4. Usage of the d4PDF database

See the "Additional Information" section at the beginning of section 4.4 and 4.5 for the Global Spectal Model (GCM) and Regional Spectral Model (RCM), respectively, for information on correcting errors and supplementing data for the global and regional models.

4.1 Experiment title (GCM and RCM)

HPB_mNNN	historical climate simulation: (1950-2011)
HPB_NAT_mNNN (GCM only)	non-warming simulation: (1951-2010)
HFB_4K_XX_mNNN ~ HFB_4K_XX_mNNN	+4K future climate simulation: (61 yr)

mNNN: Ensemble number. The number of members of the past experiment different in GCM and RCM.

GCM is 100 members of NNN = 001-100, and RCM is 50 members of NNN = 001-010, 021-030, 041-050, 061-070, 081-090. About +4K future climate simulation, it is 6 sets (XX=CC/GF/HA/MI/MP/MR) of 15 members (NNN=101-105),for a total of 90 members. Non-warming simulation (GCM only) is 100 member(NNN-001-100).

XX: The symbol representing the CMIP5 climate model used to create the sea surface temperatures given to the model.

CC = CCSM4, GF = GFDL-CM3, HA = HadGEM2-AO, MI = MIROC5, MP =MPI-ESM-MR, MR = MRI-CGCM3.

4.2 The period of data

- GCM

  historical climate simulation: 1951/01/01 – 2011/12/31

  non-warming simulation: 1951/01/01 – 2010/12/31

  +4K future climate simulation:2051/01/01 – 2111/12/31 (*1)

- RCM

  historical climate simulation: 1950/09/01 – 2011/08/31

  +4K future climate simulation:2050/09/01 – 2111/08/31 (*1), (*2)

(*1) The year of +4K future climate simulation are just for convenience.

(*2) RCM was integrated for 408 days (409 days in a leap year) of each year (from 7/20 00UTC to 9/1 00UTC). About the atmospheric 3D data, the data for the entire integration period are saved. The data for August are for the next year (not the current year), and therefore, the integration period from August 31 to September 1 is discontinuous (in the sense that the integration is not continuous).

4.3 Data composition/volume

- GCM (741 TiB)

simulation	volume
historical climate simulation (HPB _mNNN)	257TiB
non-warming simulation (HPB_NAT_mNNN)	253TiB
+4K future climate simulation HFB_4K_XX_mNNN	231TiB

- RCM (647 TiB)

simulation	volume
historical climate simulation (HPB _mNNN)	231TiB
+4K future climate simulation HFB_4K_XX_mNNN	416TiB

The total data volume (GCM + RCM) is 1388TiB (1526TB).

4.4 GCM

Additional information

2018/11/15

We have confirmed that the following files are corrupt, as indicated by the user.

Replaced it with the correct file.

- HPB_m026
  atm_24levs_snp_12hr_2.5deg_HPB_m026_198508.dr
- HPB_m081
  atm_24levs_snp_12hr_2.5deg_HPB_m081_198608.dr
- HFB_4K_MI_m106
  atm_24levs_snp_12hr_2.5deg_HFB_4K_MI_m106_210611.dr
- HFB_4K_MP_m115
  atm_24levs_snp_12hr_2.5deg_HFB_4K_MP_m115_210307.dr

2017/09/26:

We have confirmed that the following files are corrupt, as indicated by the user.

Replaced it with the correct file.

- HFB_4K_GF_m101
  atm_anp_6hr_1.25deg_HFB_4K_GF_m101_210012.dr
  atm_anp_6hr_2byte_HFB_4K_GF_m101_210012.dr
- HFB_4K_HA_m114
  sfc_snp_6hr_2byte_HFB_4K_HA_m114_205904.dr

- HFB_4K_MI_m112
  atm_snp_6hr_1.25deg_HFB_4K_MI_m112_210905.dr
  atm_snp_6hr_2byte_HFB_4K_MI_m112_210905.dr
- HFB_4K_MP_m104
  atm_snp_6hr_1.25deg_HFB_4K_MI_m112_210307.dr
  sfc_snp_6hr_2byte_HFB_4K_MI_m112_210307.dr
- HFB_4K_MP_m113
  atm_snp_6hr_1.25deg_HFB_4K_MP_m113_205704.dr
  atm_snp_6hr_2byte_HFB_4K_MP_m113_205704.dr
- HFB_4K_MP_m115
  atm_snp_6hr_1.25deg_HFB_4K_MP_m115_210307.dr
  atm_snp_6hr_2byte_HFB_4K_MP_m115_210307.dr
- HFB_4K_MR_m102
  atm_snp_6hr_1.25deg_HFB_4K_MR_m102_207108.dr
  atm_snp_6hr_2byte_HFB_4K_MR_m102_207108.dr
  sfc_snp_6hr_2byte_HFB_4K_MR_m102_207108.dr
- HPB_m027
  atm_snp_6hr_1.25deg_HPB_m027_199801.dr
  atm_snp_6hr_2byte_HPB_m027_199801.dr
- HPB_m036
  atm_snp_6hr_1.25deg_HPB_m036_198712.dr
  atm_snp_6hr_2byte_HPB_m036_198712.dr
- HPB_m063
  sfc_snp_6hr_2byte_HPB_m063_198210.dr
- HPB_m081
  atm_snp_6hr_1.25deg_HPB_m081_198608.dr
  atm_snp_6hr_2byte_HPB_m081_198608.dr

4.4.1 The name of GCM data format and file

file name	format	note
atm_24levs_snp_12hr_2.5deg_XXX_yyyymm.dr	B	*1,*4,*8,*11
atm_avr_mon_1.25deg_XXX_yyyymm.dr	B	*1,*3,*10,*11
atm_snp_6hr_1.25deg_XXX_yyyymm.dr	B	*1,*4,*8,*11
atm_snp_6hr_2byte_XXX_yyyyymm.dr	C	*1,*4,*8,*14

atm_zonal_avr_mon_XXX_yyyymm.grib	A	*1,*3,*6,*10
epflux_avr_day_XXX_yyyymm.grib	A	*3,*6,*9
precipi_avr_1hr_XXX_yyyymm.grib	A	*3,*7,*8
sfc_avr_3hr_XXX_yyyymm.grib	A	*2,*3,*8
sfc_avr_6hr_1.25deg_XXX_yyyymm.dr	B	*2,*3,*8,*11
sfc_avr_day_XXX_yyyymm.grib	A	*2,*3,*9
sfc_avr_mon_XXX_yyyymm.grib	A	*2,*3,*10
sfc_japan_avr_1hr_XXX_yyyymm.grib	A	*2,*3,*8,*13
sfc_max_day_XXX_yyyymm.grib	A	*2,*5,*9
sfc_min_day_XXX_yyyymm.grib	A	*2,*5,*9
sfc_snp_6hr_2byte_XXX_yyyymm.dr	C	*2,*4,*8,*14
sfc_souseid_avr_day_XXX_yyyymm.grib	A	*2,*3,*9,*12
TopogRatiol_gsmuv_TL319.gd	B	common

File name

XXX= XXX = name of the experiment; HPB_mNNN = past experiment, HPB_NAT_mNNN = past non-warming experiment, HFB_4K_XX = future 4°C warming experiment, XX is the symbol for the CMIP5 climate model used to generate the SST data given to the model, where CC = CCSM4 and GF = GFDL-CM3, HA = HadGEM2-AO, MI = MIROC5, MP = MPI-ESM-MR, MR = MRI-CGCM3. mNNN is the ensemble number. NNN = 001~100 for past experiments and past non-warming experiments, and NNN = 101~115 for future 4-degree warming experiments, 6 sets of 15 members, for a total of 90 members.

yyyymm = year and month (ex: 195101)

*1: atm = atmospheric 3D data

*2: sfc = 2D data (surface, top of model atmosphere, and vertical integration)

*3: avr = average

*4: snp = Instantaneous values

*5: max / min = Daily highest/lowest values

*6: zonal / epflux = Global Average zonal Values

*7: precipi = precipitation data only

*8: Xhr = X hourly instantaneous value (for snp), X hourly average value (for avr). X = 1 / 3 /6 / 12

*9: day = Daily average (for avr), daily maximum/lowest (for max/min)

*10: mon = Monthly average

*11: 1.25deg or 2.5deg = Interpolated on a 1.25-degree (288 x 145) / 2.5-degree grid (144 x

73) against the original model grid.

*12: souseid = For SOUSEI D

*13: japan = Japan-area only

*14: 2byte = 16bit Signed-integer binary format

File format

A = grib1

B = 32bit real binary format (bite orders: big endian)

C = 16bit Signed-integer binary format (bite orders: big endian)

4.4.2. The variables list of GCM (Model resolution = approx. 0.5625 degrees, no. of grids 640 x 320, unless otherwise noted for horizontal resolution.)

- atm_24levs_snp_12hr_2.5deg_XXX_yyyymm.dr

  content: 12-hour instantaneous atmospheric 3D data (horizontal resolution: 2.5 degrees)

  vertical level (24 layers): 1000 / 925 / 850 / 700 / 600 / 500 / 400 / 300 / 250 / 200 / 150 / 100/ 70 / 50 / 30 / 20 / 15 / 10 / 7 / 5 / 3 / 2 / 1 / 0.5 hPa

variables	contents	unit
U	Zonal Velocity	m/s
V	Meridional Velocity	m/s
T	Temperature	K
Z	Geopotential (*1)	m^2/s^2
OMEGA	Vertical Pressure Velocity	Pa/s

- atm_avr_mon_1.25deg_XXX_yyyymm.dr

  contents: Monthly average atmospheric 3D data (horizontal resolution: 1.25 degrees)

  vertical level (24 layers): 1000 / 925 / 850 / 700 / 600 / 500 / 400 / 300 / 250 / 200 / 150 / 100/ 70 / 50 / 30 / 20 / 15 / 10 / 7 / 5 / 3 / 2 / 1 / 0.5 hPa

variables	contents	unit
U	Zonal Velocity	m/s
V	Meridional Velocity	m/s
OMEGA	Vertical Pressure Velocity	Pa/s
Z	Geopotential (*1)	m^2/s^2
T	Temperature	K
Q	Specific Humidity	kg/kg
RH	Relarive Humidity	%

CVR	Cloud Cover	%
CWC	Cloud Water Content	kg/kg
RSHRT	Heating due to Short Wave Radiation	K/s
RLONG	Heating due to Long Wave Radiation	K/s
QU	time average of Q×U	kg/kg m/s
QV	time average of Q×V	kg/kg m/s
OZON	Ozone	ppmv
UU	time average of U×U	m^2/s^2
VV	time average of V×V	m^2/s^2
UV	time average of U×V	m^2/s^2
WMSK	Mountain Mask	0–1

- atm_snp_6hr_1.25deg_XXX_yyyymm.dr

  contents: 6-hour instantaneous atmospheric 3D data (horizontal resolution: 1.25 degrees)

  vertical level (12 layers): 1000 / 925 / 850 / 700 / 600 / 500 / 400 / 300 / 250 / 200 / 150 / 100 hPa

variables	contents	unit
U	Zonal Velocity	m/s
V	Meridional Velocity	m/s
T	Temperature	K
Q	Specific Humidity	kg/kg
Z	Geopotential (*1)	m^2/s^2
OMEGA	Vertical Pressure Velocity	Pa/s
CWC	Cloud Water Content	kg/kg

- atm_snp_6hr_2byte_XXX_yyyymm.dr

  contents: 6-hour instantaneous atmospheric data (specific level only)

Variables	contents	unit
U850	Zonal Velocity at 850hPa (*2)	m/s
U700	Zonal Velocity at 700hPa (*2)	m/s
U500	Zonal Velocity at 500hPa (*2)	m/s
U300	Zonal Velocity at 300hPa (*2)	m/s
V850	Meridional Velocity at 850hPa (*2)	m/s
V700	Meridional Velocity at 700hPa (*2)	m/s
V500	Meridional Velocity at 500hPa (*2)	m/s

V300	Meridional Velocity at 300hPa (*2)	m/s
T850	Temperature at 850hPa (*3)	K
T700	Temperature at 700hPa (*3)	K
T500	Temperature at 500hPa (*3)	K
T300	Temperature at 300hPa (*3)	K
OMG700	Vertical Pressure Velocity at 700hPa (*4)	Pa/s
OMG500	Vertical Pressure Velocity at 500hPa (*4)	Pa/s

- atm_zonal_avr_mon_XXX_yyyymm.grib

  contents: Monthly average zonal wind mean atmospheric 3D data

  vertical level (24 layers): 1000 / 850 / 700 / 600 / 500 / 400 / 300 / 250 / 200 / 150 / 100 / 70 / 50 / 30 / 20 / 15 / 10 / 7 / 5 / 3 / 2 / 1 / 0.5 hPa

variables	contents	unit
U	Zonal Velocity	m/s
V	Meridional Velocity	m/s
OMEGA	Vertical Pressure Velocity	Pa/s
Z	Geopotential (*1)	m^2/s^2
T	Temperature	K
Q	Specific Humidity	kg/kg
RH	Relarive Humidity	%
CVR	Cloud Cover	%
CWC	Cloud Water Content	kg/kg
RSHRT	Heating due to Short Wave Radiation	K/s
RLONG	Heating due to Long Wave Radiation	K/s
QU	time average of Q×U	kg/kg m/s
QV	time average of Q×V	kg/kg m/s
OZON	Ozone	ppmv
UU	time average of U×U	m^2/s^2
VV	time average of V×V	m^2/s^2
UV	time average of U×V	m^2/s^2
WMSK	Mountain Mask	0–1

- epflux_avr_day_XXX_yyyymm.grib

  contents: Daily average zonal wind mean atmospheric 3D data

  vertical level (24 layers): 1000 / 850 / 700 / 600 / 500 / 400 / 300 / 250 / 200 / 150 / 100

/ 70 / 50 / 30 / 20 / 15 / 10 / 7 / 5 / 3 / 2 / 1 / 0.5 hPa

variables	contents	unit
U	Zonal Velocity	m/s
V	Meridional Velocity	m/s
T	Temperature	K
OMEGA	Vertical Pressure Velocity	Pa/s
UT	time average of U×V	m^2/s^2
VT	time average of V×T	K m/s
WU	time average of OMEGA×U	Pa/s m/s
U_V	(time average of U) × (time average of V)	m^2/s^2
V_T	(timeaverage of V) × (time average of T)	m^2/s^2
W_U	(time average of OMEGA) × (time average of U)	Pa/s m/s

- precipi_avr_1hr_XXX_yyyymm.grib

  contents: 1-hour average precipitation data

variables	contents	unit
PRECIPI	Total Precipitation	$kg/m^2/s$

- sfc_avr_3hr_XXX_yyyymm.grib

  contents: 3-hour average 2D data

value	contents	units
ROF	Total Runoff	$kg/m^2/s$
ROFS	Surface Runoff	$kg/m^2/s$

- sfc_avr_6hr_1.25deg_XXX_yyyymm.dr

  contents: 3-hour average 2D data (horizontal resolution: 1.25 degrees)

value	contents	units
PRECIPI	Total Precipitation	$kg/m^2/s$
PPCI	Convective Precipitation	$kg/m^2/s$
FLSH	Sensible Heat Flux	W/m^2
FLLH	Latent Heat Flux	W/m^2
ULWT	OLR (Upward Longwave Radiation at the Top)	W/m^2

- sfc_avr_day_XXX_yyyymm.grib

  contents: Daily average 2D data

value	contents	units
TA	Surface Air Temperature at 2m	K
PRECIPI	Total Precipitation	$kg/m^2/s$

- sfc_avr_mon_XXX_yyyymm.grib

  contents: Monthly average 2D data

value	contents	units
TA	Surface Air Temperature at 2m	K
TGEF	Effective Ground temperature (Radiation)	K
SLP	Sea Level Pressure	Pa
PS	Surface Pressure	Pa
UA	Surface Zonal Velocity at 10m	m/s
VA	Surface Merid. Velocity at 10m	m/s
WIND	Surface Air Wind Speed at 10m	m/s
RHA	Surface Air Relative Humidity at 2m	%
QA	Surface Air Specific Humidity at 2m	kg/kg
PRECIPI	Total Precipitation	$kg/m^2/s$
SNP	Snow Precipitation	$kg/m^2/s$
PPCI	Convective precipitation	$kg/m^2/s$
EVSPS	Water Vapor Flux	$kg/m^2/s$
UMOM	Momentum Fux (X)	N/m^2
VMOM	Momentum Flux (Y)	N/m^2
FLLH	Latent Heat Flux	W/m^2
FLSH	Sensible Heat Flux	W/m^2
DLWB	Surface Downward Longwave Radiation	W/m^2
ULWB	Surface Upward Longwave Radiation	W/m^2
DSWB	Surface Downward Shortwave Radiation	W/m^2
USWB	Surface Upward Shortwave Radiation	W/m^2
CSDSWB	Surface Downward Shortwave Radiation (Clear Sky)	W/m^2
CSUSWB	Surface Upward Shortwave Radiation (Clear Sky)	W/m^2
CSDLWB	Surface Downward Longwave Radiation (Clear Sky)	W/m^2
DSWT	Downward Shortwave Radiation at the Top	W/m^2
USWT	Upward Shortwave Radiation at the Top	W/m^2
ULWT	OLR (Upward Longwave Radiation at the Top)	W/m^2
CSULWT	OLR clear sky (Upward Longwave Radiation at the Top)	W/m^2

CSUSWT	Upward Shortwave Radiation at the Top (Clear Sky)	W/m^2
PWATER	Precipitable Water	kg/m^2
TCLOUD	Total Cloud Amount	%
TCWC	Total Cloud Water Content	kg/m^2
WSL010	H2O SOIL upper 10cm	kg/m^2
H2OSLT	H2O SOIL (total)	kg/m^2
ROFS	Surface Runoff	$kg/m^2/s$
ROF	Total Runoff	$kg/m^2/s$
EVDWVEG	Evap/Dew on Leaf (downward)	$kg/m^2/s$
EVDWSL	Evap/Dew on Soil (downward)	$kg/m^2/s$
TRNSL	Transpiration from Soil (downward)	$kg/m^2/s$
H2OSL1	H2O SOIL L1	kg/m^2
H2OSL2	H2O SOIL L2	kg/m^2
H2OSL3	H2O SOIL L3	kg/m^2
TMPSL1	TMP SOIL L1	K
TMPSL2	TMP SOIL L2	K
TMPSL3	TMP SOIL L3	K
TMPSL4	TMP SOIL L4	K
CVRSNWA	Snow Coverage	0–1
SWE	Snow water equivalent	kg/m^2
DEPSNW	Snow Depth * CVRSNWA	M
TMPSNW	TMP SNOW (vertical ave)* CVRSNWA	K
EVDWSN	Evap/Dew on Snow (downward)	$kg/m^2/s$
SN2SL	Snow Melt Water from Snow to Soil (downward)	$kg/m^2/s$
AICE	Area fraction of Sea Ice	%
YICE	Mass of Sea Ice	kg/m^2
YSNW	Mass of Snow on Sea Ice	kg/m^2
VINTQU	Zonal Component of Column Total Water Vapor Flux	kg/kg m/s Pa
VINTQV	Meridional Component of Column Total Water Vapor Flux	kg/kg m/s Pa
TOTALHP	Total Heating due to physics processes	W/m^2
TOTALHM	Total Heating due to moist process	W/m^2

- sfc_japan_avr_1hr_XXX_yyyymm.grib

contents: 1-hour average 2D data over Japan

value	contents	units
SLP	Sea Level Pressure	Pa
UAOPN	Surface Zonal Velocity at 10m at open space	m/s
VAOPN	Surface Merid. Velocity at 10m at open space	m/s
TA	Surface Air Temperature at 2m	K
QA	Surface Air Specific Humidity at 2m	kg/kg
DLWB	Surface Downward Longwave Radiation	W/m^2
DSWB	Surface Downward Shortwave Radiation	W/m^2
TCLOUD	Total Cloud Amount	%

- sfc_max_day_XXX_yyyymm.grib

  contents: Daily highest 2D data

value	contents	units
TA	Surface Air Temperature at 2m	K
RHA	Surface Air Relative Humidity at 2m	%
WIND	Surface Air Wind Speed at 10m	m/s

- sfc_min_day_XXX_yyyymm.grib

  contents: Daily lowest 2D data

value	contents	units
TA	Surface Air Temperature at 2m	K
RHA	Surface Air Relative Humidity at 2m	%

- sfc_snp_6hr_2byte_XXX_yyyymm.dr

  contents: 6-hour instantaneous value 2D data

value	contents	units
SLP	Sea Level Pressure (*5)	Pa
UAOPN	Surface Zonal Velocity at 10m at open space (*2)	m/s
VAOPN	Surface Meridional Velocity at 10m at open space (*2)	m/s
TA	Surface Air Temperature at 2m (*3)	K
QA	Surface Air Specific Humidity at 2m (*6)	kg/kg
PS	Surface Pressure (*7)	Pa
PRECIPI	Total Precipitation (*8)、(6-hour average)	$kg/m^2/s$

- sfc_souseid_avr_day_XXX_yyyymm.grib

  contents: daily average 2D data (mainly land surface)

value	contents	units
TMPGRD	Ground Temperature	K
WIND	Surface Air Wind Speed at 10m	m/s
RHA	Surface Air Relative Humidity at 2m	%
TCLOUD	Total Cloud Amount	%
FLLH	Latent Heat Flux	W/m^2
TRNSL	Transpiration from Soil (downward)	$kg/m^2/s$
EVPSL	Evaporation from bare Soil (exclude dew)	$kg/m^2/s$
PRCSL	Precipitation etc to Soil (downward)	$kg/m^2/s$
SN2SL	Snow Melt Water from Snow to Soil (downward)	$kg/m^2/s$
H2OSL1	H2O SOIL L1	kg/m^2
H2OSL2	H2O SOIL L2	kg/m^2
H2OSL3	H2O SOIL L3	kg/m^2
SWE	Snow Water Equivalent	kg/m^2

- TopogRatiol_gsmuv_TL319

  contents: Elevation and land distribution data (common to all experiments)

value	contents	units
height	Topography	m
ratio	Ratio of Land Area	0–1

(*1) Y = X/9.80665 (X:geopotential; Y:geopotential height)

(*2) Y=0.01*X (X:stored value; Y:Actual value)

(*3) Y=0.005*X+273.15 (X:stored value; Y:Actual value)

(*4) Y=0.001*X (X:stored value; Y:Actual value)

(*5) Y=X+100000 (X:stored value; Y:Actual value)

(*6) $Y=10^{-6}*X+0.02$ (X:stored value; Y:Actual value)

(*7) Y=X+75000 (X:stored value; Y:Actual value)

(*8) $Y=10^{-6}*X+0.03$ (X:stored value; Y:Actual value)

4.5 RCM

Additional information

2016/05/26:

It has been discovered that the pdef parameter is incorrect for the GrADS ctl files for all

grib1 format data except for the topo_essp20 topographic data. The work to correct the files was completed on **May 25, 2016 at 20:30,** so if you obtained the data before this, please correct the following pdef parameters before using them.

Due to this error, the data interpolated to the 0.2-degree lattice is shifted by one lattice when reading the data file by GrADS. Specifically, the pdef parameter of the ctl file is wrong as follows.

collect：pdef 191 155 LCCR 35 135 97 77 30 60 135 20000 20000

wrong：pdef 191 155 LCCR 35 135 96 78 30 60 135 20000 20000

(Note the difference between the sixth and seventh numbers)

This problem is caused by the GrADS ctl file, so the data file itself (and the GrADS idx file) is not a problem. If you have already performed some kind of analysis/conversion process using GrADS, you may need to recalculate your data because the spatial information of the output data is different from the original one. In this case, a user who downloaded the data pointed out the problem at the end of last year, but the information was not sufficiently shared among the people involved, and we are very slow to correct the mistake. I apologize for the delay in correcting the mistake.

2016/07/15:

An error was made in the description of time intervals in atmospheric 3D data: 1 hour is wrong, the correct value is 6 hours. The GrADS ctl file attached to the sample program also has the same error in the description of the time interval: "60mn" in the "tdef" line is wrong, the correct value is "6hr" (modified on 15/07/2016 19:59JST).

2016/07/19:

Added the explanation about period of data.

2016/07/21:

Corrected errors in xdef & ydef parameters for GrADS ctl files for HPB_m010 ground-air data, thermodynamically related 2D data, and soil-related data. The corrected ctl file is available at the following URL (20MB, valid until 08/31/2016).

https://mri-2.mri-jma.go.jp/owncloud/public.php?service=files&t=f377b880c956987e8d3452a344ac4500

2017/01/13：RCM +4K future climate simulation (HFB_4K)

For the soil-related data (sib_XXX_yyyymm.grib), it was discovered that the year 2100 was treated as a leap year, which resulted in not only an erroneous 2/29, but also a one-day shift in the data for the period 3/1~8/31, so we replaced it with the correct file. Affected files are the following files in the directory for the year 2099 for each experiment.

sib_XXX_210002.grib、sib_XXX_210002.idx

sib_XXX_210003.grib、sib_XXX_210003.idx

sib_XXX_210004.grib、sib_XXX_210004.idx

sib_XXX_210005.grib、sib_XXX_210005.idx

sib_XXX_210006.grib、sib_XXX_210006.idx

sib_XXX_210007.grib、sib_XXX_210007.idx

sib_XXX_210008.grib、sib_XXX_210008.idx

2017/04/21:

It was found that when using the pdef parameter in GrADS to draw wind vectors, they are not displayed correctly. There are two ways to solve this problem.

(1) Draw without using pdef

In this case, delete the PDEF line in the ctl file and set it to

XDEF=191, YDEF=155

For example, you can draw it by writing

XDEF 191 LINEAR 1 1

YDEF 155 LINEAR 1 1.

However, it does not match the latitude and longitude of GRADS.

(2) (Reference) Convert wind speed data into zonal wind and north-south wind, and draw them using pdef.

Conversion method of wind at each grid point (longitude: λ);

$$\begin{pmatrix} U \\ V \end{pmatrix} = \begin{pmatrix} cos\theta & sin\theta \\ -sin\theta & cos\theta \end{pmatrix} \begin{pmatrix} u \\ v \end{pmatrix}$$

$$\theta = (\lambda - \lambda_s)*n$$

$$n = \frac{\ln (cos\varphi_1 sec\varphi_2)}{\ln \left[\tan\left(\frac{1}{4}\pi - \frac{1}{2}\varphi_1\right) \cot\left(\frac{1}{4}\pi - \frac{1}{2}\varphi_2\right)\right]}$$

U: zonal wind speed (west wind is positive)

V: North-south wind speed (southerly wind is positive)

u: wind speed in x direction on the model

v: wind speed in y direction on the model

φ_1: 30°

φ_2: 60°

λ_s: 135°

2017/05/10:

Fixed an error found in the description of the variable USOLAR in the thermodynamics-related 2D data (ph2m_XXX_yyyymm.grib).

2017/06/28:

Corrected an error in the description of the unit of momentum in the atmospheric 3D data (XXX_yyyy_dx20_3d.data).

2017/09/20:

For thermodynamics-related 2D data (ph2m_XXX_yyyymm.grib), added description that soil saturation (W_G1, W_G2) cannot be used. (Because they contain initial values and are not time-varying.)

2017/11/06:

Added information on the placement of vertical layers in the atmospheric 3D data (Attachment 1)

2019/06/27:

The following is the conversion method from temperature anomaly (PT) and pressure anomaly (PRS) to temperature and pressure in the atmospheric 3D data.

How to convert to potential temperature

potential temperature [K] = PT + PTRF

PTRF = 300[K]

How to convert to atmospheric pressure

atmospheric pressure [Pa] = p_bar + PRS / $G^{1/2}$

p_bar = p00 * (PAIRF ** (C_p / R_d))

$G^{1/2}$ = 1 - Zs / H

Zs: height of ground

H: height of top of model

p00: 100000 [Pa]

PAIRF: can be obtained from DIAS

C_p: Constant pressure specific heat of air(1004 J/K/kg)

R_d: Gas constant for dry air (287 J/K/kg)

2019/11/13: **(NEW)**

There was a bug in the model that did not include the effect of sea ice in the model. In particular, there may have been an effect on the temperature and other parameters on the Sea of Okhotsk side of Hokkaido. We are currently investigating this effect.

4.5.1. Data format and data file name of RCM

variables	Contents	units
surf_XXX_yyyymm.grib	grib1	ground atmospheric data (*2)
ph2m_XXX_yyyymm.grib	grib1	thermodynamics related 2D data (*2)
sib_XXX_yyyymm.grib	grib1	soil related data (*2)
XXX_yyyy_dx20_3d.data	Original format (*1)	atmospheric 3d data
topo_essp20.dat	32bitreal binary	Latitude, Longitude, Elevation, Land Distribution

XXX = name of the experiment; HPB_mNNN = past experiment, HFB_4K_XX = future 4°C warming experiment, XX is the symbol for the CMIP5 climate model used to generate the SST data given to the model, where CC = CCSM4, GF = GFDL-CM3, HA = HadGEM2-AO, and MI = MIROC5, MP = MPI-ESM-MR, MR = MRI-CGCM3. mNNN is the ensemble number. For past experiments NNN = 001-010, 021-030, 041-050, 061-070, 081-090 for a total of 50 members, and for future 4-degree warming experiments NNN = 101-115 for a set of 6 sets of 15 members for a total of 90 members.

yyyymm = year & month(ex： 195101)

(*1) Sample programs are available. (section 4.7.)

(*2) Data from the initial time to Aug. 31 of the current year are not stored for ground atmospheric data, thermodynamic-related 2D data, and soil-related data. The data for August is for the following year, so there is a discontinuity between Aug. 31 and Sep. 1 (The integrals are not continuous).

(*3) As for the atmospheric 3D data, the data for the entire integration period (from 7/20 00UTC to 9/1 00UTC of the following year) is stored. As with other data, the data up to 8/31 of the current year is not used, but the data after 9/1 is used.

4.5.2. List of experimental variables in RCM

- surf_XXX_yyyymm.grib

contents: ground atmospheric data

timescale: 1 hour

variables	contents	units
SMQR	rain precipitation	mm/hour
SMQI	(cloud) ice precipitation	mm/hour
SMQS	Snow precipitation	mm/hour
SMQG	Graupel precipitation	mm/hour
SMQH	Hail precipitation (Not available: Hail is not predicted	mm/hour

	in this experiment)	
RAIN	precipitation	mm/hour
PSEA	mean-sea-level barometric pressure	hPa
PSURF	surface pressure	hPa
U	Wind speed in the x direction on the ground	m/s
V	Wind speed in the y direction on the ground	m/s
T	Ground temperature	K
TTD	Ground dew-point depression	K
CLL	cloud cover in low layer	0-1
CLM	cloud cover in middle layer	0-1
CLH	cloud cover in high layer	0-1
CLA	cloud cover in all layers	0-1
TPW	precipitable water	kg/m^2

- ph2m_XXX_yyyymm.grib

contents: thermodynamics related 2D data

timescale: 1 hour

variables	contents	units
W_G1 (**Unavailable**)	Saturation of the 1st layer of soil see saturation of soil related data (sib_XXX_yyyymm.grib)	0-1
W_G2 (**Unavailable**)	Saturation of the 2nd layer of soil see saturation of soil related data (sib_XXX_yyyymm.grib)	0-1
UFLSH	Upward flux of sensible heat	W/m^2
UFLLH	Upward flux of latent heat	W/m^2
URSDB	Downward shortwave flux at the ground surface	W/m^2
URSUB	Upward shortwave flux at the ground surface	W/m^2
URLDB	Downward longwave flux at the ground surface	W/m^2
URLUB	Upward longwave flux at the ground surface	W/m^2
URBEAM	Direct solar radiation flux in horizontal plane	W/m^2
URDIFF	Sky scattered radiation flux	W/m^2
USOLAR	Downward shortwave radiation flux at the ground surface (net: URSDB-URSUB)	W/m^2
QVGRD	Specific humidity on ground	kg/kg
TIN1	temperature of soil 1st layer	K

TIN2	temperature of soil 2nd layer	K
TIN3	temperature of soil 3rd layer	K
TIN4	temperature of soil 4th layer	K
A_TSFC	highest temperature on ground	K
I_TSFC	lowest temperature on ground	K
A_VEL	maximum wind speed on ground	m/s

- sib_XXX_yyyymm.grib

contents: soil related data

timescale: 1 hour

variables	contents	units
TSC	canopy temperature	K
TSG	grass/bare ground temperature	K
TSS	snow-surface temperature	K
TSD1	soil temperature in the 1st layer	K
TSD2	soil temperature in the 2nd layer	K
TSD3	soil temperature in the 3rd layer	K
SW1	soil water saturation in the 1st layer	%
SW2	soil water saturation in the 2nd layer	%
SW3	soil water saturation in the 3rd layer	%
SI1	soil ice saturation in the 1st layer	%
SI2	soil ice saturation in the 2nd layer	%
SI3	soil ice saturation in the 3rd layer	%
TSS1	snow temperature in the 1st layer	K
ROFS	ground surface runoff	mm/day
ROFB	Downward gravity drainage at the bottom of three soil layers	mm/day
LTRS	Transpiration from leaves to the atmosphere	W/m^2
LINT	Interruption loss at leaves	W/m^2
LSBL	Sublimation from snow to atmosphere	W/m^2
SNMT	Daily snow melt	mm/day
WTR_S	Water content of each layer of snow on a grid with snow (1layers～4layers)	kg/m^2
SWE_S	Equivalent water volume of each layer of snow on the grid with snow (1layers～4layers)	kg/m^2
SWE_T	Snow equivalent water volume (of all snow layers)	kg/m^2

SNDEP	snow depth	m

- XXX_yyyy_dx20_3d.data

contents: Atmospheric 3D data

vertical level(40layers)：See Attachment 1

timescale: 6h

byte order： big endian

variables	contents	units
DNSG2	density×$G^{1/2}$(40 layers) (*1)	kg/m^3
U	momentum in x direction (40 layers)	$kg/m^2/s$
V	momentum in y direction (40 layers)	$kg/m^2/s$
W	momentum in z direction (40 layers)	$kg/m^2/s$
PT	potential temperature anomaly (40 layers) (*2)	K
TIN	underground temperature (4 layers)	K
TSD4	Temperature of soil layer 4	K
CVRS	Snow coverage	%
QV	water vapor mixing ratio (40 layers)	kg/kg
W_G	volume water content (2 layers)	m^3/m^3
QC	cloud mixing ratio (40 layers)	kg/kg
QR	rain mixing ratio (40 layers)	kg/kg
ETURB	energy of turbulence (40 layers)	J/kg
PTSQ	Autocorrelation of fluctuations in liquid water potential temperature (40 layers)	K^2
QWSQ	Autocorrelation of fluctuations in total water mixing ratio (40 layers)	kg^2/kg^2
PTQW	Correlation between fluctuations in the liquid water potential temperature and fluctuations in the total water mixing ratio (40 layers)	K kg/kg
PRS	Anomaly from the basic field of atmospheric pressure (40 layers)	Pa
QCI	cloud and ice mixing ratio (40 layers)	kg/kg
QS	snow mixing ratio (40 layers)	kg/kg
QG	graupel mixing ratio (40 layers)	kg/kg
PSEA	sea level corrective pressure	hPa

(*1) $G^{1/2} = 1 - Zs / H$ (Zs＝Height of the ground, H= Height of the top of the model)

(*2) Temperature anomaly baseline is 300K regardless of altitude (Jun 26, 2019)

This file has its own format for storage and has a sample program. It is available from DIAS, described below. (2016/05/29)

- topo_essp20

Contents: Elevation and sea/land distribution data (common to all experiments)

bite order: big endian

variables	contents	units
FLAT	Latitude	degree
FLON	Longitude	degree
ZS	Height	m
SL	The percentage of land in the grate	0~1

4.6. How to get the d4PDF database

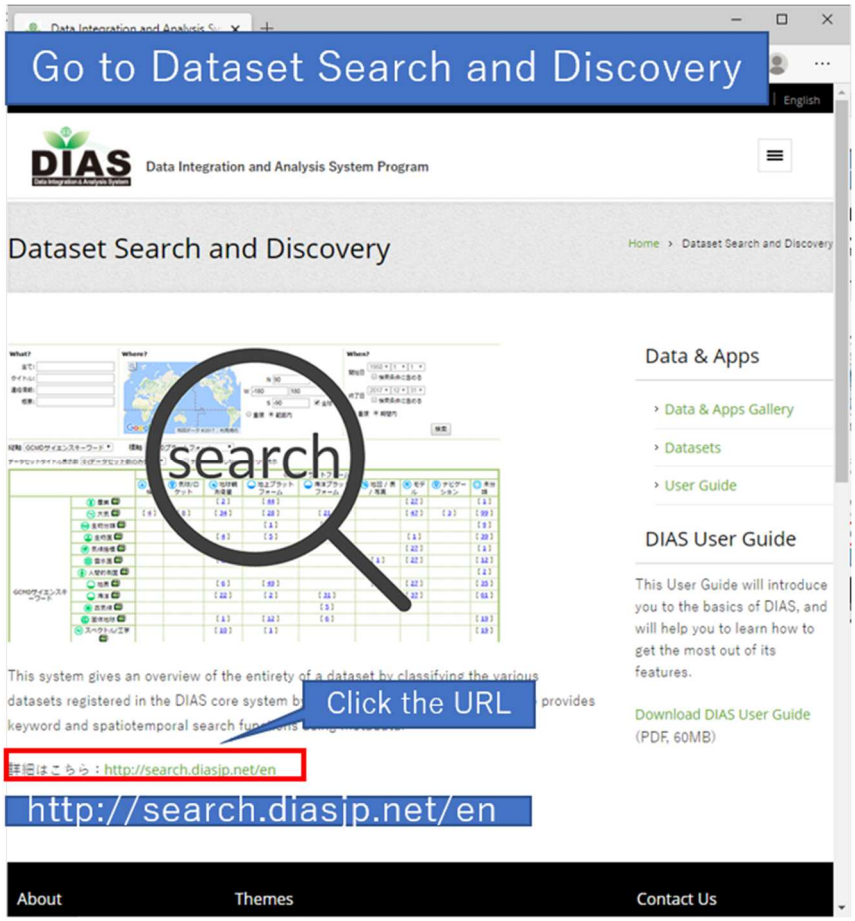
The d4PDF database is available from DIAS (Data Integration and Analysis System) of Earth Observation Data Integration & Fusion Research Initiative (EDITORIA). A brief description of the data acquisition method is shown below.

4.6.1. Access the DIAS homepage

Go to the DIAS home page (http://www.diasjp.net) and click on "View Details" under "Data Overhead and Search System" at the bottom of the page (see below).

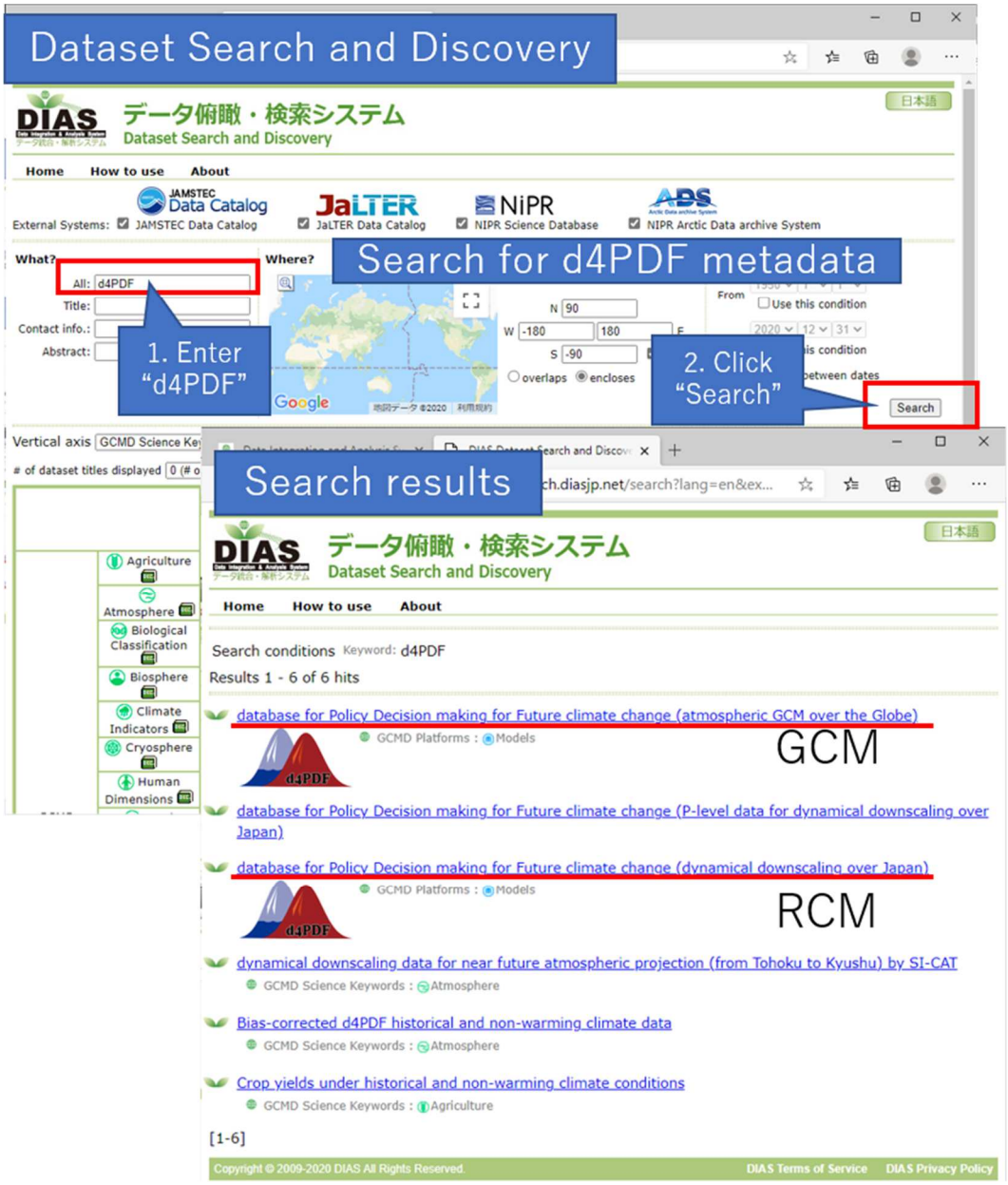
4.6.2. Dataset Search and Discovery

click on “詳細はこちら” at the bottom of the page at the bottom of the page.



4.6.3. searching for d4PDF metadata

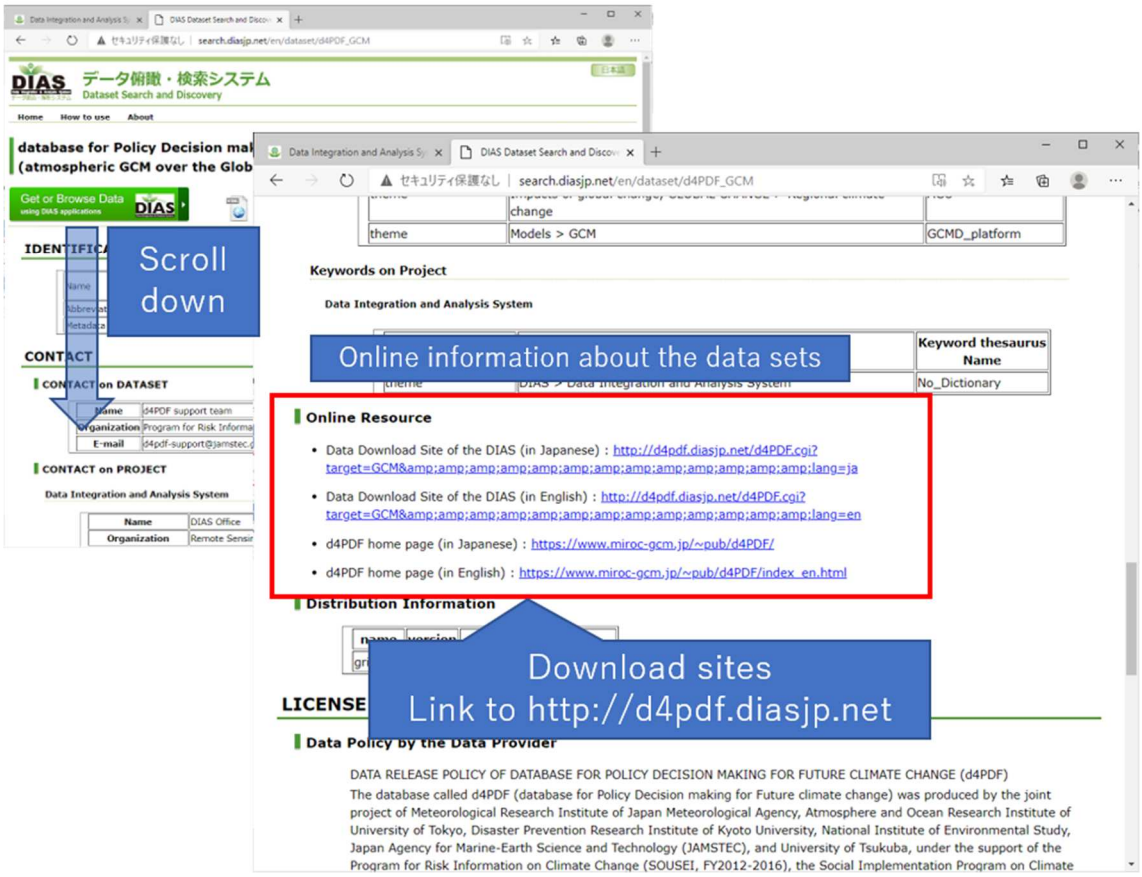
The data registered in DIAS has metadata describing data specifications and terms of use, etc. The procedure for searching metadata in d4PDF is shown in the figure below. In the search results, there are "Ensemble Climate Prediction Database for Global Warming Mitigation (GCM)" and "Ensemble Climate Prediction Database for Global Warming Mitigation (Japan Region Downscaling)". The former is the GCM data and the latter is the link to the metadata of the RCM Japan Region Downscaling data.



4.6.4. DIAS metadata

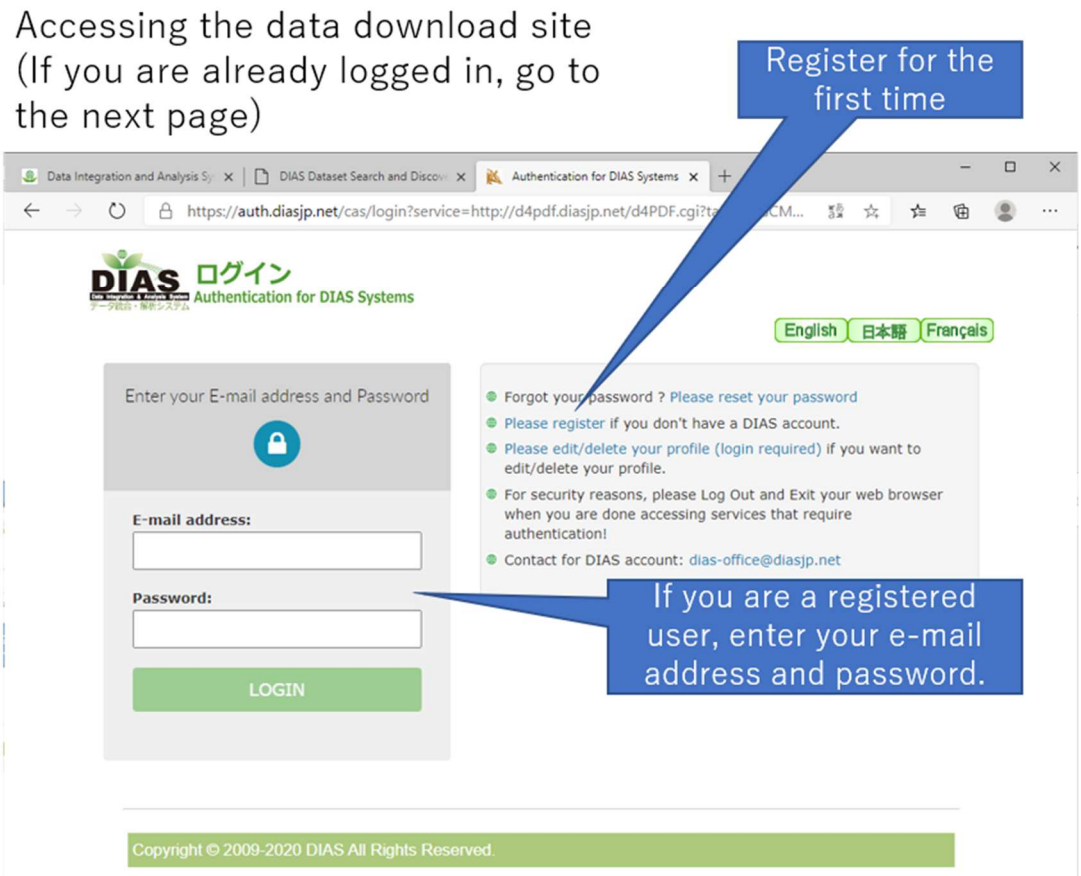
The DIAS metadata contains information such as dataset summary, dataset terms of use, and data citations. Here is a link to the data download site.

ex:GCM



4.6.5. Accessing the data download site

If you are downloading data from DIAS for the first time, click "Please register" and provide the necessary information to register as a user. If you are already a registered user, enter your registered e-mail address and password.

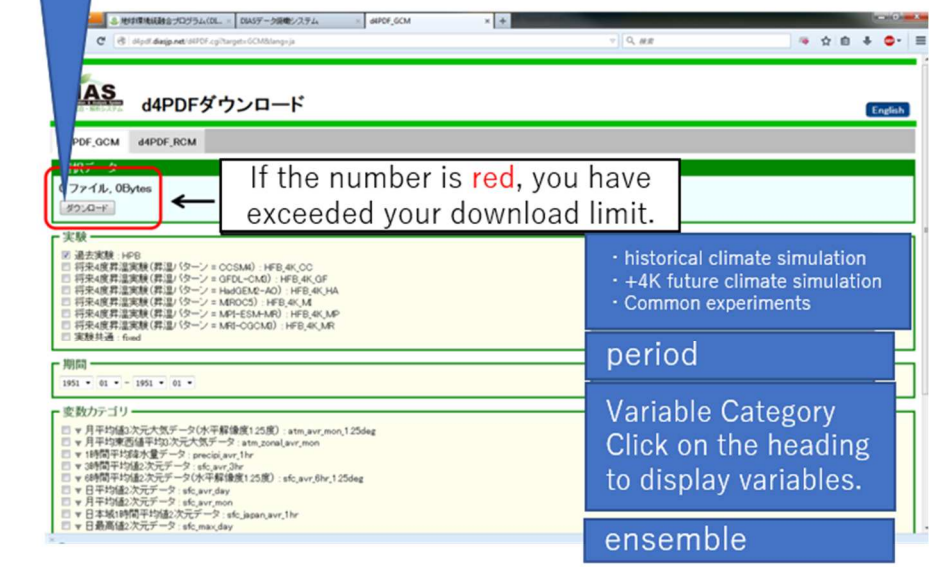


4.6.6. data download

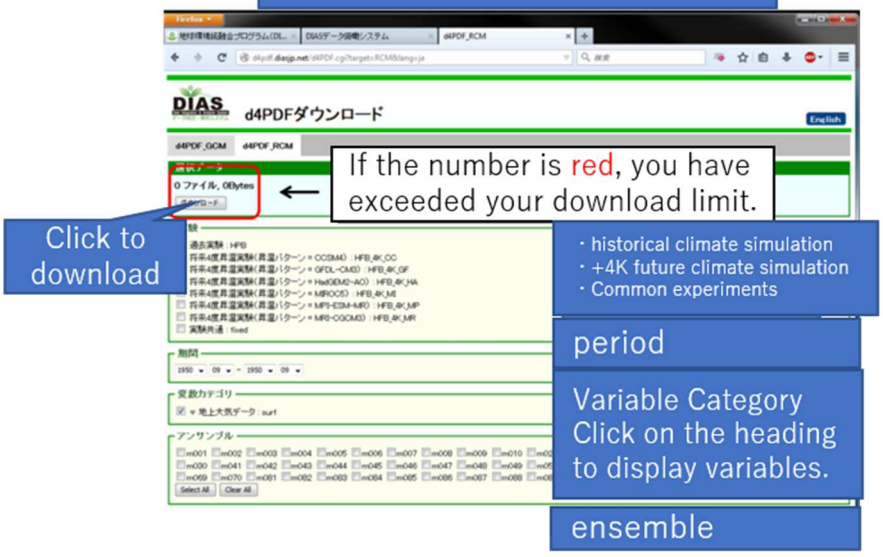
If the authentication passes, you will be redirected to the download site. Check the necessary items for each of the experiment, period, variable category, and ensemble. After selecting the necessary items, click the download button to start the download. The file format is tar, and there is an upper limit to the size and number of files that can be downloaded at one time (if the limit is exceeded, the number in the red frame below is displayed in red).

The image below is from the tentative release.

Data Download Site(GCM)



Data Download Site(RCM)



4.7. How to use the data

The d4PDF data is most easily used with GrADS*1, *2 (Grid Analysis and Display System), which is a tool widely used around the world for the analysis and visualization of weather and climate data. In this document, we recommend using GrADS to analyze and visualize both global and domain models. For more details on the use of GrADS, please refer to the following GrADS-Note*3 (permission obtained from the site writer). Note that the atmospheric 3D data of the domain model is in a original format, so it cannot be handled by GrADS as it is. The data output by the sample program on the data download site is in a data format that can be used with GrADS.

*1 GrADS (http://grads.iges.org/grads/grads.html)

*2 openGrADS (http://opengrads.org/)

(Based on GrADS with various extensions such as external function citations)

*3 GrADS−Note (writer: Yoichi Kamae) (http://seesaawiki.jp/ykamae_grads-note/)

4.8. Data Release Policy

4.8.1. Japanese

2015 年 12 月 21 日
2018 年 8 月 10 日改訂
2018 年 8 月 20 日改訂

地球温暖化施策決定に資する気候再現・予測実験データベース公開ポリシー

気象庁気象研究所、東京大学大気海洋研究所、京都大学防災研究所、国立環境研究所、海洋研究開発機構、筑波大学 （以下当事機関） は、文部科学省気候変動リスク情報創生プログラム（平成 24～28 年度）、同省気候変動適応技術社会実装プログラム（平成 27～31 年度）、および同省統合的気候モデル高度化研究プログラム（平成 29～33 年度）下の合同プロジェクトにより、本格化する地球温暖化対策推進に資するために、高解像度大規模データベース「d4PDF （database for Policy Decision making for Future climate change）」を作成しました。本データベース作成のための計算は、海洋研究開発機構の地球シミュレーター特別推進課題で行いました。このデータベースを、文部科学省地球環境情プラットフォーム構築推進プログラム （DIAS） の協力を得て、無償で提供します。

データ利用規約

1. 本データ使用責任者の氏名・所属・連絡先及び利用目的を明らかにすること。
2. 第三者に再配布しないこと。
3. 本データを利用した論文・報告文には、これを利用した旨を明記する。

引用例（和文・英文）

本研究では、文部科学省による複数の学術研究プログラム（「創生」、「統合」、SI-CAT、DIAS）間連携および地球シミュレーターにより作成された d4PDF を使用した。

This study used d4PDF produced with the Earth Simulator jointed by science programs （SOUSEI, TOUGOU, SI-CAT, DIAS） of the Ministory of Education, Culture, Sports, Science and Technology （MEXT）, Japan.

4. 本データを利用した論文・報告文を作成した場合には、以下のアドレスに写しを提出すること （推奨）。

d4pdf-support@jamstec.go.jp

免責事項

著作権ならびにその他一切の知的財産権は当該データを作成した当事機関に属します。データの利用者が d4PDF を利用して生じるいかなる損害についても、当事機関はその責任を負うものではありません。

4.8.2. English

21 December, 2015
Revision of 10 August, 2018
Revision on 20 August, 2018

DATA RELEASE POLICY OF DATABASE FOR POLICY DECISION MAKING FOR FUTURE CLIMATE CHANGE (d4PDF)

The database called d4PDF (database for Policy Decision making for Future climate change) was produced by the joint project of Meteorological Research Institute of Japan Meteorological Agency, Atmosphere and Ocean Research Institute of University of Tokyo, Disaster Prevention Research Institute of Kyoto University, National Institute of Environmental Study, Japan Agency for Marine-Science and Technology (JAMSTEC),

and University of Tsukuba, under the support of the Program for Risk Information on Climate Change (SOUSEI, FY2012-2016) the Social Implementation Program on Climate Change Adaptation Technology (SI-CAT, FY2015-2019), Integrated Research Program for Advancing Climate Models (TOUGOU, FY2017-2021), and the Data Integration and Analysis System (DIAS), funded by the Ministry of Education, Culture, Sports, Science and Technology (MEXT). The Earth Simulator was used for building up the database under "Strategic Project with Special Support" of JMASTEC. Users can access d4PDF via the data server maintained by DIAS.

Terms and Conditions

1. Individual users must register their name, affiliation, email address and purpose of use before access to the database will be permitted.

2. Individual users should not redistribute the data to any third party.

3. The source of the database should be duly acknowledged in scientific and technical papers, publications, press releases and other communications in case of using the data.

Example:

This study used the database for policy decision making for future climate change (d4PDF) which was produced with the Earth Simulator under corporations among science programs (SOUSEI, TOUGOU, SI-CAT, DIAS) sponsored by the Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan.

4. Individual users provide the joint project members (email to d4pdf-support＠jamstec.go.jp) a copy of their scientific or technical papers, publications, press releases or other communications in case of using the data (recommended).

Disclaimer

The joint project members are not responsible for any damage that may result from their use.

Intellectual property

The intellectual property rights of the database belong exclusively to the joint project members.

Updates

2015/12/21 First edition

2016/05/26 ［RCM］Added description of errors found in GrADS ctl file.

2016/05/29 ［RCM］Added description of sample program for atmospheric 3D data/

2016/06/06 ［common］Updated to reflect full data release.

2016/07/15 ［RCM］Corrected an error regarding the time interval of atmospheric 3D data.

2016/07/19 ［RCM］Added description of data period.

2016/07/20 ［common］Added the description that the byte order is big endian for data files other than grib format.

2016/07/21 ［RCM］About HPB_m010, fixed an error found in xdef & ydef parameters of ctl file for grib format files.

2017/01/13 ［RCM］About soil related data of +4K future climate simulation (HFB_4K), fixed a day shift problem caused by an error in handling leap years.

2017/04/21 ［RCM］Added a description of how to deal with the problem that wind vectors are not displayed correctly when they are drawn using the pdef parameter in GrADS.

2017/05/10 ［RCM］Fixed an error found in the description of the variable USOLAR included in thermodynamics related 2D data (ph2m_XXX_yyyymm.grib).

2017/06/28 ［RCM］About atmospheric 3D data(XXX_yyyy_dx20_3d.data), corrected a mistake in the description of the unit of momentum.

2017/09/20 ［RCM］About thermodynamics related 2D data (ph2m_XXX_yyyymm. grib), Added description that soil saturation (W_G1, W_G2) cannot be used. (The initial values are included and are not time-varying.)

2017/09/26 ［GCM］A user pointed out that some of the files were corrupted. Replaced with correct files.

2017/11/06 ［RCM］Added information on the arrangement of vertical layers in atmospheric 3D data (Appendix 1)

2018/11/15 ［GCM］A user pointed out that some of the files were corrupted. Replaced with correct files.

2019/06/27 ［RCM］Added a description of how to convert potential temperature and atmospheric pressure from potential temperature anomaly and atmospheric pressure anomaly, respectively.

2019/06/27 Updated data release policy.

2019/11/13 ［RCM］Bug report. The effect of the bug is under investigation.

2020/02/14 Added description of d2PDF.

Attachment 1: Arrangement of vertical layers of domain model 3D atmospheric data

layer No.	full-level(m)	harf-level(m)
1	***	0
2	16	32
3	48	79
4	110	156
5	203	264
6	325	402
7	478	570
8	661	768
9	874	996
10	1118	1255
11	1392	1544
12	1695	1863
13	2030	2212
14	2394	2591
15	2788	3001
16	3213	3441
17	3668	3911
18	4153	4411
19	4669	4941
20	5214	5502
21	5790	6093
22	6396	6714
23	7032	7365
24	7699	8047
25	8395	8759
26	9122	9501
27	9879	10273
28	10666	11075
29	11484	11908
30	12332	12771
31	13209	13664
32	14118	14587

33	15056	15540
34	16024	16524
35	17023	17538
36	18052	18582
37	19111	19656
38	20201	20760
39	21320	21895
40	***	

Full level: Layer for variables other than vertical velocity
Half level: Layer for vertical velocity

Ground surface: First half-level layer
(The first full-level layer is for the lower boundary conditions.
Model top: Half-level layer 39
(Full level layer 40 is for the upper boundary conditions)