

Conversion table for accumulated variables (total precipitation/fluxes)

Related articles
Introduction
Accumulated variables are those which are aggregated over a particular time periods.
The balles below show how accumulated variables from a number of CSS and ECNIVIF disassets should be processed to derive values for an hour, a day, a month and a year.
As these can be action of inferent very an inferred cidatest, its injuriest that they are interpreted correctly.
For illustration, 'total precipitation' and 'solar radiation' are used, but the same processing should be applied to all precipitation and radiative flux variables.

Hydrological parameter table

Dataset	Variables	What it is	Grib units	Netcdf Units	To get the total precipitation for an hour (mm)	To get the total precipitation for a day (mm)	To get the total precipitation for a month (mm)	To get the total precipitation for a year (mm)
ERA5 reanalysis (hourly data)	Total precipitation	Accumulations are over the hour (the processing period) ending at the validity date/time	m (of water equivalent per hour)	m (of water equivalent per hour)	$tp\ [mm] = tp\ [m] \cdot 1000$ Total precipitation over the one hour ending at forecast step.	$\begin{split} tp\left[mm\right] &= \left(\sum_{h=1}^{2d} tp_h\left[m\right] + tp_{d+1} o_{0UTC}\left[m\right]\right) \cdot 1000 \end{split}$ where h is the hour and d the day of interest (d+1 is the following day). The total precipitation over 24 hours is the sum of the individual total precipitation values for each hour.	$tp~[mm] = \sum_{n=1}^{N} \left(\sum_{h=1}^{2n} tp_h~[m] + tp_{d+1~00UTC}[m]\right)_n \cdot 1000$ where N is the number of days in the month.	$tp\ [nm] = \sum_{n=1}^N \left(\sum_{k=1}^{20} tp_k\ [m] + tp_{d+1\ 00UTC}[m]\right)_n \cdot 1000$ where N is the number of days in the year.
ERA5 ensemble members (3 hourly data)	Total precipitation	Accumulations are over the 3 hours (the processing period) ending at the validity date/time	m (of water equivalent per 3 hours)	m (of water equivalent per 3 hours)	$tp \; [mm] = tp \; [m] \cdot 1000$	$tp\left(mm\right) = \left(\sum_h tp_h[m]\right) \cdot 1000$ where h are the day finesteps available: 03 UTC, 08 UTC, 09 UTC, 12 UTC, 15 UTC, 18 UTC, 21 UTC and 00 UTC of the day after. The total precipitation over 24 hours is the sum of 8 3-hour total precipitation values.	$tp\ [mm] = \sum_{n=1}^{N} (\sum_h tp_h[m])_n \cdot 1000$ where h are the day timesteps available: 03 UTC, 08 UTC, 09 UTC, 12 UTC, 16 UTC, 21 UTC and 00 UTC of the day after and N is the number of days in the month.	$tp\ [mm] = \sum_{n=1}^{N} (\sum_h tp_h[m])_n \cdot 1000$ where h are the day timesteps available: 03 UTC, 08 UTC, 09 UTC, 12 UTC, 15 UTC, 18 UTC, 21 UTC and 00 UTC of the day after, and N is the number of days in the year.
ERA5 monthly averaged reanalysis	Total precipitation	The accumulations in monthly means of daily means have been scaled to have units that include "per day"	m (of water equivalent per day)	m (of water equivalent per day)	N/A	NA	to $[mm] = tp \ [m/day] \cdot 1000 \cdot N$ where N is the number of days in the month.	to $[mm]=\sum_{n=1}^{2}(tp\left[m/dxy\right]-1000\cdot 3)_n$ where N is the number of days in the month and n is the number of the month.
ERA5 monthly averaged ensemble members	Total precipitation	The accumulations in monthly means of daily means have been scaled to have units that include "per day"	m (of water equivalent per day)	m (of water equivalent per day)	N/A	NA	to [mm] = tp [m/day] · 1000 · N $\label{eq:main_state}$ where N is the number of days in the month.	to $[mm]=\sum_{n=1}^{2}(tp\left[m/dsy\right]\cdot1000\cdot3)_n$ where N is the number of days in the month and n is the number of the month.
ERA5- Land hourly data	Total precipitation	Accumulations are from 00 UTC to the hour ending at the forecast step ¹	m (of water equivalent)	m (of water equivalent)	$\label{eq:problem} \psi_{l}\left[mm\right] = \begin{cases} \psi_{jk}\left[m\right] \cdot 1000 & \hbar = 01UTC \\ (\psi_{jk}\left[m\right] - \psi_{jk-1}\left[m\right]) \cdot 1000 & \text{otherwise} \end{cases}$	$tp\left[mn\right] = tp_{d+100TC}[m] \cdot 1000$ where d is the day for which the average flux is being computed. The time step labelled d+1 00UTC should also be taken because it contains the accumulated flux over the previous 24 hours.	$\label{eq:total_problem} \begin{split} tp\left[num\right] &= \left(\sum_{n=1}^{N} p_{d+1} _{00 \mathrm{UTC},n}\left[n\right]\right) \cdot 1000 \\ \text{where d is the day for which the total precipitation is being computed and N is the number of days in the month. The time step labelled 4+ 100 ITC should also be taken because it contains the accumulated total precipitation over the previous 24 hours. This implies that the sum goes from the 2^{nd} of the month to that ^{12} d in the north (inclusive).$	$\label{eq:total_problem} \begin{split} & tp \left[mm \right] = \left(\sum_{n=1}^{N} tp_{d+1} \cos(t) T C_{n} \left[m \right] \right) \cdot 1000 \\ & \text{where } d is the day for which the lotal precipitation is being computed and N is the number of days in the year. \\ & \text{The time step labelled } d+1 001/12 because it contains the accumulated both precipitation over the previous 24 hours. This implies that the sum goes from 2^{nd} January of the verby of inclusive). January of the verby of inclusive). \\ & \text{January of the next part (inclusive)}. \end{split}$
ERA5- Land monthly averaged data	Total precipitation	The accumulations in monthly means of daily means have units that include "per day".	m (of water equivalent per day)	m (of water equivalent per day)	N/A	NIA	$\label{eq:tpm} \operatorname{tp}\left[\operatorname{nm}\right] = \operatorname{tp}\left[\operatorname{m/day}\right] \cdot 1000 \cdot N$ where N is the number of days in the month.	$tp \ [nm] = \sum_{n=1}^{12} \{tp \ [m/day] \cdot 1000 \cdot N\}_n$ where N is the number of days in the month and n is the number of the month.
Seasonal daily data	Total precipitation	24 hour aggregation since the beginning of the forecast	m	m	$tp\ [mm/hr] = \frac{(tp_{12}\ [m])-tp_{11}\ [m])\cdot 1000}{24}$ where t_2 is the day of interest, t_1 is the day before 12, tp_{12} is the total precipitation at 12, and tp_{11} is the total precipitation at 11.	$\begin{array}{l} tp\ [\mathrm{mm}] = (tp_{t2}\ [\mathrm{m}] - tp_{t1}\ [\mathrm{m}]) \cdot 1000 \\ \text{where } t_2\ \text{is the day of interest, } t_1\ \text{is the day before } t2,\ tp_{t2}\\ \text{is the total precipitation at } t2,\ \text{and } tp_{t1}\ \text{is the total} \\ \text{precipitation at } t1. \end{array}$	$tp \left[mm\right] = \left(tp_{f2}\left[m\right] - tp_{f1}\left[m\right]\right) \cdot 1000$ where t_2 is the 1st day of the month after the month of interest, $t_1 =$ is the 1st day of month before $t_2, t_2 =$ in the total precipitation at 12, and tp_{f1} is the total precipitation at 11.	N/A For seasonal forecasts, as data only cover 7 months
Seasonal Monthly data	Total precipitation	The accumulations in monthly means have units that include "per second".	m/s	m/s	N/A	N/A	$tp\left[nm\right]=tp_{11}\left[m\right]\cdot1000$ where t ₁ is the month of interest, N1 is the number of days in t ₁ , and tp ₁₁ is the result of (total precipitation at t ₁ * N1 * 24 * 60 * 60).	N/A For seasonal forecasts, as data only cover 7 months
Dataset	Variables	What it is	Grib units	Netcdf Units	To get the total precipitation for an hour (mm)	To get the total precipitation for a day (mm)	To get the total precipitation for a month (mm)	To get the total precipitation for a year (mm)
sub-daily data		beginning of the forecast	equivalent)	equivalent)		where the time step squared 72 has to be selected that time reference 00LTC plus the time step labelled 12 selected from time reference 12LTC because they contain the accumulated total precipitation over the 24 hours for each day.	$\begin{split} & \text{tp} \left[\text{Inm} \right] = \sum_{d=1}^{N} (\text{tfp}_{1200\text{UTC}} + \text{tp}_{1212\text{UTC}} \left[\text{m} \right])_{d} \cdot 1000 \\ & \text{where } d \text{is the day for which the total precipitation is being computed and N is the number of days in the month.} \end{split}$	$\begin{aligned} &\text{tp } [\text{mm}] = \sum_{d=1}^{N} (\text{thp } 1200\text{UTC} + \text{thp} 1212\text{UTC} [\text{m}])_d \cdot 1000 \\ &\text{where } d \text{ is the day for which the total precipitation is being computed and } N \text{ is the number of days in the year.} \end{aligned}$

Energy and momentum fluxes table

Dataset	Variables	What it is	Grib units	Netcdf Units	To get the average energy flux (Wm ⁻²)	To get the average energy flux for a day (Wm ⁻²)	To get the average energy flux for a month (Wm ⁻²)	To get the average energy flux for a year (Wm ⁻²)			
ERA5 daily data	Surface Solar Radiation (SSR)	Accumulations are over the hour (the processing period) ending at the forecast step	Jm ⁻²	Jm ⁻²	$SSR [Wm^{-2}] = SSR [Jm^{-2}] / 3000 [s]$ Average flux over the one hour ending at forecast step. $SSR [Wm^{-2}] = SSR [Jm^{-2}] / (3 \cdot 3000) [s]$	$SSR [Wm^{-2}] = \sum_{n=1}^{28} SSR_1 [Vm^{-2}] + SSR_{d+1001TC} [Jm^{-2}] \\ 86800 [i]$ The average flux over 24 hours it be sum of the individual fluxes for each hour divided by the number of seconds in a day.	$SR\left[Wm^{-2}\right] = \frac{\sum_{n}^{N} \left(\sum_{k}^{2} \sum_{j} SSRI_{k}\right) Im^{-2} \left(1.SSRI_{k} + 100 UTC L Im^{-2}\right) J_{j}}{NS68000}$ where N is the number of days in the month. The average flax over a month is the sum of the individual flaxes for each day divided by the number of seconds in the month.	$\begin{split} & SR\left[Wm^{-2}\right] = \sum_{N=1}^{N} \left(\sum_{j=1}^{N} SRA\left(jm^{-2}\right) + SRJ_{+} 100VTC\left(jm^{-2}\right)\right)_{M} \\ & N = 8000\ j$ where N is the number of days in the year. The average flux over a year is the sum of the individual fluxes for each day divided by the number of deconds in the year. $SR\left(Wm^{-2}\right) = \sum_{N=1}^{N} \left(\sum_{j} k SRA_{j}\right)_{N} N \cdot 804000 \end{split}$			
daily ensemble data	SSK	Accumulations are over the 3 hours (the processing period) ending at the forecast step	Jm ⁻²	Jm ⁻²	SSIC [Wm. 7] = SSIC [Jm. 7] (3 - 30000) [s] Average flux over the three hours ending at forecast step.	$SSR_{\parallel}[Wm^{-2}] = \Big(\sum_h SSR_h[Jm^{-2}] + SSR_{d+100UTC}[Jm^{-2}]\Big)/88400$ where h are the day timestops available: 03 UTC, 08 UTC, 09 UTC, 12 UTC, 15 UTC, 17 UTC, 18 UTC, 21 UTC and 00 UTC of the day after. The average flux over 24 hours is the sum of 8.3-hour fluxes divided by the number of seconds in a day,	$SSR\left(Wm^{-2}\right) = \sum_{n=1}^{N} \left(\sum_{h} SSR_{h} Jm^{-2} + SSR_{d+100TC} Jm^{-2} \right)_{n} / N \cdot 80400$ where h are the day timesteps available: 03 UTC, 08 UTC, 09 UTC, 12 UTC, 15 UTC, 18 UTC, 18 UTC, 21 UTC, and 00 UTC of the day after and n is the number of objay in the month. The prerage flux over a morth is the sum of the individual fluxes for each day (computed as the sum of 8 3-hour fluxes) divided by the number of seconds in the month.	where h are the day limestages available 30 LITC, 60 LITC, 60 LITC, 10 LITC, 11 LITC, 11 LITC, 11 LITC and 00 LITC of the day after and h is the number of days in the year. The average flux over a year is the sum of the individual fluxes for each day (computed as the sum of 8.3-hour fluxes) divided by the number of seconds in the year.			
ERAS monthly averaged data	SSR	Monthly means of mean daily fluxes The accumulations in monthly means of daily means have been scaled to have units that include "per day"	Jm*2	Jm ⁻²	N/A	N/A	$SSR\left(Wm^{-2}\right) = SSR\left[Jm^{-2}\right] \cdot \sum_{N \in WBOD} [n] = \frac{SSR\left[Jm^{-2}\right]}{80400 [n]}$ where N is the number of days in the month. 1. Multiply by N to obtain total monthly flux from mean daily flux 2. Divide by number of seconds in the month	$SSR\left[Wm^{-2}\right] = \frac{\sum_{i=1}^{2} SSRm_{i} \ln m^{-2} \cdot N_{in}}{D4600^{i}}$ where N _i is the number of days in the month m, and D is the number of days in the pear. 1. Multiply each value by the number of days in the month 2. Sam them together 3. Divide by number of seconds in the year			
ERA5 monthly averaged ensemble data	SSR	Monthly means of mean daily fluxes The accumulations in monthly means of daily means have been scaled to have units that include "per day"	Jm*2	Jm ⁻²	N/A	N/A	$SSR\left(Wm^{-2}\right) = SSR\left[Jm^{-2}\right) \cdot \frac{N}{N + 8000}\left[s\right] = \frac{SSR\left[Jm^{-2}\right]}{80000\left[s\right]}$ where N is the number of days in the month. 1. Multiply by N to obtain total monthly flux from mean daily flux 2. Divide by number of seconds in the month	$\begin{split} & SR\left(Wim^{-2}\right) = \frac{\sum_{i=1}^{N} SSRim_{i}\left(Im^{-2}\right) N_{im}}{D 8600^{i}} \\ & Meter N_{im} \text{ is the number of days in the month m, and D is the number of days in the year.} \\ & 1. \text{ Multiply each value by the number of days in the month} \\ & 2. \text{Sum them together} \\ & 3. \text{ Divide by number of seconds in the year.} \end{split}$			
ERA5- Land hourly data	SSR	Accumulations are from 00 UTC to the hour ending at the forecast step ¹	Jm ⁻²	Jm ⁻²	$ SSR Wm^{-2} = \begin{cases} \frac{SSRb_1 Jm ^2}{3600 s } & h = 01UTC \\ \frac{SSRb_1 Jm ^2}{3600 s } & 3600 s \end{cases}$ otherwise	$SSR\left[Wm^{-2}\right] = \frac{SSRa1s terrCulm^{-2}}{54880 \mathrm{pl}}$ where d is the day for which the average flux is being computed. The time step labelled 4-1 00UT to selected because it contains the accountialed flux over the previous 24 hours.	$SSR\left[Wm^{-2}\right] = \frac{\sum_{i} SSMA_{i} + 100TCJm^{-2}}{N5000 p_{i}}$ where of is the day for which the average flux is being computed and N is the number of days is the month. The time step labelled d+1 00UTC because it contains the accumulated flux over the previous 24 hours. This implies that the sum goes from the 2^{nd} of the month to the 1^{nd} of the read month, inclusive:	$\begin{split} & SSR\left[W_{lm}^{-2}\right] = \frac{\sum_{j}^{N} SSR_{j} + 100TTC_{j}^{N}m^{-2}}{N 6800 \ pl} \\ & where d is the day for which the average flux is being computed and N is the number of days in the year. \\ & Description of the product of the $			
ERAS- Land monthly averaged data	SSR	Accumulations are unsated from data with a forecast period falling within the month. And the month of the month. The accumulations in monthly means of daily means have been scaled to have units that include per day.	Jm ⁻²	Jm ⁻²	N/A	N/A	$SSR\left(Wm^{-2}\right) = SSR\left(Im^{-2}\right) \cdot \frac{N}{N \cdot N \cdot N \cdot N \cdot N}\left[u\right] = \frac{SSR\left(Im^{-2}\right)}{R \cdot K \cdot N}$ where N is the number of days in the enroth. 1. Multiply by N to obtain total monthly flux from mean daily flux 2. Divide by number of seconds in the month	$SSR\left[Wm^{-2}\right] = \frac{\sum_{i=1}^{12} SSRm\left[um^{-2},W_{i}\right]}{DHB000}$ where W_{i} is the number of days in the recent manner of days in the recent of days in the recent of the second of			
Seasonal daily data	SSR	24 hour aggregation since the beginning of the forecast	Jm*2	Jm ⁻²	N/A	$SSR\left[Wm^{-2}\right] = \frac{(SSR_{12} Jm^{-2}] - SSR_{11} Jm^{-2} }{24\pi6660}$ where t ₂ is the day of interset, t ₁ is the day before t2, SSR ₁₂ is the SSR at 12, and SSR ₁₁ is the SSR at 11	$SSR\left[Wm^{-2}\right] = \frac{(SRR_{22} Jm^{-2} - SSR_{12} Jm^{-2})}{SM_{23} + 60460}$ where t ₂ is the 1st day of month after the month of interest, t ₁ is 1st day of month before 12, N is number of days in month of interest, SSR ₂₂ is the SSR at 12, and SSR ₁₇ is the SSR at 11.	N/A For seasonal forecasts, as data only cover 7 months			

Dataset	Variables	What it is	Grib units	Netcdf Units	To get the average energy flux (Wm ⁻²)	To get the average energy flux for a day (Wm ⁻²)	To get the average energy flux for a month (Wm ⁻²)	To get the average energy flux for a year (Wm ⁻²)
							N/A	N/A For seasonal forecasts, as data only cover 7 months

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treated th	same as those in	ERA-Interim or ER	A-Interim/L	and, i.e., t	hey are accum	ulated from the	beginning of t	he forecast to	the end of the	e forecast step. F	For example, run	noff at day=D, s	tep=12 will							
provide ru	noff accumulated f	from day=D, time=0	to day=D,	time=12. T	he maximum	accumulation is	over 24 hours	, i.e., from day	/=D, time=0 to	day=D+1,time=	0 (step=24).									
This do	cument has been	produced in the co	intext of th	ie Coperni	cus Climate C	hange Service ((C3S).													
The act	vities leading to t	hese results have I	been contr	acted by t	he European	Centre for Media	um-Range We	ather Foreca	sts, operator	of C3S on beha	alf of the Europ	ean Union (Del	egation							
agreem	ent signed on 11/1	11/2014). All inform	ation in thi	is docume	nt is provided	"as is" and no	guarantee or	warranty is g	iven that the	information is f	it for any partic	ular purpose.								
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