

DynVarMIP data availability
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DynVarMIP data are available as part of the CMIP6 dataset via the Earth System Grid Federation (ESGF) data portals (<https://esgf-node.llnl.gov/search/cmip6/>). The information provided below is based on the analysis of ESGF made in May 2021. DynVarMIP requested output from the four DECK experiments (AMIP, piControl, abrupt4xCO2, pctCO2), historical, the high emission scenario (ssp585) as well as three Cloud Feedback Model Intercomparison Project (CFMIP) experiments (amip-4xCO2, amip-future4K, amip-p4K). While some of the models provided DynVarMIP diagnostics also for other experiments, this analysis is focused on the above mentioned experiments only.

1. EP-flux and residual circulation diagnostics

EP-flux diagnostics include three variables: meridional (epfy) and vertical (epfz) components of the EP-flux as well as the zonal mean zonal wind tendency due to the EP-flux divergence (utendepfd). Residual meridional circulation diagnostics include Transformed Eulerian Mean (TEM) meridional (vtem) and vertical (wtem) wind components as well as the TEM mass streamfunction (psitem). The data are provided as daily mean (EdayZ) and monthly mean (EmonZ) zonal mean values at an increased number of vertical levels (39 levels). Models that provided these data are listed in Table 1. Note that most models provided data only for several of the requested experiments. Data for the historical experiment is provided by most of the listed models, while data for the CFMIP experiment is only provided by few models.

Table 1: EP-flux and residual circulation diagnostics. These are zonal mean variables on the plev39 grid.

Model name	epfy & epfz		vtem & wtem		utendepfd		psitem
	EdayZ	EmonZ	EdayZ	EdayZ	EdayZ	EmonZ	EdayZ
CESM2	X	X	X	X	X	X	X
CESM2-WACCM	X	X	X	X	X	X	X
CanESM5	X	X	X	X	X	X	X
CanESM5-CanOE		X		X		X	
GFDL-CM4	X	X	X	X	X	X	X
GFDL-ESM4	X	X	X	X	X	X	X
GISS-E2-1-G		X		X		X	
GISS-E2-1-H		X		X*		X	
GISS-E2-2-G		X		X*			
HadGEM3-GC31-LL	X	X	X	X	X	X	
HadGEM3-GC31-MM	X	X	X	X	X	X	
INM-CM4-8	X	X					
INM-CM5-0	X	X					
IPSL-CM6A-LR					X		X
MIROC6	X	X	X	X	X	X	X
MRI-ESM2-0	X	X	X	X	X	X	X
UKESM1-0-LL	X	X	X	X	X	X	

* only vtem (EmonZ)

Note that a number of other models, or model versions, (GISS-E2-1-G-CC, HadGEM3-GC31-HH, HadGEM3-GC31-LM, HadGEM3-GC31-MH, INM-CM5-H, MRI-AGCM3-2-H, MRI-AGCM3-2-S, NorESM2-LM, TaiESM1) provided these diagnostics for several other experiments, but these are not included in the table.

2. Wind tendencies

In addition to the zonal mean wind tendency due to EP-flux divergence (see Table 1), other terms of the momentum budget are requested. These include the tendency of eastward winds due to orographic (*utendogw*) and non-orographic gravity waves (*utendnogw*), the tendency of northward wind due to orographic (*vtendogw*) and non-orographic gravity waves (*vtendnogw*), as well as the tendency of eastward wind due to TEM northward (*utendvtem*) and vertical (*utendwtem*) wind advection and the Coriolis term. The availability of these data for the DynVarMIP requested experiments is listed in Table 2.

Table 2: Zonal mean eastward and northward wind tendencies. These are zonal mean variables on the plev39 grid.

Model name	utendnogw		utendogw	vtendnogw	vtendogw	utendvtem	utendwtem
	EdayZ	EmonZ	EdayZ	EmonZ	EmonZ	EdayZ	EdayZ
CESM2			X			X	X
CESM2-FV2			X				
CESM2-WACCM	X	X	X			X	X
CESM2-WACCM-FV2	X	X	X				
CanESM5			X		X	X	X
GFDL-CM4	X		X		X	X	X
GFDL-ESM4	X		X		X	X	X
HadGEM3-GC31-LL	X	X	X				
HadGEM3-GC31-MM	X	X	X				
INM-CM4-8	X	X	X				
INM-CM5-0	X	X	X				
IPSL-CM5A2-INCA			X		X		
IPSL-CM6A-LR	X	X	X	X	X	X	X
MIROC6	X		X			X	X
MRI-ESM2-0	X		X			X	X
UKESM1-0-LL	X	X	X				

In addition to the zonal mean wind tendencies, 3-D monthly mean zonal mean tendencies were requested. Due to the large data volumes, these data are requested on the standard pressure levels (19 levels).

Table 3: 3-D monthly mean wind tendencies due to orographic and non-orographic gravity waves on the plev 19 grid.

Model name	utendnogw	utendogw	vtendnogw	vtendogw
	Emon	Emon	Emon	Emon
CESM2		X		
CESM2-FV2		X		
CESM2-WACCM	X	X		
CESM2-WACCM-FV2	X	X		
CNRM-CM6-1	X	X		
CNRM-ESM2-1	X	X		
CanESM5		X		X
CanESM5-CanOE		X		X
GFDL-CM4	X	X	X	X
GFDL-ESM4	X	X	X	X
HadGEM3-GC31-LL		X		
HadGEM3-GC31-MM		X		
IPSL-CM5A2-INCA		X		X
IPSL-CM6A-LR	X	X	X	X

MIROC-ES2L		X		
MRI-ESM2-0	X	X		
UKESM1-0-LL		X		

3. Age of air

Age of air (meanage) is a diagnostic crucial for the analysis of stratospheric transport and the Brewer-Dobson circulation. The diagnostic (Table 4) is provided as monthly mean zonal mean values (AERmonZ) on 39 pressure levels.

Table 4: Age of air

Model name	historical	piControl	1pctCO2	abrupt-4xCO2	ssp585	amip
CNRM-ESM2-1	X	X	X	X	X	X
GFDL-ESM4	X	X	X	X	X	X
MPI-ESM-1-2-HAM		X	X			
MRI-ESM2-0	X				X	
UKESM1-0-LL	X	X	X	X	X	X

Some of these models plus CESM2-WACCM also provide data for other experiments, not requested by DynVarMIP.

4. Surface momentum budget

DynVarMIP requested to archive parameterized zonal (tauu) and meridional (tauv) surface stresses as well as the components of the total stress due to mixing within the boundary layer (tauupbl and tauvpbl) (Table 5). These diagnostics were requested as monthly mean values; however only a few models provided tauupbl and tauvpbl diagnostics, and these are only available as daily values.

Table 5: Surface stresses

Model name	tauu	tauv	tauupbl	tauvpbl
	Amon	Amon	Eday	Eday
ACCESS-CM2	X	X		
ACCESS-ESM1-5	X	X		
AWI-CM-1-1-MR	X	X		
AWI-ESM-1-1-LR	X	X		
BCC-CSM2-MR	X	X		
BCC-ESM1	X	X		
CAMS-CSM1-0	X	X		
CAS-ESM2-0	X	X		
CESM2	X	X	X	X
CESM2-FV2	X	X	X	X
CESM2-WACCM	X	X	X	X
CESM2-WACCM-FV2	X	X	X	X
CIesm	X	X		
CMCC-CM2-HR4	X	X		
CMCC-CM2-SR5	X	X		
CMCC-ESM2	X	X		
CNRM-CM6-1	X	X		
CNRM-CM6-1-HR	X	X		
CNRM-ESM2-1	X	X		

CanESM5	X	X		
CanESM5-CanOE	X	X		
E3SM-1-0	X	X		
E3SM-1-1	X	X		
E3SM-1-1-ECA	X	X		
EC-Earth3	X	X		
EC-Earth3-AerChem	X	X		
EC-Earth3-CC	X	X		
EC-Earth3-LR	X	X		
EC-Earth3-Veg	X	X		
EC-Earth3-Veg-LR	X	X		
FGOALS-f3-L	X	X		
FGOALS-g3	X	X		
FIO-ESM-2-0	X	X		
GFDL-AM4	X	X		
GFDL-CM4	X	X		
GFDL-ESM4	X	X		
GISS-E2-1-G	X	X		
GISS-E2-1-G-CC	X	X		
GISS-E2-1-H	X	X		
GISS-E2-2-G	X	X		
HadGEM3-GC31-LL	X	X	X	X
HadGEM3-GC31-MM	X	X	X	X
IITM-ESM	X	X		
INM-CM4-8	X	X		
INM-CM5-0	X	X		
IPSL-CM5A2-INCA	X	X		
IPSL-CM6A-LR	X	X		
IPSL-CM6A-LR-INCA	X	X		
KACE-1-0-G	X	X		
KIOST-ESM	X	X		
MCM-UA-1-0	X	X		
MIROC6	X	X		
MIROC-ES2H	X	X		
MIROC-ES2L	X	X		
MPI-ESM-1-2-HAM	X	X		
MPI-ESM1-2-HR	X	X		
MPI-ESM1-2-LR	X	X		
MRI-ESM2-0	X	X		
NESM3	X	X		
NorCPM1	X	X		
NorESM1-F	X	X		
NorESM2-LM	X	X		
NorESM2-MM	X	X		
SAM0-UNICON	X	X		
TaiESM1	X	X		
UKESM1-0-LL	X	X	X	X

5. Thermal budget

DynVarMIP also requested parameterized temperature tendencies due to various physical processes. These include: tendency of air temperature due to model physics (tntmp), tendency of air temperature due to all-sky longwave (tntrl) and shortwave (tntrs) heating, tendency of air temperature due to clear-sky longwave (tntrlcs) and shortwave (tntrscs) heating, tendency of air temperature due to convection (tntc), tendency of air temperature due to stratiform clouds and precipitation (tntscp), and tendency of air temperature due to orographic (tntogw) and non-orographic (tntogw) gravity wave dissipation. The variables are requested as zonal mean

monthly mean values on a higher number of vertical levels (plev 39 levels). Models that archived the requested temperature tendencies are listed in Table 6.

Table 6: Temperature tendencies due to parameterized processes

Model name	tntmp	tntrl&tntrs	tntrcls&tnttrscs	tntc	tntscp	tntnogw	tntogw
	EmonZ	EmonZ	EmonZ	EmonZ	EmonZ	EmonZ	EmonZ
AWI-ESM-1-1-LR	X	X		X	X		
CESM2	X	X	X				X
CESM2-FV2	X	X	X				X
CESM2-WACCM	X	X	X			X	X
CESM2-WACCM-FV2	X	X	X			X	X
GFDL-CM4	X	X	X	X	X	X	X
GFDL-ESM4	X	X	X	X	X	X	X
INM-CM4-8	X	X		X	X	X	X
INM-CM5-0	X	X		X	X	X	X
IPSL-CM5A2-INCA	X	X	X	X	X		X
IPSL-CM6A-LR	X		X	X	X		X
IPSL-CM6A-LR-INCA	X			X			
MIROC6	X		X	X	X		
MIROC-ES2L	X		X	X			
MPI-ESM-1-2-HAM	X	X		X	X		
MPI-ESM1-2-LR	X	X		X	X		

We encourage researchers interested in the atmospheric circulation and its future changes to benefit from the opportunity provided by the availability of DynVarMIP data and to actively use them. If you are interested in using the data or have published an article using the data, please let us know. Contact persons:

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More information about the project, as well as its current status, can be found from

DynVarMIP's web-site: <https://dynvarmip.github.io/>

Reference:

Gerber, E. P. and E. Manzini, 2016: The Dynamics and Variability Model Intercomparison Project (DynVarMIP) for CMIP6: Assessing the stratosphere–troposphere system, *Geosci. Model Dev.*, **9**, 3413–3425, doi:10.5194/gmd-9-3413-2016.”