|  |  |  |
| --- | --- | --- |
| 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, taking account of the atmospheric conditions. This parameter has units of kelvin (K). Temperature measured in kelvin can be converted to degrees Celsius (°C) by subtracting 273.15. |
| 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 between the lowest model level and the Earth's surface, taking account of the atmospheric conditions. This parameter has units of kelvin (K). Temperature measured in kelvin can be converted to degrees Celsius (°C) by subtracting 273.15. |
| 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 the development of thunderstorms. This parameter is related to the probability of occurrence of a thunderstorm: <20 K No thunderstorm, 20-25 K Isolated thunderstorms, 26-30 K Widely scattered thunderstorms, 31-35 K Scattered thunderstorms, >35 K Numerous thunderstorms. |
| 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 temperature. Values of precipitation type defined in the IFS: 0: No precipitation, 1: Rain, 3: Freezing rain (i.e. supercooled raindrops which freeze on contact with the ground and other surfaces), 5: Snow, 6: Wet snow (i.e. snow particles which are starting to melt); 7: Mixture of rain and snow, 8: Ice pellets. These precipitation types are consistent with WMO Code Table 4.201. Other types in this WMO table are not defined in the IFS. |
| Sea surface temperature | 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 September 2007, SST from the HadISST2 dataset is used and from September 2007 onwards, the OSTIA dataset is used. This parameter has units of kelvin (K). Temperature measured in kelvin can be converted to degrees Celsius (°C) by subtracting 273.15. |
| 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 makes it difficult to see the low and high pressure weather systems over mountainous areas, so mean sea level pressure, rather than surface pressure, is normally used for this purpose. The units of this parameter are Pascals (Pa). Surface pressure is often measured in hPa and sometimes is presented in the old units of millibars, mb (1 hPa = 1 mb= 100 Pa). |
| 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 pressure are used to identify the locations of low and high pressure weather systems, often referred to as cyclones and anticyclones. Contours of mean sea level pressure also indicate the strength of the wind. Tightly packed contours show stronger winds. The units of this parameter are pascals (Pa). Mean sea level pressure is often measured in hPa and sometimes is presented in the old units of millibars, mb (1 hPa = 1 mb = 100 Pa). |
| 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 makes it difficult to see the low and high pressure weather systems over mountainous areas, so mean sea level pressure, rather than surface pressure, is normally used for this purpose. The units of this parameter are Pascals (Pa). Surface pressure is often measured in hPa and sometimes is presented in the old units of millibars, mb (1 hPa = 1 mb= 100 Pa). |
| 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 are often local to a particular point in space and time, rather than representing averages over a model grid box. This parameter can be combined with the northward component to give the speed and direction of the horizontal 100 m wind. |
| 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 are often local to a particular point in space and time, rather than representing averages over a model grid box. This parameter can be combined with the eastward component to give the speed and direction of the horizontal 100 m wind. |
| 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 that describes land surface vegetation. "High vegetation" consists of evergreen trees, deciduous trees, mixed forest/woodland, and interrupted forest. |
| 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 vegetation. "Low vegetation" consists of crops and mixed farming, irrigated crops, short grass, tall grass, tundra, semidesert, bogs and marshes, evergreen shrubs, deciduous shrubs, and water and land mixtures. |
| 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 = Interrupted forest. A value of 0 indicates a point without high vegetation, including an oceanic or inland water location. Vegetation types are used to calculate the surface energy balance and snow albedo. This parameter does not vary in time. |
| 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 = Water and land mixtures. A value of 0 indicates a point without low vegetation, including an oceanic or inland water location. Vegetation types are used to calculate the surface energy balance and snow albedo. This parameter does not vary in time. |

**Influence on Each other:**

Weather variables are highly interdependent, with some directly influencing others while some interact more indirectly. Below is a breakdown of how the listed variables impact each other:

### **Temperature (t2m) & Dewpoint (d2m)**

* **Dewpoint (d2m) is closely tied to temperature (t2m)**. When air cools to its dewpoint, condensation occurs, leading to cloud formation and precipitation.
* A small difference between **t2m** and **d2m** indicates high humidity, while a large difference means dry air.
* **t2m** affects **msl** (Mean Sea Level Pressure) because warm air is less dense and leads to lower pressure.
* **t2m** also impacts **sst** (Sea Surface Temperature), though oceans respond more slowly than air.

### **Mean Sea Level Pressure (msl) & Surface Pressure (sp)**

* **Lower pressure (msl, sp) is associated with storms**, while **higher pressure brings clear skies**.
* **Temperature (t2m)** influences **pressure**: warm air rises, lowering pressure; cold air sinks, raising pressure.
* **Wind speeds (u100, v100)** are driven by **pressure gradients**—stronger differences in pressure result in stronger winds.

### **Wind Speed (u100, v100) & Pressure (msl, sp)**

* **East Wind Speed (u100) and North Wind Speed (v100)** determine overall wind direction and strength.
* **Winds are caused by pressure differences**: air moves from **high pressure to low pressure**.
* Faster winds increase **evaporation**, which can lead to more **precipitation (tp, cp, lsp)**.
* Winds also impact **temperature (t2m)** by bringing warm or cold air masses into a region.

### **Precipitation (tp, cp, lsp) & Convective Rain Rate (crr)**

* **Total Precipitation (tp)** includes both **convective (cp) and large-scale (lsp) precipitation**.
* **Convective Precipitation (cp)** is from thunderstorms and intense weather, while **large-scale precipitation (lsp)**occurs in widespread weather systems (e.g., frontal systems).
* **Higher dewpoint (d2m) and temperature (t2m) increase precipitation** by increasing moisture in the air.
* **Lower pressure (msl, sp) and strong winds (u100, v100) can enhance precipitation** by driving moist air upward.

### **Sea Surface Temperature (sst) & Geopotential Height (z)**

* **SST (Sea Surface Temperature) impacts atmospheric moisture**—warmer oceans contribute to higher humidity, leading to more precipitation.
* Warmer SSTs fuel hurricanes and storms by supplying energy.
* **Geopotential height (z) represents the altitude of pressure levels**. Higher geopotential heights indicate warmer conditions, while lower values signal colder air.

### **Vegetation Cover (cvh, cvl) & Climate**

* **Vegetation (cvh, cvl) affects local climate** by influencing **evaporation and transpiration**, which affect **humidity and precipitation**.
* Forests and vegetation help cool temperatures by **increasing moisture in the air**.
* Urban or barren areas with low vegetation **increase temperatures and reduce local precipitation**.

### **Key Interactions & Feedback Loops**

1. **Warmer Air Holds More Moisture** → Higher **t2m** increases **d2m**, leading to more clouds and precipitation.
2. **Low Pressure Brings Storms** → Lower **msl/sp** leads to stronger winds (**u100, v100**) and more precipitation (**tp, cp, lsp**).
3. **Higher SST Increases Humidity & Rain** → Warm **sst** increases **d2m**, leading to more storms.
4. **Wind Drives Evaporation & Clouds** → Strong winds (**u100, v100**) increase moisture transfer, impacting **tp, cp, lsp**.
5. **Vegetation Regulates Local Climate** → More **cvh, cvl** can moderate **t2m** and increase precipitation.