot and Plan for Dissemination and Exploitation
- Review data management strategy & methods

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