ERA5 hourly data on single levels from 1940 to present

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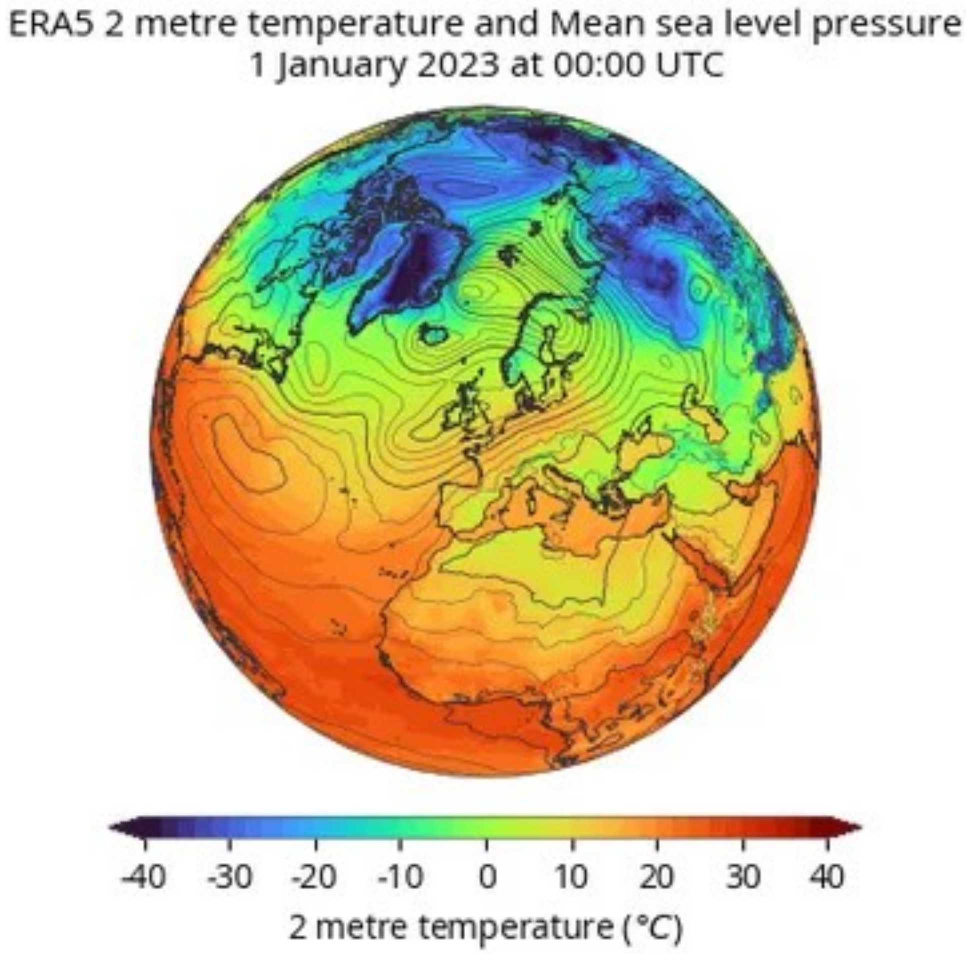
Documentation



ERA5 is the fifth generation ECMWF reanalysis for the global climate and weather for the past 8 decades. Data is available from 1940 onwards. ERA5 replaces the ERA-Interim reanalysis.

Reanalysis combines model data with observations from across the world into a globally complete and consistent dataset using the laws of physics. This principle, called data assimilation, is based on the method used by numerical weather prediction centres, where every so many hours (12 hours at ECMWF) a previous forecast is combined with newly available observations in an optimal way to produce a new best estimate of the state of the atmosphere, called analysis, from which an updated, improved forecast is issued. Reanalysis works in the same way, but at reduced resolution to allow for the provision of a dataset spanning back several decades. Reanalysis does not have the constraint of issuing timely forecasts, so there is more time to collect observations, and when going further back in time, to allow for the ingestion of improved versions of the original observations, which all benefit the quality of the reanalysis product.

ERA5 provides hourly estimates for a large number of atmospheric, ocean-wave and land-surface quantities. An uncertainty estimate is sampled by an underlying 10-member ensemble at three-hourly intervals. Ensemble mean and spread have been pre-computed for convenience. Such uncertainty estimates are closely related to the information content of the available observing system which has evolved considerably over time. They also indicate flow-dependent sensitive areas. To facilitate many climate applications, monthly-mean averages have been pre-calculated too, though monthly means are not available for the ensemble mean and spread.

ERA5 is updated daily with a latency of about 5 days. In case that serious flaws are detected in this early release (called ERA5T), this data could be different from the final release 2 to 3 months later. In case that this occurs users are notified.

The data set presented here is a regridded subset of the full ERA5 data set on native resolution. It is online on spinning disk, which should ensure fast and easy access. It should satisfy the requirements for most common applications.

An overview of all ERA5 datasets can be found in this article. Information on access to ERA5 data on native resolution is provided in these guidelines.

Data has been regridded to a regular lat-lon grid of 0.25 degrees for the reanalysis and 0.5 degrees for the uncertainty estimate (0.5 and 1 degree respectively for ocean waves). There are four main sub sets: hourly and monthly products, both on pressure levels (upper air fields) and single levels (atmospheric, ocean-wave and land surface quantities).

The present entry is "ERA5 hourly data on single levels from 1940 to present".

Data description

Data type	Gridded
Projection	Regular latitude-longitude grid
Horizontal coverage	Global
Horizontal resolution	Reanalysis: 0.25° x 0.25° (atmosphere), 0.5 Mean, spread and members: 0.5° x 0.5° (at

Temporal coverage	1940 to present
Temporal resolution	Hourly
File format	GRIB
Update frequency	Daily

Main variables

Name	Units	Description
100m u-component of wind	$m\ s^{-1}$	This parameter is the eastward component of the 100 m wind. It is the horizontal speed of air moving towards the east, at a height of 100 metres above the surface of the Earth, in metres per second. Care should be taken when comparing model parameters with observations, because observations
100m v-component of wind	$m\ s^{-1}$	This parameter is the northward component of the 100 m wind. It is the horizontal speed of air moving towards the north, at a height of 100 metres above the surface of the Earth, in metres per second. Care should be taken when comparing model parameters with observations, because observations

10m u-component of neutral wind	m s-1	This parameter is the eastward component of the "neutral wind", at a height of 10 metres above the surface of the Earth. The neutral wind is calculated from the surface stress and the corresponding roughness length by assuming that the air is neutrally stratified. The
10m u-component of wind	m s-1	This parameter is the eastward component of the 10m wind. It is the horizontal speed of air moving towards the east, at a height of ten metres above the surface of the Earth, in metres per second. Care should be taken when comparing this parameter with observations, because wind observations vary on small space and time scales and are
10m v-component of neutral wind	m s-1	This parameter is the northward component of the "neutral wind", at a height of 10 metres above the surface of the Earth. The neutral wind is calculated from the surface stress and the corresponding roughness length by assuming that the air is neutrally stratified. The

10m v-component of wind	m s^{-1}	This parameter is the northward component of the 10m wind. It is the horizontal speed of air moving towards the north, at a height of ten metres above the surface of the Earth, in metres per second. Care should be taken when comparing this parameter with observations, because wind observations vary on small space and time scales and are
10m wind gust since previo	m s^{-1}	Maximum 3 second wind at 10 m height as defined by WMO. Parametrization represents turbulence only before 01102008; thereafter effects of convection are
2m dewpoint temperature	K	This parameter is the temperature to which the air, at 2 metres above the surface of the Earth, would have to be cooled for saturation to occur. It is a measure of the humidity of the air. Combined with temperature, it can be used to calculate the relative humidity. 2m dew point temperature is calculated by interpolating
2m temperature	K	This parameter is the temperature of air at 2m above the surface of land, sea or inland waters. 2m temperature is calculated by interpolating between the lowest model level and the Earth's surface

Air density over the oceans	kg m^{-3}	This parameter is the mass of air per cubic metre over the oceans, derived from the temperature, specific humidity and pressure at the lowest model level in the atmospheric model. This parameter is one of the parameters used to
Angle of sub-gridscale orography	radians	This parameter is one of four parameters (the others being standard deviation, slope and anisotropy) that describe the features of the orography that are too small to be resolved by the model grid. These four parameters are calculated for orographic features with horizontal scales comprised between 5 km and the model grid resolution, being derived
Anisotropy of sub-gridscale orography	Dimensionless	This parameter is one of four parameters (the others being standard deviation, slope and angle of sub-gridscale orography) that describe the features of the orography that are too small to be resolved by the model grid. These four parameters are calculated for orographic features with horizontal scales comprised between 5 km and the model grid resolution, being derived from the height of valleys, hills and mountains at about 1 km resolution. They are used as input

Benja min-feir index	Dimen sionle ss	This parameter is used to calculate the likelihood of freak ocean waves, which are waves that are higher than twice the mean height of the highest third of waves. Large values of this parameter (in practice of the order 1) indicate increased probability of the occurrence of freak waves. The ocean/sea surface wave field consists of a combination of waves with different heights, lengths and directions (known as
Bound ary layer dissip ation	J m^{-2}	This parameter is the accumulated conversion of kinetic energy in the mean flow into heat, over the whole atmospheric column, per unit area, that is due to the effects of stress associated with turbulent eddies near the surface and turbulent orographic form drag. It is calculated by the ECMWF Integrated Forecasting System's turbulent diffusion and turbulent orographic form drag schemes. The turbulent eddies near the surface are related to the roughness of the surface. The turbulent orographic form drag is the stress due to the valleys, hills and mountains on

Boundary layer height	m	This parameter is the depth of air next to the Earth's surface which is most affected by the resistance to the transfer of momentum, heat or moisture across the surface. The boundary layer height can be as low as a few tens of metres, such as in cooling air at night, or as high as several kilometres over the desert in the middle of a hot sunny day.
Charnock	Dimensionless	This parameter accounts for increased aerodynamic roughness as wave heights grow due to increasing surface stress. It depends on the wind speed, wave age and other aspects of the sea state and is used to calculate how much the waves slow down the

Clear-sky direct solar radiation at surface	J m^{-2}	This parameter is the amount of direct radiation from the Sun (also known as solar or shortwave radiation) reaching the surface of the Earth, assuming clear-sky (cloudless) conditions. It is the amount of radiation passing through a horizontal plane. Solar radiation at the surface can be direct or diffuse. Solar radiation can be scattered in all directions by particles in the atmosphere, some of which reaches the surface (diffuse solar radiation). Some solar radiation reaches the surface without being scattered (direct solar radiation). Clear-sky radiation quantities are computed for exactly the same atmospheric conditions of temperature, humidity, ozone, trace gases and aerosol as
Cloud base height	m	The height above the Earth's surface of the base of the lowest cloud layer, at the specified time. This parameter is calculated by searching from the second lowest model level upwards, to the height of the level where cloud fraction

Coefficient of drag with waves	Dimensionless	This parameter is the resistance that ocean waves exert on the atmosphere. It is sometimes also called a "friction coefficient". It is calculated by the wave model as the ratio of the square of the friction velocity, to the square of the neutral wind speed at a height of 10 metres above the surface of the Earth. The
Convective available potential energy	J kg^{-1}	This is an indication of the instability (or stability) of the atmosphere and can be used to assess the potential for the development of convection, which can lead to heavy rainfall, thunderstorms and other severe weather. In the ECMWF Integrated Forecasting System (IFS), CAPE is calculated by considering parcels of air departing at different model levels below the 350 hPa level. If a parcel of air is more buoyant (warmer and/or with more moisture) than its surrounding environment, it will continue to rise (cooling as it rises) until it reaches a point where it no longer has positive buoyancy. CAPE is the potential energy represented by the total excess buoyancy. The maximum CAPE

Convective inhibition	J kg-1	This parameter is a measure of the amount of energy required for convection to commence. If the value of this parameter is too high, then deep, moist convection is unlikely to occur even if the convective available potential energy or convective available potential energy shear are large.
Convective precipitation	m	This parameter is the accumulated precipitation that falls to the Earth's surface, which is generated by the convection scheme in the ECMWF Integrated Forecasting System (IFS). The convection scheme represents convection at spatial scales smaller than the grid box. Precipitation can also be generated by the cloud scheme in the IFS, which represents the formation and dissipation of clouds and large-scale precipitation due to changes in atmospheric quantities (such as pressure, temperature and moisture) predicted directly at spatial scales of the grid box or larger. In the IFS, precipitation is comprised of rain and snow. In the IFS, precipitation is comprised of rain and snow. This

Convective rain rate	kg m^{-2} s^{-}	This parameter is the rate of rainfall (rainfall intensity), at the Earth's surface and at the specified time, which is generated by the convection scheme in the ECMWF Integrated Forecasting System (IFS). The convection scheme represents convection at spatial scales smaller than the grid box. Rainfall can also be generated by the cloud scheme in the IFS, which represents the formation and dissipation of clouds and large-scale precipitation due to changes in atmospheric quantities (such as pressure, temperature and moisture) predicted directly at

Convective snowfall	m of water equivalent	This parameter is the accumulated snow that falls to the Earth's surface, which is generated by the convection scheme in the ECMWF Integrated Forecasting System (IFS). The convection scheme represents convection at spatial scales smaller than the grid box. Snowfall can also be generated by the cloud scheme in the IFS, which represents the formation and dissipation of clouds and large-scale precipitation due to changes in atmospheric quantities (such as pressure, temperature and moisture) predicted directly at spatial scales of the grid box or larger. In the IFS, precipitation is comprised of rain and snow. This parameter is accumulated over a

Convective snowfall rate water equivalent	kg m-2 s-	This parameter is the rate of snowfall (snowfall intensity), at the Earth's surface and at the specified time, which is generated by the convection scheme in the ECMWF Integrated Forecasting System (IFS). The convection scheme represents convection at spatial scales smaller than the grid box. Snowfall can also be generated by the cloud scheme in the IFS, which represents the formation and dissipation of clouds and large-scale precipitation due to changes in atmospheric quantities (such as pressure, temperature and moisture) predicted directly at spatial scales of the grid box or

Downward UV radiation at the surface	J m^{-2}	This parameter is the amount of ultraviolet (UV) radiation reaching the surface. It is the amount of radiation passing through a horizontal plane. UV radiation is part of the electromagnetic spectrum emitted by the Sun that has wavelengths shorter than visible light. In the ECMWF Integrated Forecasting system (IFS) it is defined as radiation with a wavelength of 0.20-0.44 µm (microns, 1 millionth of a metre). Small amounts of UV are essential for living organisms, but overexposure may result in cell damage; in humans this includes acute and chronic health effects on the skin, eyes and immune system
Duct base height	m	Duct base height as diagnosed from the vertical gradient of atmospheric refractivity

Eastward gravity wave surface stress	N m^{-2} s	Air flowing over a surface exerts a stress (drag) that transfers momentum to the surface and slows the wind. This parameter is the component of the accumulated surface stress in an eastward direction, associated with low-level, orographic blocking and orographic gravity waves. It is calculated by the ECMWF Integrated Forecasting System's sub-grid orography scheme, which represents stress due to unresolved valleys, hills and mountains with horizontal scales between 5 km and the model grid-scale. (The stress associated with orographic features with horizontal scales smaller than 5 km is accounted for by the turbulent orographic form drag scheme).

Eastward turbulent surface stress	N m^{-2} s	Air flowing over a surface exerts a stress (drag) that transfers momentum to the surface and slows the wind. This parameter is the component of the accumulated surface stress in an eastward direction, associated with turbulent eddies near the surface and turbulent orographic form drag. It is calculated by the ECMWF Integrated Forecasting System's turbulent diffusion and turbulent orographic form drag schemes. The turbulent eddies near the surface are related to the roughness of the surface. The turbulent orographic form drag is the stress due to the valleys, hills and mountains on
Evaporation	m of water equivalent	This parameter is the accumulated amount of water that has evaporated from the Earth's surface, including a simplified representation of transpiration (from vegetation), into vapour in the air above. This parameter is accumulated over a particular time period which depends on the data extracted. For the reanalysis, the accumulation period is over the 1

Forecast albedo	Dimensionless	This parameter is a measure of the reflectivity of the Earth's surface. It is the fraction of short-wave (solar) radiation reflected by the Earth's surface, for diffuse radiation, assuming a fixed spectrum of downward short-wave radiation at the surface. The values of this parameter vary between zero and one. Typically, snow and ice have high reflectivity with albedo values of 0.8 and above, land has intermediate values between about 0.1 and 0.4 and the ocean has low values of 0.1 or less. Short-wave
Forecast logarithm of surface roughness for heat	Dimensionless	This parameter is the natural logarithm of the roughness length for heat. The surface roughness for heat is a measure of the surface resistance to heat transfer. This parameter is used to determine the air to surface transfer of heat. For given atmospheric conditions, a higher surface roughness for heat means that it is more difficult for the
Forecast surface roughness	m	This parameter is the aerodynamic roughness length in metres. It is a measure of the surface resistance. This parameter is used to determine the air to surface transfer of momentum. For given atmospheric conditions, a higher surface

Free convective velocity over the oceans	m s^{-1}	This parameter is an estimate of the vertical velocity of updraughts generated by free convection. Free convection is fluid motion induced by buoyancy forces, which are driven by density gradients. The free convective velocity is used to estimate the impact of wind gusts on ocean wave growth. It is calculated at the height of the lowest temperature inversion (the
Friction velocity	m s^{-1}	Air flowing over a surface exerts a stress that transfers momentum to the surface and slows the wind. This parameter is a theoretical wind speed at the Earth's surface that expresses the magnitude of stress. It is calculated by dividing the surface stress by air density and taking its square root. For turbulent

Gravity wave dissipation	J m^{-2}	This parameter is the accumulated conversion of kinetic energy in the mean flow into heat, over the whole atmospheric column, per unit area, that is due to the effects of stress associated with low-level, orographic blocking and orographic gravity waves. It is calculated by the ECMWF Integrated Forecasting System's sub-grid orography scheme, which represents stress due to unresolved valleys, hills and mountains with horizontal scales between 5 km and the model grid-scale. (The dissipation associated with orographic features with horizontal scales smaller than 5 km is accounted for by the turbulent
High cloud cover	Dimensionless	The proportion of a grid box covered by cloud occurring in the high levels of the troposphere. High cloud is a single level field calculated from cloud occurring on model levels with a pressure less than 0.45 times the surface pressure. So, if the surface pressure is 1000 hPa (hectopascal), high cloud would be calculated using levels with a pressure of less than

High vegetation cover	Dimensionless	This parameter is the fraction of the grid box that is covered with vegetation that is classified as "high". The values vary between 0 and 1 but do not vary in time. This is one of the parameters in the model
Ice temperature layer 1	K	This parameter is the sea-ice temperature in layer 1 (0 to 7cm). The ECMWF Integrated Forecasting System (IFS) has a four-layer sea-ice slab: Layer 1: 0-7cm, Layer 2: 7-28cm, Layer 3: 28-100cm, Layer 4: 100-150cm. The temperature of the sea-ice in each layer changes as heat is transferred between the sea-ice layers and the atmosphere
Ice temperature layer 2	K	This parameter is the sea-ice temperature in layer 2 (7 to 28cm). The ECMWF Integrated Forecasting System (IFS) has a four-layer sea-ice slab: Layer 1: 0-7cm, Layer 2: 7-28cm, Layer 3: 28-100cm, Layer 4: 100-150cm. The temperature of the sea-ice in each layer changes as heat is transferred between the sea-ice layers and the atmosphere

Ice temperature layer 3	K	This parameter is the sea-ice temperature in layer 3 (28 to 100cm). The ECMWF Integrated Forecasting System (IFS) has a four-layer sea-ice slab: Layer 1: 0-7cm, Layer 2: 7-28cm, Layer 3: 28-100cm, Layer 4: 100-150cm. The temperature of the sea-ice in each layer changes as heat is transferred between the sea-ice
Ice temperature layer 4	K	This parameter is the sea-ice temperature in layer 4 (100 to 150cm). The ECMWF Integrated Forecasting System (IFS) has a four-layer sea-ice slab: Layer 1: 0-7cm, Layer 2: 7-28cm, Layer 3: 28-100cm, Layer 4: 100-150cm. The temperature of the sea-ice in each layer changes as heat is transferred between the sea-ice
Instantaneous 10m wind gust	$m\ s^{-1}$	This parameter is the maximum wind gust at the specified time, at a height of ten metres above the surface of the Earth. The WMO defines a wind gust as the maximum of the wind averaged over 3 second intervals. This duration is shorter than a model time step, and so the ECMWF Integrated Forecasting System (IFS)

Instantaneous eastward turbulent surface stress	N m^{-2}	Air flowing over a surface exerts a stress (drag) that transfers momentum to the surface and slows the wind. This parameter is the component of the surface stress at the specified time, in an eastward direction, associated with turbulent eddies near the surface and turbulent orographic form drag. It is calculated by the ECMWF Integrated Forecasting System's turbulent diffusion and turbulent orographic form drag schemes. The turbulent eddies near the surface
Instantaneous large-scale surface precipitation fraction	Dimensionless	This parameter is the fraction of the grid box (0-1) covered by large-scale precipitation at the specified time. Large-scale precipitation is rain and snow that falls to the Earth's surface, and is generated by the cloud scheme in the ECMWF Integrated Forecasting System (IFS). The cloud scheme represents the formation and dissipation of clouds and large-scale precipitation due to
Instantaneous moisture flux	kg m^{-2} s-	This parameter is the net rate of moisture exchange between the land/ocean surface and the atmosphere, due to the processes of evaporation (including evapotranspiration) and

Instantaneous northward turbulent surface stress	N m^{-2}	Air flowing over a surface exerts a stress (drag) that transfers momentum to the surface and slows the wind. This parameter is the component of the surface stress at the specified time, in a northward direction, associated with turbulent eddies near the surface and turbulent orographic form drag. It is calculated by the ECMWF Integrated Forecasting System's turbulent diffusion and turbulent orographic form drag schemes. The turbulent eddies near the surface
Instantaneous surface sensible heat flux	W m^{-2}	This parameter is the transfer of heat between the Earth's surface and the atmosphere, at the specified time, through the effects of turbulent air motion (but excluding any heat transfer resulting from condensation or evaporation). The magnitude of the sensible heat flux is governed by the difference in

K index	K	This parameter is a measure of the potential for a thunderstorm to develop, calculated from the temperature and dew point temperature in the lower part of the atmosphere. The calculation uses the temperature at 850, 700 and 500 hPa and dewpoint temperature at 850 and 700 hPa. Higher values of K indicate a higher potential for
Lake bottom temperature	K	This parameter is the temperature of water at the bottom of inland water bodies (lakes, reservoirs, rivers and coastal waters). This parameter is defined over the whole globe, even where there is no inland water. Regions without inland water can be masked out by only considering grid points where the lake cover is greater than 0.0. In May 2015, a lake model was implemented in the
Lake cover	Dimensionless	This parameter is the proportion of a grid box covered by inland water bodies (lakes, reservoirs, rivers and coastal waters). Values vary between 0: no inland water, and 1: grid box is fully covered with inland water. This parameter is specified from observations and does not

Lake depth	m	This parameter is the mean depth of inland water bodies (lakes, reservoirs, rivers and coastal waters). This parameter is specified from in-situ measurements and indirect estimates and does not vary in time. This parameter is defined over the whole globe, even where there is no inland water. Regions without inland water can be masked
Lake ice depth	m	This parameter is the thickness of ice on inland water bodies (lakes, reservoirs, rivers and coastal waters). This parameter is defined over the whole globe, even where there is no inland water. Regions without inland water can be masked out by only considering grid points where the lake cover is greater than 0.0. In May 2015, a lake model was implemented in the ECMWF

Lake ice temperature	K	This parameter is the temperature of the uppermost surface of ice on inland water bodies (lakes, reservoirs, rivers and coastal waters). It is the temperature at the ice/atmosphere or ice/snow interface. This parameter is defined over the whole globe, even where there is no inland water. Regions without inland water can be masked out by only considering grid points where the lake cover is greater than 0.0. In May 2015, a lake model was
Lake mix-layer depth	m	This parameter is the thickness of the uppermost layer of inland water bodies (lakes, reservoirs, rivers and coastal waters) that is well mixed and has a near constant temperature with depth (i.e., a uniform distribution of temperature with depth). Mixing can occur when the density of the surface (and near-surface) water is greater than that of the water below. Mixing can also occur through the action of wind on the surface of the water. This parameter is defined over the whole globe, even where there is no inland water. Regions without inland water can be masked out by only considering grid points where the

Lake mix-layer temperature	K	This parameter is the temperature of the uppermost layer of inland water bodies (lakes, reservoirs, rivers and coastal waters) that is well mixed and has a near constant temperature with depth (i.e., a uniform distribution of temperature with depth). Mixing can occur when the density of the surface (and near-surface) water is greater than that of the water below. Mixing can also occur through the action of wind on the surface of the water. This parameter is defined over the whole globe, even where there is no inland water. Regions without inland water can be masked out by only considering grid points where the lake cover is greater than 0.0. In May 2015, a lake model was

Lake shape factor	Dimensionless	This parameter describes the way that temperature changes with depth in the thermocline layer of inland water bodies (lakes, reservoirs, rivers and coastal waters) i.e., it describes the shape of the vertical temperature profile. It is used to calculate the lake bottom temperature and other lake-related parameters. This parameter is defined over the whole globe, even where there is no inland water. Regions without inland water can be masked out by only considering grid points where the lake cover is greater than 0.0. In May 2015, a lake model was implemented in the

Lake total layer tempe rature	K	This parameter is the mean temperature of the total water column in inland water bodies (lakes, reservoirs, rivers and coastal waters). This parameter is defined over the whole globe, even where there is no inland water. Regions without inland water can be masked out by only considering grid points where the lake cover is greater than 0.0. In May 2015, a lake model was implemented in the ECMWF Integrated Forecasting System (IFS) to represent the water temperature and lake ice of all the world's major inland water bodies. Lake depth and area fraction (cover) are kept
Land-sea mask	Dimen sionle ss	This parameter is the proportion of land, as opposed to ocean or inland waters (lakes, reservoirs, rivers and coastal waters), in a grid box. This parameter has values ranging between zero and one and is dimensionless. In cycles of the ECMWF Integrated Forecasting System (IFS) from CY41R1 (introduced in May 2015) onwards, grid boxes where this parameter has a value above 0.5 can be comprised of a mixture of land and inland water but not ocean. Grid

Large scale rain rate	kg m-2 s-	This parameter is the rate of rainfall (rainfall intensity), at the Earth's surface and at the specified time, which is generated by the cloud scheme in the ECMWF Integrated Forecasting System (IFS). The cloud scheme represents the formation and dissipation of clouds and large-scale precipitation due to changes in atmospheric quantities (such as pressure, temperature and moisture) predicted directly at spatial scales of the grid box or larger. Rainfall can also be generated by the convection scheme in the IFS, which represents convection at
Large scale snowfall rate water equivalent	kg m-2 s-	This parameter is the rate of snowfall (snowfall intensity), at the Earth's surface and at the specified time, which is generated by the cloud scheme in the ECMWF Integrated Forecasting System (IFS). The cloud scheme represents the formation and dissipation of clouds and large-scale precipitation due to changes in atmospheric quantities (such as pressure, temperature and moisture) predicted directly at spatial scales of the grid box or larger. Snowfall can also be generated by the convection scheme in the IFS, which represents

Large-scale precipitation	m	This parameter is the accumulated precipitation that falls to the Earth's surface, which is generated by the cloud scheme in the ECMWF Integrated Forecasting System (IFS). The cloud scheme represents the formation and dissipation of clouds and large-scale precipitation due to changes in atmospheric quantities (such as pressure, temperature and moisture) predicted directly at spatial scales of the grid box or larger. Precipitation can also be generated by the convection scheme in the IFS, which represents convection at spatial scales smaller than the grid box. In the IFS, precipitation is comprised of rain and snow. This parameter is
Large-scale precipitation fraction	s	This parameter is the accumulation of the fraction of the grid box (0-1) that is covered by large-scale precipitation. This parameter is accumulated over a particular time period which depends on the data extracted. For the reanalysis, the

Large-scale snowfall	m of water equivalent	This parameter is the accumulated snow that falls to the Earth's surface, which is generated by the cloud scheme in the ECMWF Integrated Forecasting System (IFS). The cloud scheme represents the formation and dissipation of clouds and large-scale precipitation due to changes in atmospheric quantities (such as pressure, temperature and moisture) predicted directly at spatial scales of the grid box or larger. Snowfall can also be generated by the convection scheme in the IFS, which represents convection at spatial scales smaller than the grid box. In the IFS, precipitation is comprised of rain and snow. This parameter is
Leaf area index, high vegetation	$m^2\ m^{-2}$	This parameter is the surface area of one side of all the leaves found over an area of land for vegetation classified as "high". This parameter has a value of 0 over bare ground or where there are no leaves. It can be calculated daily from satellite data. It is important for forecasting, for example, how much rainwater will

Leaf area index, low vegetation	$m^2 m^{-2}$	This parameter is the surface area of one side of all the leaves found over an area of land for vegetation classified as "low". This parameter has a value of 0 over bare ground or where there are no leaves. It can be calculated daily from satellite data. It is important for forecasting, for example, how much rainwater will be intercepted by the vegetative
Low cloud cover	Dimensionless	This parameter is the proportion of a grid box covered by cloud occurring in the lower levels of the troposphere. Low cloud is a single level field calculated from cloud occurring on model levels with a pressure greater than 0.8 times the surface pressure. So, if the surface pressure is 1000 hPa (hectopascal)
Low vegetation cover	Dimensionless	This parameter is the fraction of the grid box that is covered with vegetation that is classified as "low". The values vary between 0 and 1 but do not vary in time. This is one of the parameters in the model that describes land surface

Maximum 2m temperature since previous	K	This parameter is the highest temperature of air at 2m above the surface of land, sea or inland water since the parameter was last archived in a particular forecast. 2m temperature is calculated by interpolating between the lowest
Maximum individual wave height	m	This parameter is an estimate of the height of the expected highest individual wave within a 20 minute time window. It can be used as a guide to the likelihood of extreme or freak waves. The interactions between waves are non-linear and occasionally concentrate wave energy giving a wave height considerably larger than the significant wave height. If the maximum individual wave height is more than twice the significant wave height, then the wave is considered as a freak wave. The significant wave height represents
Maximum total precipitation	$kg\ m^{-2}\ s^{-}$	The total precipitation is calculated from the combined large-scale and convective rainfall and snowfall rates every time step and the maximum is kept since the last

Mean boundary layer dissipation	W m^{-2}	This parameter is the mean rate of conversion of kinetic energy in the mean flow into heat, over the whole atmospheric column, per unit area, that is due to the effects of stress associated with turbulent eddies near the surface and turbulent orographic form drag. It is calculated by the ECMWF Integrated Forecasting System's turbulent diffusion and turbulent orographic form drag schemes. The turbulent eddies near the surface are related to the roughness of the surface. The turbulent orographic form drag is the stress due to the valleys, hills and mountains on

Mean convective precipitation rate	kg m^{-2} s-	This parameter is the rate of precipitation at the Earth's surface, which is generated by the convection scheme in the ECMWF Integrated Forecasting System (IFS). The convection scheme represents convection at spatial scales smaller than the grid box. Precipitation can also be generated by the cloud scheme in the IFS, which represents the formation and dissipation of clouds and large-scale precipitation due to changes in atmospheric quantities (such as pressure, temperature and moisture) predicted directly at spatial scales of the grid box or larger. In the IFS, precipitation is comprised of rain and snow. This parameter is a mean over a particular time period (the processing period) which depends

Mean convective snowfall rate	kg m^{-2} s^{-}	This parameter is the rate of snowfall (snowfall intensity) at the Earth's surface, which is generated by the convection scheme in the ECMWF Integrated Forecasting System (IFS). The convection scheme represents convection at spatial scales smaller than the grid box. Snowfall can also be generated by the cloud scheme in the IFS, which represents the formation and dissipation of clouds and large-scale precipitation due to changes in atmospheric quantities (such as pressure, temperature and moisture) predicted directly at spatial scales of the grid box or larger. In the IFS, precipitation is comprised of rain and snow. This parameter is a mean over a particular time period (the
Mean direction of total swell	degrees	This parameter is the mean direction of waves associated with swell. The ocean/sea surface wave field consists of a combination of waves with different heights, lengths and directions (known as the two-dimensional wave spectrum). The wave spectrum can be decomposed into wind-sea waves, which are directly affected by local winds, and swell, the waves that were generated by the wind at a

Mean direction of wind waves	degrees	The mean direction of waves generated by local winds. The ocean/sea surface wave field consists of a combination of waves with different heights, lengths and directions (known as the two-dimensional wave spectrum). The wave spectrum can be decomposed into wind-sea waves, which are directly affected by local winds, and swell, the waves that were generated by the wind at a
Mean eastward gravity wave surface stress	N m^{-2}	Air flowing over a surface exerts a stress (drag) that transfers momentum to the surface and slows the wind. This parameter is the component of the mean surface stress in an eastward direction, associated with low-level, orographic blocking and orographic gravity waves. It is calculated by the ECMWF Integrated Forecasting System's sub-grid orography scheme, which represents stress due to unresolved valleys, hills and mountains with horizontal scales between 5 km and the model grid-scale. (The stress associated with orographic features with horizontal scales smaller than 5 km is accounted for by the turbulent orographic form drag scheme).

Mean eastward turbulent surface stress	N m^{-2}	Air flowing over a surface exerts a stress (drag) that transfers momentum to the surface and slows the wind. This parameter is the component of the mean surface stress in an eastward direction, associated with turbulent eddies near the surface and turbulent orographic form drag. It is calculated by the ECMWF Integrated Forecasting System's turbulent diffusion and turbulent orographic form drag schemes. The turbulent eddies near the surface are related to the roughness of the surface. The turbulent orographic form drag is the stress due to the valleys, hills and mountains on
Mean evaporation rate	kg m^{-2} s-	This parameter is the amount of water that has evaporated from the Earth's surface, including a simplified representation of transpiration (from vegetation), into vapour in the air above. This parameter is a mean over a particular time period (the processing period) which depends on the data extracted. For the reanalysis, the processing period is

Mean gravity wave dissipation	W m^{-2}	This parameter is the mean rate of conversion of kinetic energy in the mean flow into heat, over the whole atmospheric column, per unit area, that is due to the effects of stress associated with low-level, orographic blocking and orographic gravity waves. It is calculated by the ECMWF Integrated Forecasting System's sub-grid orography scheme, which represents stress due to unresolved valleys, hills and mountains with horizontal scales between 5 km and the model grid-scale. (The dissipation associated with orographic features with horizontal scales smaller than 5 km is accounted for by the turbulent
Mean large-scale precipitation fraction	Dimensionless	This parameter is the mean of the fraction of the grid box (0-1) that is covered by large-scale precipitation. This parameter is a mean over a particular time period (the processing period) which depends on the data extracted. For the

Mean large-scale precipitation rate	kg m^{-2} s-	This parameter is the rate of precipitation at the Earth's surface, which is generated by the cloud scheme in the ECMWF Integrated Forecasting System (IFS). The cloud scheme represents the formation and dissipation of clouds and large-scale precipitation due to changes in atmospheric quantities (such as pressure, temperature and moisture) predicted directly at spatial scales of the grid box or larger. Precipitation can also be generated by the convection scheme in the IFS, which represents convection at spatial scales smaller than the grid box. In the IFS, precipitation is comprised of rain and snow. This parameter is a mean over a particular time period (the

Mean large-scale snowfall rate	kg m^{-2} s-	This parameter is the rate of snowfall (snowfall intensity) at the Earth's surface, which is generated by the cloud scheme in the ECMWF Integrated Forecasting System (IFS). The cloud scheme represents the formation and dissipation of clouds and large-scale precipitation due to changes in atmospheric quantities (such as pressure, temperature and moisture) predicted directly at spatial scales of the grid box or larger. Snowfall can also be generated by the convection scheme in the IFS, which represents convection at spatial scales smaller than the grid box. In the IFS, precipitation is comprised of rain and snow. This parameter is a mean over a particular time period (the processing period) which depends

Mean northward gravity wave surface stress	N m^{-2}	Air flowing over a surface exerts a stress (drag) that transfers momentum to the surface and slows the wind. This parameter is the component of the mean surface stress in a northward direction, associated with low-level, orographic blocking and orographic gravity waves. It is calculated by the ECMWF Integrated Forecasting System's sub-grid orography scheme, which represents stress due to unresolved valleys, hills and mountains with horizontal scales between 5 km and the model grid-scale. (The stress associated with orographic features with horizontal scales smaller than 5 km is accounted for by the turbulent orographic form drag scheme).

Mean northward turbulent surface stress	N m^{-2}	Air flowing over a surface exerts a stress (drag) that transfers momentum to the surface and slows the wind. This parameter is the component of the mean surface stress in a northward direction, associated with turbulent eddies near the surface and turbulent orographic form drag. It is calculated by the ECMWF Integrated Forecasting System's turbulent diffusion and turbulent orographic form drag schemes. The turbulent eddies near the surface are related to the roughness of the surface. The turbulent orographic form drag is the stress due to the valleys, hills and mountains on horizontal scales below 5km, which
Mean period of total swell	s	This parameter is the average time it takes for two consecutive wave crests, on the surface of the ocean/ sea associated with swell, to pass through a fixed point. The ocean/ sea surface wave field consists of a combination of waves with different heights, lengths and directions (known as the two-dimensional wave spectrum). The wave

Mean period of wind waves	s	This parameter is the average time it takes for two consecutive wave crests, on the surface of the ocean/ sea generated by local winds, to pass through a fixed point. The ocean/sea surface wave field consists of a combination of waves with different heights, lengths and directions (known as the two-dimensional wave spectrum). The
Mean potential evaporation rate	kg m^{-2} s-	This parameter is a measure of the extent to which near-surface atmospheric conditions are conducive to the process of evaporation. It is usually considered to be the amount of evaporation, under existing atmospheric conditions, from a surface of pure water which has the temperature of the lowest layer of the atmosphere and gives an indication of the maximum possible evaporation. Potential evaporation in the current ECMWF Integrated Forecasting System (IFS) is based on surface energy balance calculations with the vegetation parameters set to "crops/mixed farming" and assuming "no stress from soil moisture". In other words,

Mean runoff rate	kg m^{-2} s^{-}	Some water from rainfall, melting snow, or deep in the soil, stays stored in the soil. Otherwise, the water drains away, either over the surface (surface runoff), or under the ground (sub-surface runoff) and the sum of these two is called runoff. This parameter is a mean over a particular time period (the processing period) which depends on the data extracted. For the reanalysis, the processing period is over the 1 hour ending at the validity date and time. For the
Mean sea level pressure	Pa	This parameter is the pressure (force per unit area) of the atmosphere at the surface of the Earth, adjusted to the height of mean sea level. It is a measure of the weight that all the air in a column vertically above a point on the Earth's surface would have, if the point were located at mean sea level. It is calculated over all surfaces - land, sea and inland water. Maps of mean sea level

Mean snow evaporation rate	kg m-2 s-	This parameter is the average rate of snow evaporation from the snow-covered area of a grid box into vapour in the air above. The ECMWF Integrated Forecasting System (IFS) represents snow as a single additional layer over the uppermost soil level. The snow may cover all or part of the grid box. This parameter is a mean over a particular time period (the processing period) which depends on the data extracted. For the reanalysis, the processing period is over the 1 hour ending at the validity date and time. For the

Mean snowfall rate	kg m^{-2} s^{-}	This parameter is the rate of snowfall at the Earth's surface. It is the sum of large-scale and convective snowfall. Large-scale snowfall is generated by the cloud scheme in the ECMWF Integrated Forecasting System (IFS). The cloud scheme represents the formation and dissipation of clouds and large-scale precipitation due to changes in atmospheric quantities (such as pressure, temperature and moisture) predicted directly at spatial scales of the grid box or larger. Convective snowfall is generated by the convection scheme in the IFS, which represents convection at spatial scales smaller than the grid box. In the IFS, precipitation is comprised of rain and snow. This parameter is a mean over a

Mean snow melt rate	kg m-2 s-	This parameter is the rate of snow melt in the snow-covered area of a grid box. The ECMWF Integrated Forecasting System (IFS) represents snow as a single additional layer over the uppermost soil level. The snow may cover all or part of the grid box. This parameter is a mean over a particular time period (the processing period) which depends on the data extracted. For the reanalysis, the processing period is over the 1 hour ending at the
Mean square slope of waves	Dimensionless	This parameter can be related analytically to the average slope of combined wind-sea and swell waves. It can also be expressed as a function of wind speed under some statistical assumptions. The higher the slope, the steeper the waves. This parameter indicates the roughness of the sea/ocean surface

Mean sub-surface runoff rate	kg m^{-2} s^{-}	Some water from rainfall, melting snow, or deep in the soil, stays stored in the soil. Otherwise, the water drains away, either over the surface (surface runoff), or under the ground (sub-surface runoff) and the sum of these two is called runoff. This parameter is a mean over a particular time period (the processing period) which depends on the data extracted. For the reanalysis, the processing period is over the 1 hour ending at the validity date and time. For the
Mean surface direct short-wave radiation flux	W m^{-2}	This parameter is the amount of direct solar radiation (also known as shortwave radiation) reaching the surface of the Earth. It is the amount of radiation passing through a horizontal plane. Solar radiation at the surface can be direct or diffuse. Solar radiation can be scattered in all directions by particles in the atmosphere, some of which reaches the surface (diffuse solar radiation). Some solar radiation reaches the surface without being scattered

Mean surface direct short-wave radiation flux, clear sky	W m^{-2}	This parameter is the amount of direct radiation from the Sun (also known as solar or shortwave radiation) reaching the surface of the Earth, assuming clear-sky (cloudless) conditions. It is the amount of radiation passing through a horizontal plane. Solar radiation at the surface can be direct or diffuse. Solar radiation can be scattered in all directions by particles in the atmosphere, some of which reaches the surface (diffuse solar radiation). Some solar radiation reaches the surface without being scattered (direct solar radiation). Clear-sky radiation quantities are computed

Mean surface downward UV radiation flux	W m^{-2}	This parameter is the amount of ultraviolet (UV) radiation reaching the surface. It is the amount of radiation passing through a horizontal plane. UV radiation is part of the electromagnetic spectrum emitted by the Sun that has wavelengths shorter than visible light. In the ECMWF Integrated Forecasting system (IFS) it is defined as radiation with a wavelength of 0.20-0.44 µm (microns, 1 millionth of a metre). Small amounts of UV are essential for living organisms, but overexposure may result in cell damage; in humans this includes
Mean surface downward long-wave radiation flux	W m^{-2}	This parameter is the amount of thermal (also known as longwave or terrestrial) radiation emitted by the atmosphere and clouds that reaches a horizontal plane at the surface of the Earth. The surface of the Earth emits thermal radiation, some of which is absorbed by the atmosphere and clouds. The atmosphere and clouds likewise emit thermal radiation in all directions, some of which reaches the surface (represented by this

Mean surface downward long-wave radiation flux, clear sky	W m^{-2}	This parameter is the amount of thermal (also known as longwave or terrestrial) radiation emitted by the atmosphere that reaches a horizontal plane at the surface of the Earth, assuming clear-sky (cloudless) conditions. The surface of the Earth emits thermal radiation, some of which is absorbed by the atmosphere and clouds. The atmosphere and clouds likewise emit thermal radiation in all directions, some of which reaches the surface. Clear-sky radiation quantities are computed for exactly the same atmospheric conditions of

Mean surface downward short-wave radiation flux	W m^{-2}	This parameter is the amount of solar radiation (also known as shortwave radiation) that reaches a horizontal plane at the surface of the Earth. This parameter comprises both direct and diffuse solar radiation. Radiation from the Sun (solar, or shortwave, radiation) is partly reflected back to space by clouds and particles in the atmosphere (aerosols) and some of it is absorbed. The rest is incident on the Earth's surface (represented by this parameter). To a reasonably good approximation, this parameter is the model equivalent of what would be measured by a pyranometer (an instrument used for

Mean surface downward short-wave radiation flux, clear sky	W m^{-2}	This parameter is the amount of solar radiation (also known as shortwave radiation) that reaches a horizontal plane at the surface of the Earth, assuming clear-sky (cloudless) conditions. This parameter comprises both direct and diffuse solar radiation. Radiation from the Sun (solar, or shortwave, radiation) is partly reflected back to space by clouds and particles in the atmosphere (aerosols) and some of it is absorbed. The rest is incident on the Earth's surface. Clear-sky radiation quantities are computed for exactly the same atmospheric
Mean surface latent heat flux	W m^{-2}	This parameter is the transfer of latent heat (resulting from water phase changes, such as evaporation or condensation) between the Earth's surface and the atmosphere through the effects of turbulent air motion. Evaporation from the Earth's surface represents a transfer of energy from the surface to the atmosphere. This parameter is a mean over a particular time

Mean surface net long-wave radiation flux	W m^{-2}	Thermal radiation (also known as longwave or terrestrial radiation) refers to radiation emitted by the atmosphere, clouds and the surface of the Earth. This parameter is the difference between downward and upward thermal radiation at the surface of the Earth. It is the amount of radiation passing through a horizontal plane. The atmosphere and clouds emit thermal radiation in all directions, some of which reaches the surface as downward thermal radiation. The upward thermal radiation at the surface

Mean surface net long-wave radiation flux, clear sky	W m^{-2}	Thermal radiation (also known as longwave or terrestrial radiation) refers to radiation emitted by the atmosphere, clouds and the surface of the Earth. This parameter is the difference between downward and upward thermal radiation at the surface of the Earth, assuming clear-sky (cloudless) conditions. It is the amount of radiation passing through a horizontal plane. Clear-sky radiation quantities are computed for exactly the same atmospheric conditions of temperature, humidity, ozone, trace gases and aerosol as the corresponding total-sky quantities (clouds included), but assuming that the clouds are not there. The
Mean surface net short-wave radiation flux	W m^{-2}	This parameter is the amount of solar radiation (also known as shortwave radiation) that reaches a horizontal plane at the surface of the Earth (both direct and diffuse) minus the amount reflected by the Earth's surface (which is governed by the albedo). Radiation from the Sun (solar, or shortwave, radiation) is partly reflected back to space by clouds and particles in the atmosphere (aerosols) and some of it is absorbed. The remainder is incident on the Earth's surface

Mean surface net short-wave radiation flux, clear sky	W m^{-2}	This parameter is the amount of solar (shortwave) radiation reaching the surface of the Earth (both direct and diffuse) minus the amount reflected by the Earth's surface (which is governed by the albedo), assuming clear-sky (cloudless) conditions. It is the amount of radiation passing through a horizontal plane. Clear-sky radiation quantities are computed for exactly the same atmospheric conditions of temperature, humidity, ozone, trace gases and aerosol as the corresponding total-sky quantities (clouds included), but assuming that the clouds are not there. Radiation from the Sun (solar, or shortwave, radiation) is partly reflected back to
Mean surface runoff rate	kg m^{-2} s-	Some water from rainfall, melting snow, or deep in the soil, stays stored in the soil. Otherwise, the water drains away, either over the surface (surface runoff), or under the ground (sub-surface runoff) and the sum of these two is called runoff. This parameter is a mean over a particular time period (the processing period) which depends on the data extracted. For the reanalysis, the processing period is over the 1 hour ending at the validity date and time. For the

Mean surfac e sensib le heat flux	W m-2	This parameter is the transfer of heat between the Earth's surface and the atmosphere through the effects of turbulent air motion (but excluding any heat transfer resulting from condensation or evaporation). The magnitude of the sensible heat flux is governed by the difference in temperature between the surface and the overlying atmosphere, wind speed and the surface roughness. For example, cold air overlying a warm surface would produce a sensible heat flux from the land (or
Mean top down ward short-wave radiati on flux	W m-2	This parameter is the incoming solar radiation (also known as shortwave radiation), received from the Sun, at the top of the atmosphere. It is the amount of radiation passing through a horizontal plane. This parameter is a mean over a particular time period (the processing period) which depends on the data extracted. For the reanalysis, the processing

Mean top net long-wave radiation flux	W m^{-2}	The thermal (also known as terrestrial or longwave) radiation emitted to space at the top of the atmosphere is commonly known as the Outgoing Longwave Radiation (OLR). The top net thermal radiation (this parameter) is equal to the negative of OLR. This parameter is a mean over a particular time period (the processing period) which
Mean top net long-wave radiation flux, clear sky	W m^{-2}	This parameter is the thermal (also known as terrestrial or longwave) radiation emitted to space at the top of the atmosphere, assuming clear-sky (cloudless) conditions. It is the amount passing through a horizontal plane. Note that the ECMWF convention for vertical fluxes is positive downwards, so a flux from the atmosphere to space will be negative. Clear-sky radiation quantities are computed for exactly the same atmospheric conditions of temperature, humidity, ozone, trace gases and aerosol as total-sky quantities (clouds included), but

Mean top net short-wave radiation flux	W m^{-2}	This parameter is the incoming solar radiation (also known as shortwave radiation) minus the outgoing solar radiation at the top of the atmosphere. It is the amount of radiation passing through a horizontal plane. The incoming solar radiation is the amount received from the Sun. The outgoing solar radiation is the amount reflected and scattered by the Earth's atmosphere and surface. This
Mean top net short-wave radiation flux, clear sky	W m^{-2}	This parameter is the incoming solar radiation (also known as shortwave radiation) minus the outgoing solar radiation at the top of the atmosphere, assuming clear-sky (cloudless) conditions. It is the amount of radiation passing through a horizontal plane. The incoming solar radiation is the amount received from the Sun. The outgoing solar radiation is the amount reflected and scattered by the Earth's atmosphere and surface, assuming clear-sky (cloudless) conditions. Clear-sky radiation quantities are computed for exactly

Mean total precipitation rate	kg m-2 s-	This parameter is the rate of precipitation at the Earth's surface. It is the sum of the rates due to large-scale precipitation and convective precipitation. Large-scale precipitation is generated by the cloud scheme in the ECMWF Integrated Forecasting System (IFS). The cloud scheme represents the formation and dissipation of clouds and large-scale precipitation due to changes in atmospheric quantities (such as pressure, temperature and moisture) predicted directly at spatial scales of the grid box or larger. Convective precipitation is generated by the convection scheme in the IFS, which represents convection at spatial scales smaller than the grid box. In the IFS, precipitation is comprised of rain and snow. This parameter is a mean
Mean vertical gradient of	m-1	Mean vertical gradient of atmospheric refractivity inside the trapping layer.

Mean vertically integrated moisture divergence	kg m-2 s-	The vertical integral of the moisture flux is the horizontal rate of flow of moisture (water vapour, cloud liquid and cloud ice), per metre across the flow, for a column of air extending from the surface of the Earth to the top of the atmosphere. Its horizontal divergence is the rate of moisture spreading outward from a point, per square metre. This parameter is a mean over a particular time period (the processing period) which depends on the data extracted. For the reanalysis, the processing period is over the 1 hour ending at the validity date and time. For the ensemble members, ensemble mean and ensemble spread, the processing period is over the 3 hours ending at the validity date and

Mean wave direction	degree true	This parameter is the mean direction of ocean/sea surface waves. The ocean/sea surface wave field consists of a combination of waves with different heights, lengths and directions (known as the two-dimensional wave spectrum). This parameter is a mean over all frequencies and directions of the two-dimensional wave spectrum. The wave spectrum can be decomposed into wind-sea waves, which are directly affected by local winds, and swell, the waves that were generated by the wind at a
Mean wave direction of first swell partition	degrees	This parameter is the mean direction of waves in the first swell partition. The ocean/sea surface wave field consists of a combination of waves with different heights, lengths and directions (known as the two-dimensional wave spectrum). The wave spectrum can be decomposed into wind-sea waves, which are directly affected by local winds, and swell, the waves that were generated by the wind at a different location and time. In many situations, swell can be made up of different swell systems, for example, from two distant and

Mean wave direction of second swell partition	degrees	This parameter is the mean direction of waves in the second swell partition. The ocean/sea surface wave field consists of a combination of waves with different heights, lengths and directions (known as the two-dimensional wave spectrum). The wave spectrum can be decomposed into wind-sea waves, which are directly affected by local winds, and swell, the waves that were generated by the wind at a different location and time. In many situations, swell can be made up of different swell systems, for example, from two
Mean wave direction of third swell partition	degrees	This parameter is the mean direction of waves in the third swell partition. The ocean/sea surface wave field consists of a combination of waves with different heights, lengths and directions (known as the two-dimensional wave spectrum). The wave spectrum can be decomposed into wind-sea waves, which are directly affected by local winds, and swell, the waves that were generated by the wind at a different location and time. In many situations, swell can be made up of different swell systems, for example, from two distant and

Mean wave period	s	This parameter is the average time it takes for two consecutive wave crests, on the surface of the ocean/ sea, to pass through a fixed point. The ocean/sea surface wave field consists of a combination of waves with different heights, lengths and directions (known as the two-dimensional wave spectrum). This parameter is a mean over all frequencies and directions of the two-dimensional wave spectrum
Mean wave period based on first moment	s	This parameter is the reciprocal of the mean frequency of the wave components that represent the sea state. All wave components have been averaged proportionally to their respective amplitude. This parameter can be used to estimate the magnitude of Stokes drift transport in deep water. The ocean/

Mean wave period based on first moment for swell	s	This parameter is the reciprocal of the mean frequency of the wave components associated with swell. All wave components have been averaged proportionally to their respective amplitude. This parameter can be used to estimate the magnitude of Stokes drift transport in deep water associated with swell. The ocean/sea surface wave field consists of a combination of waves with different heights
Mean wave period based on first moment for wind waves	s	This parameter is the reciprocal of the mean frequency of the wave components generated by local winds. All wave components have been averaged proportionally to their respective amplitude. This parameter can be used to estimate the magnitude of Stokes drift transport in deep water associated with wind waves. The ocean/sea surface wave field consists of a combination of waves with different

Mean wave period based on secon d mome nt for swell	s	This parameter is equivalent to the zero-crossing mean wave period for swell. The zero-crossing mean wave period represents the mean length of time between occasions where the sea/ocean surface crosses a defined zeroth level (such as mean sea level). The ocean/sea surface wave field consists of a combination of waves with different heights, lengths and directions (known as
Mean wave period based on secon d mome nt for wind waves	s	This parameter is equivalent to the zero-crossing mean wave period for waves generated by local winds. The zero-crossing mean wave period represents the mean length of time between occasions where the sea/ocean surface crosses a defined zeroth level (such as mean sea level). The ocean/sea surface wave field consists of a combination of waves with different heights,

Mean wave period of first swell partition	s	This parameter is the mean period of waves in the first swell partition. The wave period is the average time it takes for two consecutive wave crests, on the surface of the ocean/sea, to pass through a fixed point. The ocean/sea surface wave field consists of a combination of waves with different heights, lengths and directions (known as the two-dimensional wave spectrum). The wave spectrum can be decomposed into wind-sea waves, which are directly affected by local winds, and swell, the waves that
Mean wave period of second swell partition	s	This parameter is the mean period of waves in the second swell partition. The wave period is the average time it takes for two consecutive wave crests, on the surface of the ocean/sea, to pass through a fixed point. The ocean/sea surface wave field consists of a combination of waves with different heights, lengths and directions (known as the two-dimensional wave spectrum). The wave spectrum can be decomposed into wind-sea waves, which are directly affected by local winds, and swell

Mean wave period of third swell partition	s	This parameter is the mean period of waves in the third swell partition. The wave period is the average time it takes for two consecutive wave crests, on the surface of the ocean/ sea, to pass through a fixed point. The ocean/sea surface wave field consists of a combination of waves with different heights, lengths and directions (known as the two-dimensional wave spectrum). The wave spectrum can be decomposed into wind-sea waves, which are directly affected by local winds, and swell, the waves that
Mean zero-crossing wave period	s	This parameter represents the mean length of time between occasions where the sea/ocean surface crosses mean sea level. In combination with wave height information, it could be used to assess the length of time that a coastal structure might be under water, for example. The ocean/sea

Medium cloud cover	Dimensionless	This parameter is the proportion of a grid box covered by cloud occurring in the middle levels of the troposphere. Medium cloud is a single level field calculated from cloud occurring on model levels with a pressure between 0.45 and 0.8 times the surface pressure. So, if the surface pressure is 1000 hPa (hectopascal), medium cloud would be calculated using levels with a pressure of less than or equal to
Minimum 2m temperature since previous post-	K	This parameter is the lowest temperature of air at 2m above the surface of land, sea or inland waters since the parameter was last archived in a particular forecast. 2m temperature is calculated by interpolating between the lowest model level and the Earth's surface
Minimum total precipitation	kg m^{-2} s^{-}	The total precipitation is calculated from the combined large-scale and convective rainfall and snowfall rates every time step and the minimum is kept since the last
Minimum vertical gradie	m^{-1}	Minimum vertical gradient of atmospheric refractivity inside the trapping layer.

Model bathymetry	m	This parameter is the depth of water from the surface to the bottom of the ocean. It is used by the ocean wave model to specify the propagation properties of the different waves that could be present. Note that the ocean wave model grid is too coarse to resolve
Near IR albedo for diffuse radiation	Dimensionless	Albedo is a measure of the reflectivity of the Earth's surface. This parameter is the fraction of diffuse solar (shortwave) radiation with wavelengths between 0.7 and 4 μm (microns, 1 millionth of a metre) reflected by the Earth's surface (for snow-free land surfaces only). Values of this parameter vary between 0 and 1. In the ECMWF Integrated Forecasting System (IFS) albedo is dealt with separately for solar radiation with wavelengths greater/less than 0.7μm and for direct and diffuse solar radiation

Near IR albedo for direct radiation	Dimensionless	Albedo is a measure of the reflectivity of the Earth's surface. This parameter is the fraction of direct solar (shortwave) radiation with wavelengths between 0.7 and 4 µm (microns, 1 millionth of a metre) reflected by the Earth's surface (for snow-free land surfaces only). Values of this parameter vary between 0 and 1. In the ECMWF Integrated Forecasting System (IFS) albedo is dealt with separately for solar radiation with wavelengths greater/less than 0.7µm and for direct and diffuse solar radiation
Normalized energy flux into ocean	Dimensionless	This parameter is the normalised vertical flux of turbulent kinetic energy from ocean waves into the ocean. The energy flux is calculated from an estimation of the loss of wave energy due to white capping waves. A white capping wave is one that appears white at its crest as it breaks, due to air being mixed into
Normalized energy flux into	Dimensionless	This parameter is the normalised vertical flux of energy from wind into the ocean waves. A positive flux implies a flux into the waves. The energy flux has units of Watts per

Normalized stress into ocean	Dimensionless	This parameter is the normalised surface stress, or momentum flux, from the air into the ocean due to turbulence at the air-sea interface and breaking waves. It does not include the flux used to generate waves. The ECMWF convention for
Northward gravity wave surface stress	N m-2 s	Air flowing over a surface exerts a stress (drag) that transfers momentum to the surface and slows the wind. This parameter is the component of the accumulated surface stress in a northward direction, associated with low-level, orographic blocking and orographic gravity waves. It is calculated by the ECMWF Integrated Forecasting System's sub-grid orography scheme, which represents stress due to unresolved valleys, hills and mountains with horizontal scales between 5 km and the model grid-scale. (The stress associated with orographic features with horizontal scales smaller than 5 km is accounted for by the turbulent orographic form drag scheme).

Northward turbulent surface stress	N m^{-2} s	Air flowing over a surface exerts a stress (drag) that transfers momentum to the surface and slows the wind. This parameter is the component of the accumulated surface stress in a northward direction, associated with turbulent eddies near the surface and turbulent orographic form drag. It is calculated by the ECMWF Integrated Forecasting System's turbulent diffusion and turbulent orographic form drag schemes. The turbulent eddies near the surface are related to the roughness of the surface. The turbulent orographic form drag is the stress due to the valleys, hills and mountains on
Ocean surface stress equivalent 10m neutral wind direction	degrees	This parameter is the direction from which the "neutral wind" blows, in degrees clockwise from true north, at a height of ten metres above the surface of the Earth. The neutral wind is calculated from the surface stress and roughness length by assuming that the air is neutrally stratified. The neutral wind is, by definition, in the direction of the surface stress. The size of the

Ocean surface stress equivalent 10m neutral wind speed	m s^{-1}	This parameter is the horizontal speed of the "neutral wind", at a height of ten metres above the surface of the Earth. The units of this parameter are metres per second. The neutral wind is calculated from the surface stress and roughness length by assuming that the air is neutrally stratified. The neutral wind is, by definition, in the direction of the surface stress. The
Geopotential	m^2 s^{-2}	This parameter is the gravitational potential energy of a unit mass, at a particular location at the surface of the Earth, relative to mean sea level. It is also the amount of work that would have to be done, against the force of gravity, to lift a unit mass to that location from mean sea level.
Peak wave period	s	This parameter represents the period of the most energetic ocean waves generated by local winds and associated with swell. The wave period is the average time it takes for two consecutive wave crests, on the surface of the ocean/sea, to pass through a fixed point. The ocean/sea surface wave field consists of a combination of waves with different heights, lengths and directions (known as the two-dimensional wave spectrum). This

Period corresponding to maximum individual wave height	s	This parameter is the period of the expected highest individual wave within a 20-minute time window. It can be used as a guide to the characteristics of extreme or freak waves. Wave period is the average time it takes for two consecutive wave crests, on the surface of the ocean/sea, to pass through a fixed point. Occasionally waves of different periods reinforce and interact non-linearly giving a wave height considerably larger than the significant wave height. If the maximum individual wave height is more than twice the significant wave height, then the wave is considered to be a freak wave. The

Potential evaporation	m	This parameter is a measure of the extent to which near-surface atmospheric conditions are conducive to the process of evaporation. It is usually considered to be the amount of evaporation, under existing atmospheric conditions, from a surface of pure water which has the temperature of the lowest layer of the atmosphere and gives an indication of the maximum possible evaporation. Potential evaporation in the current ECMWF Integrated Forecasting System (IFS) is based on surface energy balance calculations with the vegetation parameters set to "crops/mixed farming" and assuming "no stress from soil moisture". In other words,
Precipitation type	Dimensionless	This parameter describes the type of precipitation at the surface, at the specified time. A precipitation type is assigned wherever there is a non-zero value of precipitation. In the ECMWF Integrated Forecasting System (IFS) there are only two predicted precipitation variables: rain and snow. Precipitation type is derived from these two predicted variables in combination with atmospheric conditions, such as

Runoff	m	Some water from rainfall, melting snow, or deep in the soil, stays stored in the soil. Otherwise, the water drains away, either over the surface (surface runoff), or under the ground (sub-surface runoff) and the sum of these two is called runoff. This parameter is accumulated over a particular time period which depends on the data extracted. For the reanalysis, the accumulation period is over the 1 hour ending at the validity date and time. For the ensemble members, ensemble mean and ensemble spread, the accumulation period is over the 3
Sea surfac e tempe rature	K	This parameter (SST) is the temperature of sea water near the surface. In ERA5, this parameter is a foundation SST, which means there are no variations due to the daily cycle of the sun (diurnal variations). SST, in ERA5, is given by two external providers. Before

Sea-ice cover	Dimensionless	This parameter is the fraction of a grid box which is covered by sea ice. Sea ice can only occur in a grid box which includes ocean or inland water according to the land-sea mask and lake cover, at the resolution being used. This parameter can be known as sea-ice (area) fraction, sea-ice concentration and more generally as sea-ice cover. In ERA5, sea-ice cover is given by two external providers. Before 1979 the HadISST2 dataset is used. From 1979 to August 2007 the OSI SAF
Significant height of combined wind waves and swell	m	This parameter represents the average height of the highest third of surface ocean/sea waves generated by wind and swell. It represents the vertical distance between the wave crest and the wave trough. The ocean/sea surface wave field consists of a combination of waves with different heights, lengths and directions (known as the two-dimensional wave spectrum). The wave spectrum can be decomposed into wind-sea waves, which are directly affected

Significant height of total swell	m	This parameter represents the average height of the highest third of surface ocean/sea waves associated with swell. It represents the vertical distance between the wave crest and the wave trough. The ocean/sea surface wave field consists of a combination of waves with different heights, lengths and directions (known as the two-dimensional wave spectrum). The wave spectrum can be decomposed into wind-sea waves, which are directly affected by local winds, and swell, the waves that were generated by the wind at a
Significant height of wind waves	m	This parameter represents the average height of the highest third of surface ocean/sea waves generated by the local wind. It represents the vertical distance between the wave crest and the wave trough. The ocean/sea surface wave field consists of a combination of waves with different heights, lengths and directions (known as the two-dimensional wave spectrum). The wave spectrum can be decomposed into wind-sea waves, which are directly affected by local winds, and swell, the waves that were generated by the wind at a different location and time. This

Significant wave height of first swell partition	m	This parameter represents the average height of the highest third of surface ocean/sea waves associated with the first swell partition. Wave height represents the vertical distance between the wave crest and the wave trough. The ocean/sea surface wave field consists of a combination of waves with different heights, lengths and directions (known as the two-dimensional wave spectrum). The wave spectrum can be decomposed into wind-sea waves, which are directly affected by local winds, and swell, the waves that were generated by the wind at a different location and time. In many situations, swell can be made up of different swell systems, for example, from two distant and separate storms. To account for this, the

Significant wave height of second swell partition	m	This parameter represents the average height of the highest third of surface ocean/sea waves associated with the second swell partition. Wave height represents the vertical distance between the wave crest and the wave trough. The ocean/sea surface wave field consists of a combination of waves with different heights, lengths and directions (known as the two-dimensional wave spectrum). The wave spectrum can be decomposed into wind-sea waves, which are directly affected by local winds, and swell, the waves that were generated by the wind at a different location and time. In many situations, swell can be made up of different swell systems, for example, from two distant and separate storms. To account for this, the

Significant wave height of third swell partition	m	This parameter represents the average height of the highest third of surface ocean/sea waves associated with the third swell partition. Wave height represents the vertical distance between the wave crest and the wave trough. The ocean/sea surface wave field consists of a combination of waves with different heights, lengths and directions (known as the two-dimensional wave spectrum). The wave spectrum can be decomposed into wind-sea waves, which are directly affected by local winds, and swell, the waves that were generated by the wind at a different location and time. In many situations, swell can be made up of different swell systems, for example, from two distant and separate storms. To account for this, the
Skin reservoir content	m of water equivalent	This parameter is the amount of water in the vegetation canopy and/ or in a thin layer on the soil. It represents the amount of rain intercepted by foliage, and water from dew. The maximum amount of

Skin temperature	K	This parameter is the temperature of the surface of the Earth. The skin temperature is the theoretical temperature that is required to satisfy the surface energy balance. It represents the temperature of the uppermost surface layer, which has no heat capacity and so can
Slope of sub-gridscale orography	Dimensionless	This parameter is one of four parameters (the others being standard deviation, angle and anisotropy) that describe the features of the orography that are too small to be resolved by the model grid. These four parameters are calculated for orographic features with horizontal scales comprised between 5 km and the model grid resolution, being derived
Snow albedo	Dimensionless	This parameter is a measure of the reflectivity of the snow-covered part of the grid box. It is the fraction of solar (shortwave) radiation reflected by snow across the solar spectrum. The ECMWF Integrated Forecasting System (IFS) represents snow as a single additional layer over the uppermost soil level. The snow may cover all or part of the grid box. This parameter changes with snow age and also depends on vegetation height. It has a range of values

Snow density	kg m-3	This parameter is the mass of snow per cubic metre in the snow layer. The ECMWF Integrated Forecasting System (IFS) represents snow as a single additional layer over the uppermost soil level. The snow may cover all or part of the grid box. This parameter is defined over the whole
Snow depth	m of water equivalent	This parameter is the amount of snow from the snow-covered area of a grid box. Its units are metres of water equivalent, so it is the depth the water would have if the snow melted and was spread evenly over the whole grid box. The ECMWF
Snow evaporation	m of water equivalent	This parameter is the accumulated amount of water that has evaporated from snow from the snow-covered area of a grid box into vapour in the air above. The ECMWF Integrated Forecasting System (IFS) represents snow as a single additional layer over the uppermost soil level. The snow may cover all or part of the grid box. This parameter is the depth of water there would be if the evaporated snow (from the snow-covered area of a grid box) were liquid and were

Snowfall	m of water equivalent	This parameter is the accumulated snow that falls to the Earth's surface. It is the sum of large-scale snowfall and convective snowfall. Large-scale snowfall is generated by the cloud scheme in the ECMWF Integrated Forecasting System (IFS). The cloud scheme represents the formation and dissipation of clouds and large-scale precipitation due to changes in atmospheric quantities (such as pressure, temperature and moisture) predicted directly at spatial scales of the grid box or larger. Convective snowfall is generated by the convection scheme in the IFS, which represents convection at spatial scales smaller than the grid box. In the IFS, precipitation is comprised of rain
Snow melt	m of water equivalent	This parameter is the accumulated amount of water that has melted from snow in the snow-covered area of a grid box. The ECMWF Integrated Forecasting System (IFS) represents snow as a single additional layer over the uppermost soil level. The snow may cover all or part of the grid box. This parameter is the depth of water there would be if the melted snow (from the snow-covered area of a grid box) were spread evenly over the whole grid

Soil temperature level 1	K	This parameter is the temperature of the soil at level 1 (in the middle of layer 1). The ECMWF Integrated Forecasting System (IFS) has a four-layer representation of soil, where the surface is at 0cm: Layer 1: 0 - 7cm, Layer 2: 7 - 28cm, Layer 3: 28 - 100cm, Layer 4: 100 - 289cm. Soil temperature is set at the middle of each layer, and heat transfer is calculated at the interfaces between them. It is assumed that there is no
Soil temperature level 2	K	This parameter is the temperature of the soil at level 2 (in the middle of layer 2). The ECMWF Integrated Forecasting System (IFS) has a four-layer representation of soil, where the surface is at 0cm: Layer 1: 0 - 7cm, Layer 2: 7 - 28cm, Layer 3: 28 - 100cm, Layer 4: 100 - 289cm. Soil temperature is set at the middle of each layer, and heat transfer is calculated at the interfaces between them. It is assumed that there is no

Soil temperature level 3	K	This parameter is the temperature of the soil at level 3 (in the middle of layer 3). The ECMWF Integrated Forecasting System (IFS) has a four-layer representation of soil, where the surface is at 0cm: Layer 1: 0 - 7cm, Layer 2: 7 - 28cm, Layer 3: 28 - 100cm, Layer 4: 100 - 289cm. Soil temperature is set at the middle of each layer, and heat transfer is calculated at the interfaces between them. It is assumed that there is no
Soil temperature level 4	K	This parameter is the temperature of the soil at level 4 (in the middle of layer 4). The ECMWF Integrated Forecasting System (IFS) has a four-layer representation of soil, where the surface is at 0cm: Layer 1: 0 - 7cm, Layer 2: 7 - 28cm, Layer 3: 28 - 100cm, Layer 4: 100 - 289cm. Soil temperature is set at the middle of each layer, and heat transfer is calculated at the interfaces between them. It is assumed that there is no

Soil type	Dimensionless	This parameter is the texture (or classification) of soil used by the land surface scheme of the ECMWF Integrated Forecasting System (IFS) to predict the water holding capacity of soil in soil moisture and runoff calculations. It is derived from the root zone data (30-100 cm below the surface) of the FAO/
Standard deviation of filtered	m	Climatological parameter (scales between approximately 3 and 22 km are included). This parameter does not vary in time.
Standard deviation of orography	Dimensionless	This parameter is one of four parameters (the others being angle of sub-gridscale orography, slope and anisotropy) that describe the features of the orography that are too small to be resolved by the model grid. These four parameters are calculated for orographic features with horizontal scales comprised between 5 km and the model grid resolution, being derived

Sub-surface runoff	m	Some water from rainfall, melting snow, or deep in the soil, stays stored in the soil. Otherwise, the water drains away, either over the surface (surface runoff), or under the ground (sub-surface runoff) and the sum of these two is called runoff. This parameter is accumulated over a particular time period which depends on the data extracted. For the reanalysis, the accumulation period is over the 1 hour ending at the validity date and time. For the ensemble members, ensemble mean and ensemble spread, the accumulation period is over the 3
Surface latent heat flux	J m^{-2}	This parameter is the transfer of latent heat (resulting from water phase changes, such as evaporation or condensation) between the Earth's surface and the atmosphere through the effects of turbulent air motion. Evaporation from the Earth's surface represents a transfer of energy from the surface to the atmosphere. This parameter is accumulated over a particular time period which depends on the data extracted. For the reanalysis,

Surface net solar radiation	J m^{-2}	This parameter is the amount of solar radiation (also known as shortwave radiation) that reaches a horizontal plane at the surface of the Earth (both direct and diffuse) minus the amount reflected by the Earth's surface (which is governed by the albedo). Radiation from the Sun (solar, or shortwave, radiation) is partly reflected back to space by clouds and particles in the atmosphere (aerosols) and some of it is absorbed. The remainder is incident on the Earth's surface, where some of it is reflected. This parameter is accumulated over a

Surface net solar radiation, clear sky	J m^{-2}	This parameter is the amount of solar (shortwave) radiation reaching the surface of the Earth (both direct and diffuse) minus the amount reflected by the Earth's surface (which is governed by the albedo), assuming clear-sky (cloudless) conditions. It is the amount of radiation passing through a horizontal plane. Clear-sky radiation quantities are computed for exactly the same atmospheric conditions of temperature, humidity, ozone, trace gases and aerosol as the corresponding total-sky quantities (clouds included), but assuming that the clouds are not there. Radiation from the Sun (solar, or shortwave, radiation) is partly reflected back to space by clouds and particles in the atmosphere (aerosols) and some of

Surface net thermal radiation	J m^{-2}	Thermal radiation (also known as longwave or terrestrial radiation) refers to radiation emitted by the atmosphere, clouds and the surface of the Earth. This parameter is the difference between downward and upward thermal radiation at the surface of the Earth. It is the amount of radiation passing through a horizontal plane. The atmosphere and clouds emit thermal radiation in all directions, some of which reaches the surface as downward thermal radiation. The upward thermal radiation at the surface consists of thermal radiation emitted by the surface plus the fraction of downwards thermal

Surface net thermal radiation, clear sky	J m^{-2}	Thermal radiation (also known as longwave or terrestrial radiation) refers to radiation emitted by the atmosphere, clouds and the surface of the Earth. This parameter is the difference between downward and upward thermal radiation at the surface of the Earth, assuming clear-sky (cloudless) conditions. It is the amount of radiation passing through a horizontal plane. Clear-sky radiation quantities are computed for exactly the same atmospheric conditions of temperature, humidity, ozone, trace gases and aerosol as the corresponding total-sky quantities (clouds included), but assuming that the clouds are not there. The atmosphere and clouds emit thermal radiation in all directions
Surface pressure	Pa	This parameter is the pressure (force per unit area) of the atmosphere at the surface of land, sea and inland water. It is a measure of the weight of all the air in a column vertically above a point on the Earth's surface. Surface pressure is often used in combination with temperature to calculate air density. The strong variation of pressure with altitude

Surface runoff	m	Some water from rainfall, melting snow, or deep in the soil, stays stored in the soil. Otherwise, the water drains away, either over the surface (surface runoff), or under the ground (sub-surface runoff) and the sum of these two is called runoff. This parameter is accumulated over a particular time period which depends on the data extracted. For the reanalysis, the accumulation period is over the 1 hour ending at the validity date and time. For the ensemble members, ensemble mean and ensemble spread, the accumulation period is over the 3
Surface sensible heat flux	$J\ m^{-2}$	This parameter is the transfer of heat between the Earth's surface and the atmosphere through the effects of turbulent air motion (but excluding any heat transfer resulting from condensation or evaporation). The magnitude of the sensible heat flux is governed by the difference in temperature between the surface and the overlying atmosphere, wind speed and the surface roughness. For example, cold air overlying a warm surface would produce a sensible heat flux from the land (or ocean) into the atmosphere. This parameter is accumulated over a

Surface solar radiation downward, clear sky	J m^{-2}	This parameter is the amount of solar radiation (also known as shortwave radiation) that reaches a horizontal plane at the surface of the Earth, assuming clear-sky (cloudless) conditions. This parameter comprises both direct and diffuse solar radiation. Radiation from the Sun (solar, or shortwave, radiation) is partly reflected back to space by clouds and particles in the atmosphere (aerosols) and some of it is absorbed. The rest is incident on the Earth's surface. Clear-sky radiation quantities are computed for exactly the same atmospheric conditions of temperature, humidity, ozone, trace gases and aerosol as

Surface solar radiation downwards	J m^{-2}	This parameter is the amount of solar radiation (also known as shortwave radiation) that reaches a horizontal plane at the surface of the Earth. This parameter comprises both direct and diffuse solar radiation. Radiation from the Sun (solar, or shortwave, radiation) is partly reflected back to space by clouds and particles in the atmosphere (aerosols) and some of it is absorbed. The rest is incident on the Earth's surface (represented by this parameter). To a reasonably good approximation, this parameter is the model equivalent of what would be measured by a pyranometer (an instrument used for measuring solar radiation) at the surface. However, care should be

Surface thermal radiation downward, clear sky	J m-2	This parameter is the amount of thermal (also known as longwave or terrestrial) radiation emitted by the atmosphere that reaches a horizontal plane at the surface of the Earth, assuming clear-sky (cloudless) conditions. The surface of the Earth emits thermal radiation, some of which is absorbed by the atmosphere and clouds. The atmosphere and clouds likewise emit thermal radiation in all directions, some of which reaches the surface. Clear-sky radiation quantities are computed for exactly the same atmospheric conditions of temperature, humidity, ozone, trace gases and aerosol as the
Surface thermal radiation downwards	J m-2	This parameter is the amount of thermal (also known as longwave or terrestrial) radiation emitted by the atmosphere and clouds that reaches a horizontal plane at the surface of the Earth. The surface of the Earth emits thermal radiation, some of which is absorbed by the atmosphere and clouds. The atmosphere and clouds likewise emit thermal radiation in all directions, some of which reaches the surface (represented by this parameter). This parameter is accumulated over a particular time

TOA incident solar radiation	J m^{-2}	This parameter is the incoming solar radiation (also known as shortwave radiation), received from the Sun, at the top of the atmosphere. It is the amount of radiation passing through a horizontal plane. This parameter is accumulated over a particular time period which depends on the data extracted. For the reanalysis, the accumulation period is over the 1 hour ending at the validity date and time. For the ensemble members
Temperature of snow layer	K	This parameter gives the temperature of the snow layer from the ground to the snow-air interface. The ECMWF Integrated Forecasting System (IFS) represents snow as a single additional layer over the uppermost soil level. The snow may cover all or part of the grid box. This parameter is defined over the whole globe, even where

Top net solar radiation	J m^{-2}	This parameter is the incoming solar radiation (also known as shortwave radiation) minus the outgoing solar radiation at the top of the atmosphere. It is the amount of radiation passing through a horizontal plane. The incoming solar radiation is the amount received from the Sun. The outgoing solar radiation is the amount reflected and scattered by the Earth's atmosphere and surface. This parameter is accumulated over a particular time period which
Top net solar radiation, clear sky	J m^{-2}	This parameter is the incoming solar radiation (also known as shortwave radiation) minus the outgoing solar radiation at the top of the atmosphere, assuming clear-sky (cloudless) conditions. It is the amount of radiation passing through a horizontal plane. The incoming solar radiation is the amount received from the Sun. The outgoing solar radiation is the amount reflected and scattered by the Earth's atmosphere and surface, assuming clear-sky (cloudless) conditions. Clear-sky radiation quantities are computed for exactly the same atmospheric conditions of temperature, humidity, ozone, trace gases and aerosol as the total-sky

Top net thermal radiation	J m^{-2}	The thermal (also known as terrestrial or longwave) radiation emitted to space at the top of the atmosphere is commonly known as the Outgoing Longwave Radiation (OLR). The top net thermal radiation (this parameter) is equal to the negative of OLR. This parameter is accumulated over a particular time period which depends on the data extracted. For the reanalysis, the accumulation period is over the 1
Top net thermal radiation, clear sky	J m^{-2}	This parameter is the thermal (also known as terrestrial or longwave) radiation emitted to space at the top of the atmosphere, assuming clear-sky (cloudless) conditions. It is the amount passing through a horizontal plane. Note that the ECMWF convention for vertical fluxes is positive downwards, so a flux from the atmosphere to space will be negative. Clear-sky radiation quantities are computed for exactly the same atmospheric conditions of temperature, humidity, ozone, trace gases and aerosol as total-sky quantities (clouds included), but assuming that the clouds are not there. The thermal radiation emitted to space at the top of the atmosphere is commonly known as

Total cloud cover	Dimensionless	This parameter is the proportion of a grid box covered by cloud. Total cloud cover is a single level field calculated from the cloud occurring at different model levels through the atmosphere. Assumptions are made
Total column cloud ice water	kg m^{-2}	This parameter is the amount of ice contained within clouds in a column extending from the surface of the Earth to the top of the atmosphere. Snow (aggregated ice crystals) is not included in this parameter. This parameter represents the area averaged value for a model grid box. Clouds contain a continuum of different sized water droplets and ice particles. The ECMWF
Total column cloud liquid water	kg m^{-2}	This parameter is the amount of liquid water contained within cloud droplets in a column extending from the surface of the Earth to the top of the atmosphere. Rain water droplets, which are much larger in size (and mass), are not included in this parameter. This parameter represents the area averaged value for a model grid box. Clouds contain a continuum of different

Total column ozone	kg m^{-2}	This parameter is the total amount of ozone in a column of air extending from the surface of the Earth to the top of the atmosphere. This parameter can also be referred to as total ozone, or vertically integrated ozone. The values are dominated by ozone within the stratosphere. In the ECMWF Integrated Forecasting System (IFS), there is a simplified representation of ozone chemistry (including representation of the chemistry which has caused the ozone hole). Ozone is also transported around in
Total column rain water	kg m^{-2}	This parameter is the total amount of water in droplets of raindrop size (which can fall to the surface as precipitation) in a column extending from the surface of the Earth to the top of the atmosphere. This parameter represents the area averaged value for a grid box. Clouds contain a continuum of different sized water droplets and

Total column snow water	kg m^{-2}	This parameter is the total amount of water in the form of snow (aggregated ice crystals which can fall to the surface as precipitation) in a column extending from the surface of the Earth to the top of the atmosphere. This parameter represents the area averaged value for a grid box. Clouds contain a continuum of different sized water
Total column supercooled liquid water	kg m^{-2}	This parameter is the total amount of supercooled water in a column extending from the surface of the Earth to the top of the atmosphere. Supercooled water is water that exists in liquid form below $0^{o}C$. It is common in cold clouds and is important in the formation of precipitation. Also, supercooled water in clouds extending to the surface (i.e., fog) can cause icing/riming of various structures. This parameter represents the area
Total column water	kg m^{-2}	This parameter is the sum of water vapour, liquid water, cloud ice, rain and snow in a column extending from the surface of the Earth to the top of the atmosphere. In old
Total column water	kg m^{-2}	This parameter is the total amount of water vapour in a column extending from the surface of the Earth to the top of the atmosphere.

Total precipitation	m	This parameter is the accumulated liquid and frozen water, comprising rain and snow, that falls to the Earth's surface. It is the sum of large-scale precipitation and convective precipitation. Large-scale precipitation is generated by the cloud scheme in the ECMWF Integrated Forecasting System (IFS). The cloud scheme represents the formation and dissipation of clouds and large-scale precipitation due to changes in atmospheric quantities (such as pressure, temperature and moisture) predicted directly by the IFS at spatial scales of the grid box or larger. Convective precipitation is generated by the convection scheme in the IFS, which represents convection at spatial scales smaller than the grid box. This parameter does not include fog, dew or the

Total sky direct solar radiation at surface	J m^{-2}	This parameter is the amount of direct solar radiation (also known as shortwave radiation) reaching the surface of the Earth. It is the amount of radiation passing through a horizontal plane. Solar radiation at the surface can be direct or diffuse. Solar radiation can be scattered in all directions by particles in the atmosphere, some of which reaches the surface (diffuse solar radiation). Some solar radiation reaches the surface without being scattered (direct solar radiation). This parameter is accumulated over a particular time period which
Total totals index	K	This parameter gives an indication of the probability of occurrence of a thunderstorm and its severity by using the vertical gradient of temperature and humidity. The values of this index indicate the following: <44 Thunderstorms not likely, 44-50 Thunderstorms likely, 51-52 Isolated severe thunderstorms, 53-56 Widely scattered severe thunderstorms, 56-60 Scattered severe
Trapping layer	m	Trapping layer base height as diagnosed from the vertical gradient of atmospheric refractivity

Trapping layer	m	Trapping layer top height as diagnosed from the vertical gradient of atmospheric refractivity
Type of high vegetation	Dimensionless	This parameter indicates the 6 types of high vegetation recognised by the ECMWF Integrated Forecasting System: 3 = Evergreen needleleaf trees, 4 = Deciduous needleleaf trees, 5 = Deciduous broadleaf trees, 6 = Evergreen broadleaf trees, 18 = Mixed forest/woodland, 19 =
Type of low vegetation	Dimensionless	This parameter indicates the 10 types of low vegetation recognised by the ECMWF Integrated Forecasting System: 1 = Crops, Mixed farming, 2 = Grass, 7 = Tall grass, 9 = Tundra, 10 = Irrigated crops, 11 = Semidesert, 13 = Bogs and marshes, 16 = Evergreen shrubs, 17 = Deciduous shrubs, 20
U-component stokes drift	m s^{-1}	This parameter is the eastward component of the surface Stokes drift. The Stokes drift is the net drift velocity due to surface wind waves. It is confined to the upper few metres of the ocean water column

UV visible albedo for diffuse radiation	Dimensionless	Albedo is a measure of the reflectivity of the Earth's surface. This parameter is the fraction of diffuse solar (shortwave) radiation with wavelengths between 0.3 and 0.7 µm (microns, 1 millionth of a metre) reflected by the Earth's surface (for snow-free land surfaces only). In the ECMWF Integrated Forecasting System (IFS) albedo is dealt with separately for solar radiation with wavelengths greater/ less than 0.7µm and for direct and diffuse solar radiation (giving 4 components to albedo). Solar
UV visible albedo for direct radiation	Dimensionless	Albedo is a measure of the reflectivity of the Earth's surface. This parameter is the fraction of direct solar (shortwave) radiation with wavelengths between 0.3 and 0.7 µm (microns, 1 millionth of a metre) reflected by the Earth's surface (for snow-free land surfaces only). In the ECMWF Integrated Forecasting System (IFS) albedo is dealt with separately for solar radiation with wavelengths greater/ less than 0.7µm and for direct and diffuse solar radiation (giving 4

V-component stokes drift	m s^{-1}	This parameter is the northward component of the surface Stokes drift. The Stokes drift is the net drift velocity due to surface wind waves. It is confined to the upper few metres of the ocean water column
Vertical integral of divergence of cloud frozen water flux	kg m^{-2} s-	The vertical integral of the cloud frozen water flux is the horizontal rate of flow of cloud frozen water, per metre across the flow, for a column of air extending from the surface of the Earth to the top of the atmosphere. Its horizontal divergence is the rate of cloud frozen water spreading outward from a point, per square metre. This parameter is positive for cloud
Vertical integral of divergence of cloud liquid water	kg m^{-2} s-	The vertical integral of the cloud liquid water flux is the horizontal rate of flow of cloud liquid water, per metre across the flow, for a column of air extending from the surface of the Earth to the top of the atmosphere. Its horizontal divergence is the rate of cloud liquid water spreading outward from a point, per square metre. This

Vertical integral of divergence of geopotential flux	W m^{-2}	The vertical integral of the geopotential flux is the horizontal rate of flow of geopotential, per metre across the flow, for a column of air extending from the surface of the Earth to the top of the atmosphere. Its horizontal divergence is the rate of geopotential spreading outward from a point, per square metre. This parameter is positive for geopotential that is spreading out, or diverging, and negative for the opposite, for geopotential that is
Vertical integral of divergence of kinetic energy flux	W m^{-2}	The vertical integral of the kinetic energy flux is the horizontal rate of flow of kinetic energy, per metre across the flow, for a column of air extending from the surface of the Earth to the top of the atmosphere. Its horizontal divergence is the rate of kinetic energy spreading outward from a point, per square metre. This parameter is positive for kinetic energy that is spreading out, or diverging, and negative for the opposite, for kinetic energy that is

Vertical integral of divergence of mass flux	kg m-2 s-	The vertical integral of the mass flux is the horizontal rate of flow of mass, per metre across the flow, for a column of air extending from the surface of the Earth to the top of the atmosphere. Its horizontal divergence is the rate of mass spreading outward from a point, per square metre. This parameter is positive for mass that is spreading
Vertical integral of divergence of moisture flux	kg m-2 s-	The vertical integral of the moisture flux is the horizontal rate of flow of moisture, per metre across the flow, for a column of air extending from the surface of the Earth to the top of the atmosphere. Its horizontal divergence is the rate of moisture spreading outward from a point, per square metre. This parameter is positive for moisture that is spreading out, or diverging, and negative for the opposite, for

Vertical integral of divergence of ozone flux	kg m^{-2} s^{-}	The vertical integral of the ozone flux is the horizontal rate of flow of ozone, per metre across the flow, for a column of air extending from the surface of the Earth to the top of the atmosphere. Its horizontal divergence is the rate of ozone spreading outward from a point, per square metre. This parameter is positive for ozone that is spreading out, or diverging, and negative for the opposite, for ozone that is concentrating, or converging
Vertical integral of divergence of thermal energy flux	W m^{-2}	The vertical integral of the thermal energy flux is the horizontal rate of flow of thermal energy, per metre across the flow, for a column of air extending from the surface of the Earth to the top of the atmosphere. Its horizontal divergence is the rate of thermal energy spreading outward from a point, per square metre. This parameter is positive for thermal energy that is spreading out, or diverging, and negative for the opposite, for thermal energy that is concentrating, or converging (convergence). This parameter thus indicates whether atmospheric motions act to decrease (for divergence) or increase (for convergence) the vertical integral of thermal energy. The thermal energy

Vertical integral of divergence of total energy flux	W m-2	The vertical integral of the total energy flux is the horizontal rate of flow of total energy, per metre across the flow, for a column of air extending from the surface of the Earth to the top of the atmosphere. Its horizontal divergence is the rate of total energy spreading outward from a point, per square metre. This parameter is positive for total energy that is spreading out, or diverging, and negative for the
Vertical integral of eastward	kg m-1 s-	This parameter is the horizontal rate of flow of cloud frozen water, in the eastward direction, per metre across the flow, for a column of air extending from the surface of the Earth to the top of the atmosphere
Vertical integral of eastw	kg m-1 s-	This parameter is the horizontal rate of flow of cloud liquid water, in the eastward direction, per metre across the flow, for a column of air extending from the surface of the
Vertical integral of eastward geopotential flux	W m-1	This parameter is the horizontal rate of flow of geopotential, in the eastward direction, per metre across the flow, for a column of air extending from the surface of the Earth to the top of the atmosphere. Positive values indicate a flux from west to east. Geopotential is the gravitational potential energy of a

Vertical integral of eastward heat flux	W m^{-1}	This parameter is the horizontal rate of flow of heat in the eastward direction, per meter across the flow, for a column of air extending from the surface of the Earth to the top of the atmosphere. Positive values indicate a flux from west to east. Heat (or thermal energy) is equal to enthalpy, which is the sum of the internal energy and the energy associated with the pressure of the air on its surroundings. Internal energy is the energy contained
Vertical integral of eastward kinetic energy	W m^{-1}	This parameter is the horizontal rate of flow of kinetic energy, in the eastward direction, per metre across the flow, for a column of air extending from the surface of the Earth to the top of the atmosphere. Positive values indicate a flux from west to east. Atmospheric kinetic
Vertical integral of eastward	kg m^{-1} s-	This parameter is the horizontal rate of flow of mass, in the eastward direction, per metre across the flow, for a column of air extending from the surface of the Earth to the top of the atmosphere. Positive values

Vertical integral of eastward ozone flux	kg m-1 s-	This parameter is the horizontal rate of flow of ozone in the eastward direction, per metre across the flow, for a column of air extending from the surface of the Earth to the top of the atmosphere. Positive values denote a flux from west to east. In the ECMWF Integrated Forecasting
Vertical integral of eastward total	W m-1	This parameter is the horizontal rate of flow of total energy in the eastward direction, per metre across the flow, for a column of air extending from the surface of the Earth to the top of the atmosphere. Positive values indicate a flux from
Vertical integral of eastw	kg m-1 s-	This parameter is the horizontal rate of flow of water vapour, in the eastward direction, per metre across the flow, for a column of air extending from the surface of the
Vertical integral of energy conversion	W m-2	This parameter is one contribution to the amount of energy being converted between kinetic energy, and internal plus potential energy, for a column of air extending from the surface of the Earth to the top of the atmosphere. Negative values indicate a conversion to kinetic

Vertical integral of kinetic energy	J m-2	This parameter is the vertical integral of kinetic energy for a column of air extending from the surface of the Earth to the top of the atmosphere. Atmospheric kinetic energy is the energy of the
Vertical integral of mass of	kg m-2	This parameter is the total mass of air for a column extending from the surface of the Earth to the top of the atmosphere, per square metre. This parameter is calculated by dividing surface pressure by the Earth's
Vertical integral of mass tendency	kg m-2 s-	This parameter is the rate of change of the mass of a column of air extending from the Earth's surface to the top of the atmosphere. An increasing mass of the column indicates rising surface pressure. In contrast, a decrease indicates a falling surface pressure. The mass
Vertical integral of northward	kg m-1 s-	This parameter is the horizontal rate of flow of cloud frozen water, in the northward direction, per metre across the flow, for a column of air extending from the surface of the Earth to the top of the atmosphere
Vertical integral of northw	kg m-1 s-	This parameter is the horizontal rate of flow of cloud liquid water, in the northward direction, per metre across the flow, for a column of air extending from the surface of the

Vertical integral of northward geopotential flux	W m^{-1}	This parameter is the horizontal rate of flow of geopotential in the northward direction, per metre across the flow, for a column of air extending from the surface of the Earth to the top of the atmosphere. Positive values indicate a flux from south to north. Geopotential is the gravitational potential energy of a
Vertical integral of northward heat flux	W m^{-1}	This parameter is the horizontal rate of flow of heat in the northward direction, per metre across the flow, for a column of air extending from the surface of the Earth to the top of the atmosphere. Positive values indicate a flux from south to north. Heat (or thermal energy) is equal to enthalpy, which is the sum of the internal energy and the energy associated with the pressure of the air on its surroundings. Internal energy is the energy contained
Vertical integral of northward kinetic energy	W m^{-1}	This parameter is the horizontal rate of flow of kinetic energy, in the northward direction, per metre across the flow, for a column of air extending from the surface of the Earth to the top of the atmosphere. Positive values indicate a flux from south to north. Atmospheric kinetic

Vertical integral of northward	kg m^{-1} s-	This parameter is the horizontal rate of flow of mass, in the northward direction, per metre across the flow, for a column of air extending from the surface of the Earth to the top of the atmosphere. Positive values
Vertical integral of northward ozone flux	kg m^{-1} s-	This parameter is the horizontal rate of flow of ozone in the northward direction, per metre across the flow, for a column of air extending from the surface of the Earth to the top of the atmosphere. Positive values denote a flux from south to north. In the ECMWF Integrated Forecasting
Vertical integral of northward total	W m^{-1}	This parameter is the horizontal rate of flow of total energy in the northward direction, per metre across the flow, for a column of air extending from the surface of the Earth to the top of the atmosphere. Positive values indicate a flux from
Vertical integral of northw	kg m^{-1} s-	This parameter is the horizontal rate of flow of water vapour, in the northward direction, per metre across the flow, for a column of air extending from the surface of the

Vertical integral of potential and internal energy	J m^{-2}	This parameter is the mass weighted vertical integral of potential and internal energy for a column of air extending from the surface of the Earth to the top of the atmosphere. The potential energy of an air parcel is the amount of work that would have to be done, against the force of gravity, to lift the air to that location from mean sea level. Internal energy is the energy
Vertical integral of potential, internal and latent energy	J m^{-2}	This parameter is the mass weighted vertical integral of potential, internal and latent energy for a column of air extending from the surface of the Earth to the top of the atmosphere. The potential energy of an air parcel is the amount of work that would have to be done, against the force of gravity, to lift the air to that location from mean sea level. Internal energy is the energy contained within a system i.e., the microscopic energy of the air
Vertical integral of tempe	K kg m^{-2}	This parameter is the mass-weighted vertical integral of temperature for a column of air extending from the surface of the Earth to the top of the atmosphere

Vertical integral of thermal energy	J m^{-2}	This parameter is the mass-weighted vertical integral of thermal energy for a column of air extending from the surface of the Earth to the top of the atmosphere. Thermal energy is calculated from the product of temperature and the specific heat capacity of air at constant pressure. The thermal energy is equal to enthalpy, which is the sum of the internal energy and the energy associated with the pressure of the air on its surroundings. Internal energy is the energy contained within a system
Vertical integral of total	J m^{-2}	This parameter is the vertical integral of total energy for a column of air extending from the surface of the Earth to the top of the atmosphere. Total atmospheric

Vertically integrated moisture divergence	kg m^{-2}	The vertical integral of the moisture flux is the horizontal rate of flow of moisture (water vapour, cloud liquid and cloud ice), per metre across the flow, for a column of air extending from the surface of the Earth to the top of the atmosphere. Its horizontal divergence is the rate of moisture spreading outward from a point, per square metre. This parameter is accumulated over a particular time period which depends on the data extracted. For the reanalysis, the accumulation period is over the 1 hour ending at the validity date and time. For the ensemble members, ensemble mean and ensemble spread, the accumulation period is over the 3 hours ending at the
Volumetric soil water layer 1	m^3 m^{-3}	This parameter is the volume of water in soil layer 1 (0 - 7cm, the surface is at 0cm). The ECMWF Integrated Forecasting System (IFS) has a four-layer representation of soil: Layer 1: 0 - 7cm, Layer 2: 7 - 28cm, Layer 3: 28 - 100cm, Layer 4: 100 - 289cm. Soil water is defined over the whole globe, even over

Volumetric soil water layer 2	$m^3 m^{-3}$	This parameter is the volume of water in soil layer 2 (7 - 28cm, the surface is at 0cm). The ECMWF Integrated Forecasting System (IFS) has a four-layer representation of soil: Layer 1: 0 - 7cm, Layer 2: 7 - 28cm, Layer 3: 28 - 100cm, Layer 4: 100 - 289cm. Soil water is defined over the whole globe, even over
Volumetric soil water layer 3	$m^3 m^{-3}$	This parameter is the volume of water in soil layer 3 (28 - 100cm, the surface is at 0cm). The ECMWF Integrated Forecasting System (IFS) has a four-layer representation of soil: Layer 1: 0 - 7cm, Layer 2: 7 - 28cm, Layer 3: 28 - 100cm, Layer 4: 100 - 289cm. Soil water is defined over the whole globe, even over
Volumetric soil water layer 4	$m^3 m^{-3}$	This parameter is the volume of water in soil layer 4 (100 - 289cm, the surface is at 0cm). The ECMWF Integrated Forecasting System (IFS) has a four-layer representation of soil: Layer 1: 0 - 7cm, Layer 2: 7 - 28cm, Layer 3: 28 - 100cm, Layer 4: 100 - 289cm. Soil water is defined over the whole globe, even over

Wave spectral directional width	radians	This parameter indicates whether waves (generated by local winds and associated with swell) are coming from similar directions or from a wide range of directions. The ocean/sea surface wave field consists of a combination of waves with different heights, lengths and directions (known as the two-dimensional wave spectrum). Many ECMWF wave parameters (such as the mean wave period) give information averaged over all wave frequencies and directions, so do not give any information about the distribution of wave energy across

Wave spectral directional width for swell	radians	This parameter indicates whether waves associated with swell are coming from similar directions or from a wide range of directions. The ocean/sea surface wave field consists of a combination of waves with different heights, lengths and directions (known as the two-dimensional wave spectrum). The wave spectrum can be decomposed into wind-sea waves, which are directly affected by local winds, and swell, the waves that were generated by the wind at a different location and time. This parameter takes account of all swell only. Many ECMWF wave parameters (such as the mean wave

Wave spectral directional width for wind waves	radians	This parameter indicates whether waves generated by the local wind are coming from similar directions or from a wide range of directions. The ocean/sea surface wave field consists of a combination of waves with different heights, lengths and directions (known as the two-dimensional wave spectrum). The wave spectrum can be decomposed into wind-sea waves, which are directly affected by local winds, and swell, the waves that were generated by the wind at a different location and time. This parameter takes account of wind-sea waves only. Many ECMWF wave parameters (such as the mean wave period) give information
Wave spectral kurtosis	Dimensionless	This parameter is a statistical measure used to forecast extreme or freak ocean/sea waves. It describes the nature of the sea surface elevation and how it is affected by waves generated by local winds and associated with swell. Under typical conditions, the sea surface elevation, as described by its probability density function, has a near normal distribution in the statistical sense. However, under certain wave conditions the probability density function of the

Wave spectral peakedness	Dimensionless	This parameter is a statistical measure used to forecast extreme or freak waves. It is a measure of the relative width of the ocean/sea wave frequency spectrum (i.e., whether the ocean/sea wave field is made up of a narrow or broad range of frequencies). The ocean/sea surface wave field consists of a combination of waves with different heights, lengths and directions
Wave spectral skewness	Dimensionless	This parameter is a statistical measure used to forecast extreme or freak ocean/sea waves. It describes the nature of the sea surface elevation and how it is affected by waves generated by local winds and associated with swell. Under typical conditions, the sea surface elevation, as described by its probability density function, has a near normal distribution in the statistical sense. However, under certain wave conditions the
Zero degree level	m	The height above the Earth's surface where the temperature passes from positive to negative values, corresponding to the top of a warm layer, at the specified time. This parameter can be used to help forecast snow. If more than one