

WRF-Hydro V5.1.1	Output Variable Matrix	OutputFile	Variable Name	Long Name	Description	Units	IO_Config 0	IO_Config 1	IO_Config 2	IO_Config 3	IO_Config 4	IO_Config 5	IO_Config 6	IO_Config Outputs	Min	Max	Scale	Offset	Fill	Special Notes	
Streamflow output at all channel reaches/cells	CHROUT_DOMAIN	time	valid output time	Valid output time	Valid output time	minutes since 1970-01-01 00:00:00 UTC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A		
	CHROUT_DOMAIN	reference_time	model initialization time	Model initialization time	Model initialization time	minutes since 1970-01-01 00:00:00 UTC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A		
	CHROUT_DOMAIN	feature_id	Reach ID	Unique reach or channel cell ID	Unique reach or channel cell ID	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A		
	CHROUT_DOMAIN	latitude	Feature latitude	Station latitude	Station latitude	decimal degrees	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A		
	CHROUT_DOMAIN	longitude	Feature Longitude	Station longitude	Station longitude	decimal degrees	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A		
	CHROUT_DOMAIN	order	Streamflow order	Strahler stream order for output reach or cell	Strahler stream order for output reach or cell	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A		
	CHROUT_DOMAIN	elevation	Feature Elevation	Elevation for output reach or cell	Elevation for output reach or cell	m	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A		
	CHROUT_DOMAIN	streamflow	River Flow	Streamflow	Streamflow	m3 s-1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	0	500000	0.01	0	-9999		
	CHROUT_DOMAIN	nudge	Amount of stream flow alteration	Streamflow nudge value (only if nudging DA is active)	Streamflow nudge value (only if nudging DA is active)	m3 s-1	No	No	No	No	No	No	No	No	-500000	500000	0.01	0	-9999	Values only when nudging DA is active	
	CHROUT_DOMAIN	q_lateral	Runoff into channel reach	Lateral flow into channel reach or cell	Lateral flow into channel reach or cell	m3 s-1	Yes	No	No	No	No	No	Yes	Yes	0	500000	0.1	0	-9999		
CHROUT_DOMAIN	velocity	River Velocity	Channel velocity	Channel velocity	m s-1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	0	500000	0.01	0	-9999			
CHROUT_DOMAIN	head	River Stage	River stage (gridded channel only)	River stage (gridded channel only)	m	Yes	No	No	No	No	No	No	No	0	500000	0.01	0	-9999			
CHROUT_DOMAIN	qSfcLatRunoff	Runoff from terrain routing	Flux from terrain routing	Flux from terrain routing	m3 s-1	No	No	No	No	No	No	No	No	0	500000	0.001	0	-9999	Only available for UDMP_OPT=1		
CHROUT_DOMAIN	qBucket	Flux from gw bucket	Flux from groundwater buckets	Flux from groundwater buckets	m3 s-1	No	No	No	No	No	No	No	No	0	500000	0.001	0	-9999	Only available for UDMP_OPT=1		
CHROUT_DOMAIN	qBtmVertRunoff	Runoff from bottom of soil to bucket	Flux from bottom of soil column into groundwater buckets	Flux from bottom of soil column into groundwater buckets	m3	No	No	No	No	No	No	No	No	0	500000	0.001	0	-9999	Only available for UDMP_OPT=1		
CHROUT_DOMAIN	AccSfcLatRunoff	Accumulated runoff from terrain routing	Accumulated flux from terrain routing	Accumulated flux from terrain routing	m3	No	No	No	No	No	No	No	No	0	500000	0.01	0	-9999	Only available for UDMP_OPT=1		
CHROUT_DOMAIN	accBucket	Accumulated runoff from gw bucket	Accumulated flux from groundwater buckets	Accumulated flux from groundwater buckets	m3	No	No	No	No	No	No	No	No	0	500000	0.01	0	-9999	Only available for UDMP_OPT=1		
Streamflow on the 2D high resolution routing grid (gridded channel routing only)	CHROUT_GRID	time	valid output time	Valid output time	Valid output time	minutes since 1970-01-01 00:00:00 UTC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A	Only active with gridded channel routing	
	CHROUT_GRID	reference_time	model initialization time	Model initialization time	Model initialization time	minutes since 1970-01-01 00:00:00 UTC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A	Only active with gridded channel routing	
	CHROUT_GRID	x	x coordinate of projection	x coordinate (in native projection)	x coordinate (in native projection)	native projection units	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A	Only active with gridded channel routing	
	CHROUT_GRID	y	y coordinate of projection	y coordinate (in native projection)	y coordinate (in native projection)	native projection units	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A	Only active with gridded channel routing	
	CHROUT_GRID	Index	Stream cell index value	Stream cell index value	Stream cell index value	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A	Only active with gridded channel routing	
forecast points or gage	CHROUT_GRID	streamflow	River Flow	Streamflow	Streamflow	m3 s-1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	0	500000	0.1	0	-9999	Only active with gridded channel routing	
	N	time	valid output time	Valid output time	Valid output time	00:00:00 UTC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A		
	N	reference_time	model initialization time	Model initialization time	Model initialization time	00:00:00 UTC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A		
	N	feature_id	Reach ID	Unique reach or channel cell ID	Unique reach or channel cell ID	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A		
	N	latitude	Feature latitude	Station latitude	Station latitude	decimal degrees	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A		
	N	longitude	Feature longitude	Station longitude	Station longitude	decimal degrees	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A		
	N	order	Streamflow Order	Strahler stream order for output reach or cell	Strahler stream order for output reach or cell	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A		
	N	elevation	Feature Elevation	Elevation for output reach or cell	Elevation for output reach or cell	m	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A		
	N	streamflow	River Flow	Streamflow	Streamflow	m3 s-1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	0	500000	0.01	0	-9999		
	Terrain routing variables on the 2D high resolution routing grid	RTOUT_DOMAIN	time	valid output time	Valid output time	Valid output time	minutes since 1970-01-01 00:00:00 UTC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A	
RTOUT_DOMAIN		reference_time	model initialization time	Model initialization time	Model initialization time	00:00:00 UTC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A		
RTOUT_DOMAIN		x	x coordinate of projection	x coordinate (in native projection)	x coordinate (in native projection)	native projection units	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A		
RTOUT_DOMAIN		y	y coordinate of projection	y coordinate (in native projection)	y coordinate (in native projection)	native projection units	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A		
RTOUT_DOMAIN		SOIL_M	volumetric soil moisture	Volumetric soil moisture	Volumetric soil moisture	m3 m-3	Yes	No	No	No	No	No	No	No	0	1	0.01	0	-9999		
RTOUT_DOMAIN	zwattabirt	water table depth	Depth to saturated layers (=2m when no saturation; =0 when fully saturated)	Depth to saturated layers (=2m when no saturation; =0 when fully saturated)	m	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	0	10	0.1	0	-9999			
RTOUT_DOMAIN	sfheadsbrt	surface head	Instantaneous value of depth of ponded water on surface	Instantaneous value of depth of ponded water on surface	mm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	0	1E+06	1	0	-9999			
RTOUT_DOMAIN	QSTRMVOLRT	channel inflow	Accumulated depth of stream channel inflow	Accumulated depth of stream channel inflow	mm	Yes	No	No	No	No	No	No	No	0	1000	1	0	-9999			
RTOUT_DOMAIN	QBDRYRT	flux	from the boundary cells	from the boundary cells	mm	Yes	No	No	No	No	No	No	No	0	1000	1	0	-9999			
Lake output variables	N	time	valid output time	Valid output time	Valid output time	00:00:00 UTC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A		
	N	reference_time	model initialization time	Model initialization time	Model initialization time	00:00:00 UTC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A		
	N	feature_id	Lake COMMON ID	Unique lake ID	Unique lake ID	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A		
	N	latitude	Lake latitude	Lake latitude	Lake latitude	decimal degrees	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A		
	N	longitude	Lake longitude	Lake longitude	Lake longitude	decimal degrees	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A		
	N	water_sfc_elev	Water Surface Elevation	Water surface elevation above sea level	Water surface elevation above sea level	m	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A		
	N	inflow	Lake Inflow	Total inflow into waterbody	Total inflow into waterbody	m3 s-1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-10000	10000	0.01	0	-9999		
	N	outflow	Lake Outflow	Outflow from waterbody outlet	Outflow from waterbody outlet	m3 s-1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-10000	10000	0.01	0	-9999		
	variables	GWOUT_DOMAIN	time	valid output time	Valid output time	Valid output time	00:00:00 UTC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A	
		GWOUT_DOMAIN	reference_time	model initialization time	Model initialization time	Model initialization time	00:00:00 UTC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A	
GWOUT_DOMAIN		feature_id	Groundwater Bucket ID	Unique groundwater bucket ID	Unique groundwater bucket ID	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A		
GWOUT_DOMAIN		inflow	Bucket Inflow	Total groundwater bucket inflow	Total groundwater bucket inflow	m3 s-1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-10000	10000	0.01	0	-9999		
GWOUT_DOMAIN		outflow	Bucket Outflow	Total groundwater bucket outflow	Total groundwater bucket outflow	m3 s-1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-10000	10000	0.01	0	-9999		
GWOUT_DOMAIN		depth	Bucket Depth	Groundwater bucket water level	Groundwater bucket water level	mm	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-10000	10000	0.1	0	-9999		
output		N	time	valid output time	Valid output time	Valid output time	00:00:00 UTC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A	
		N	reference_time	model initialization time	Model initialization time	Model initialization time	00:00:00 UTC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A	
		N	x	x coordinate of projection	x coordinate (in native projection)	x coordinate (in native projection)	native projection units	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A	
		N	y	y coordinate of projection	y coordinate (in native projection)	y coordinate (in native projection)	native projection units	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	N/A	N/A	N/A	N/A	N/A	
	N	IVGTP	Dominant vegetation category	Dominant vegetation category	Dominant vegetation category	category	Yes	No	No	No	No	No	No	No	0	100	1	0	-9999		
	N	ISLTP	Dominant soil category	Dominant soil category	Dominant soil category	category	Yes	No	No	No	No	No	No	No	0	100	1	0	-9999		
	N	FVEG	Green Vegetation Fraction	Fraction of surface covered by vegetation	Fraction of surface covered by vegetation	fraction	Yes	No	No	No	No	No	No	No	0	1	0.01	0	-9999		
	N	LAI	Leaf area index	Leaf area index	Leaf area index	m2 m-2	Yes	No	No	No	No	No	No	No	0	20	0.1	0	-9999		
	N	SAI	Stem area index	Stem area index	Stem area index	m2 m-2	Yes	No	No	No	No	No	No	No	0	20	0.1	0	-9999		
	N	SWFORC	Shortwave forcing	Shortwave radiation forcing	Shortwave radiation forcing	W m-2	Yes	No	No	No	No	No	No	-1000	3000	0.1	0	-9999			
N	COSZ	Cosine of zenith angle	-	-	-	Yes	No	No	No	No	No	No	-1	1	0.01	0	-9999				
N	LWFORC	Longwave forcing	Longwave radiation forcing	Longwave radiation forcing	W m-2	Yes	No	No	No	No	No	No	-1500	1500	0.1	0	-9999				
N	RAINRATE	Precipitation rate	Precipitation in model timestep	Precipitation in model timestep	mm s-1	Yes	No	No	No	No	No	No	0	100	1E-06	0	-9999				
N	EMISS	Grid emissivity	Emissivity; grid-average	Emissivity; grid-average	-	Yes	No	No	No	No	No	No	0	1	0.01	0	-9999				
N	FSA	Total absorbed SW radiation	Total absorbed SW radiation	Total absorbed SW radiation	W m-2	Yes	No	No	Yes	No	Yes	Yes	Yes	-1500	1500	0.1	0	-9999			
N	FIRA	atmosphere	Total net LW radiation (+ to atmosphere)	Total net LW radiation (+ to atmosphere)	W m-2	Yes	No	No	Yes	No	Yes	Yes	Yes	-1500	1500	0.1	0	-9999			
N	GRDFLX	Heat flux into the soil	Ground heat flux grid-average (+ to soil)	Ground heat flux grid-average (+ to soil)	W m-2	Yes	No	Yes	No	Yes	No	Yes	Yes	-1500	1500	0.1	0	-9999			
N	HFX	atmosphere	Sensible heat flux grid-average (+ to atmosphere)	Sensible heat flux grid-average (+ to atmosphere)	W m-2	Yes	No	No	Yes	No	Yes	Yes	Yes	-1500	1500	0.1	0	-9999			
N	LH	Total latent heat to the atmosphere	Latent heat flux grid-average (+ to atmosphere)	Latent heat flux grid-average (+ to atmosphere)	W m-2	Yes	No	No	Yes	No	Yes	Yes	Yes	-1500	1500	0.1	0	-9999			
N	ECAN	Canopy water evaporation rate	Canopy water evaporation rate	Canopy water evaporation rate	kg m-2 s-1	Yes	No	No	No	No	No	No	-100	100	1E-06	0	-9999				
N	EDIR	Direct from soil evaporation rate	Direct soil evaporation rate	Direct soil evaporation rate	kg m-2 s-1	Yes	No	No	No	No	No	No	-100	100	1E-06	0	-9999				
N	ALBEDO	Surface albedo	Total-gnd surface albedo	Total-gnd surface albedo	-	Yes	No	No	No	No	No	No	0	1	0.01	0	-9999				
N	ETRAN	Transpiration rate	Transpiration rate	Transpiration rate	kg m-2 s-1	Yes	No	No	No	No	No	No	-100	100	1E-06	0	-9999				
N	UGDRNOFF	Accumulated underground runoff	Underground runoff; accumulated	Underground runoff; accumulated	mm	Yes	No	No	Yes	Yes	Yes	Yes	-100	100000	0.01	0	-9999				
N	SFCRNOFF	Accumulated surface runoff	Surface runoff; accumulated	Surface runoff; accumulated	mm	Yes	No	No	No	Yes	Yes	Yes	0	100000	0.001	0	-9999				
N	CANLIQ	Canopy liquid water content	Canopy liquid water content	Canopy liquid water content	mm	Yes	No	No	No	No	No	No	-5	30000	0.01	0	-9999				
N	CANICE	Canopy ice water content	Canopy ice water content	Canopy ice water content	mm	Yes	No	No	No	No	No	No	-5	30000	0.01	0	-9999				
N	ZWT	Depth to water table	Depth to water table	Depth to water table	m	Yes	No	No	No	No	No	No	0	10	1E-05	0	-9999				
N	WA	Water in aquifer	Water in aquifer relative to reference level	Water in aquifer relative to reference level	kg m-2	Yes	No	No	No	No	No	No	0	10000	0.01	0	-9999				
N	WT	Water in aquifer and saturated soil	Water in aquifer and saturated soil	Water in aquifer and saturated soil	kg m-2	Yes	No	No	No	No	No	No	0	10000	0.01	0	-9999				
N	ACCPRCP	Accumulated precip	Accumulated precipitation	Accumulated precipitation	mm	Yes	No	No	No	No	No	No	0	1E+06	0.01	0	-9999				
N	ACCCECAN	Accumulated canopy water	Accumulated canopy evaporation	Accumulated canopy evaporation	mm	Yes	No	No	Yes	No	No	Yes	-100	1E+06	0.01	0	-9999				
N	ACCEDIR	Accumulated direct soil ev																			