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| **2D fields** |

**Hourly**

* Total precipitation (TOT\_PREC)
* Large-scale and convective snowfall (SNOW\_GSP & SNOW\_CON) 🡪 add in post-processing
* 2m temperature (T\_2M)
* Specific humidity (QV\_2M)

**Hourly 🡪 postprocess to monthly diurnal cycles**

* Average surface energy balance fluxes:
  + Sensible heat (ASHFL\_S), latent heat (ALHFL\_S),
  + Net downward SW (ASOB\_S), downward direct SW (ASWDIR\_S), downward diffuse SW (ASWDIFD\_S) (redundant: upward SW (ASWDIFU\_S))
  + Net downward LW (ATHB\_S), downward LW(ATHD\_S)
* CAPE (CAPE\_ML), CIN (CIN\_ML)
* Surface evaporation (AEVAP\_S)

**3-hourly**

* Surface pressure (PS)
* Mean sea level pressure (PMSL)
* Total cloud cover (CLCT)
* Ground temperature (T\_G)
* 10m wind (U\_10M, V\_10M)
* Surface albedo (ALB\_RAD)
* Average top of atmosphere fluxes: Net downward SW (ASOB\_T), Outgoing LW (ATHB\_T)
* Precipitable water (TQV), Vertical integrated cloud water (TQC), vertical integrated cloud ice (TQI), Total water content (TWATER)
* Total zonal/meridional water flux (TWATFLXU, TWATFLXV)
* Height of the boundary layer (HPBL)
* Low, medium and high cloud cover (CLCL, CLCM, CLCH)

**Daily**

* 10m wind speed maximum (VMAX\_10M)
* Snow water equivalent (W\_SNOW), Snow depth (H\_SNOW)
* 2m minimum/maximum temperature (TMIN\_2M, TMAX\_2M)
* Duration of the sun (DURSUN)
* (Sub-)surface runoff (RUNOFF\_S, RUNOFF\_G)
* Snowmelt (SNOW\_MELT)
* Soil water content (W\_SO)

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| **3D fields** |

**3-hourly**

* Zonal, meridional and vertical wind (U, V, W)
* Specific humidity (QV), Temperature (T), Geopotential (FI)
* 150, 200, 300, 400, 500, 700, 850, 925, 1000 hPa
* Total diabatic heating (temperature tendency, temperature vertical diffusion, solar heating rate and longwave heating rate):
  + Solar radiation heating rate in the atmosphere (SOHR\_RAD)
  + Thermal radiation heating rate in the atmosphere (THHR\_RAD)
  + Convective tendency of temperature (DT\_CON)
  + Tendency of t due to SSO (DT\_SSO)

**6-hourly -> daily means**

* Soil temperature (T\_SO) 🡪 Top two + bottom layers

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| **Miscellaneous** |

**Uncertain output variables**

* Moisture convergence in the air for kuo type closure (QCVG\_CON)

Total precipitation rate (TOT\_PR) 🡪 instantaneous?

* Hourly output at 100 m (U, V)
* On Ruolan’s list:
  + VABS\_10M\_AV
  + 2m dew point temperature (TD\_2M)
  + TQR, TQS, TQG
* Panosetti et al., 2016/2018/2019 🡪 more output for atmospheric water vapor and heat budget, maximal updraft velocities, rain rate, liquid water path, convective mass flux
* Imamovic et al. 2017/2019 🡪 vertically integrated atmospheric water (qt = qv + qc + qi + qs + qg; vapor, cloud, ice, snow, graupel, rain)

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| **Variables used in relevant studies** |

**(Near-)surface variables**

* Surface wind (10 m zonal/meridional): Paeth et al. (2019) 🡪 cluster analysis, Kitoh et al. (2010)

**3D fields**

* Horizontal wind @ different pressure levels
  + **850 hPa**, SLP: Zhang et al. (2015)
  + 200, 500 hPa : Sabin et al. (2013)
  + 700 hPa: Dong et al. (2018)
  + 1000 hPa: Liu et al. (2015c)
* Temperature @ different pressure levels
  + Average 200 - 600 hPa: Deplazes (2021)
  + 500 hPa: Zhang et al. (2015)
  + 250 hPa: Molnar et al. (2010)
* Vertical velocity
  + 500 hPa: Zhang et al. (2015), Dong et al. (2018)
  + Various elevations/pressure levels: Liu et al. (2015b)
* Geopotential height
  + 500 hPa: Paeth et al. (2019)
  + 200 hPa: Dong et al. (2018)
* Vertically integrated water vapor transport [kg m-1 s-1]: Zhang et al. (2015)
  + Zonal/meridional wind (u, v), specific humidity (q), pressure (p) 🡪 integration from 1’000 to 300 hPa: Guan et al. (2019), surface pressure to 100 hPa: Dong et al. (2018)
* Total diabatic heating, (vertical velocity): Zhang et al. 2015 🡪 vertical cross sections

🡪 Tada et al. (2016)

* Water vapor flux and wind convergence in the lower (below 500 hPa) troposphere: Kitoh et al. (2017)
* Total precipitation water (TPW): Zhang et al. (2015) 🡪 probably the same as total precipitable water (🡪 vertically integrated specific humidity): Sabin et al. (2013)
* Moist static energy: Sabin et al. (2013) 🡪 <https://en.wikipedia.org/wiki/Moist_static_energy>
* Divergence, relative vorticity: Sabin et al. (2013)
* Dry static stability: Park et al. (2012)
* Equivalent potential temperature: Ma et al. (2014)

**Evaluation data**

* Precipitation: IMERG, ERA5, TRMM, etc.
* Temperature: CRU, etc.
* Radiation, total cloud
* Snow (daily)

**Glacier model input**

* Open Global Glacier Model: monthly temperature and precipitation
* Global Glacier Evolution Model (GloGEM): monthly temperature and precipitation