Thanks for all the fish meme

Latent thermal current (They) comprise the energy the current lost (received) during evaporation (condensation) as water shifted from higher to lower energy (or vice versa). From: Earth-Science Reviews, 2017Shiro Imawaki, ... Bo Qiu, in international geophysics, 2013Lective and rational heat changes increase by 3-5 times the warm waters of agulhas current, and the boundary layer of the marine atmosphere deepens and the formation of convectorous clouds increases (Jury and Walker, 1988; Lee-Thorp et al., 1998; Rouault et al., 2000). During the return flow of Agulhas, the reaction of surface winds and rational heat flow to the SST fronts is almost twice as strong during the austral winter as in summer (O'Neill et al., 2005). The Agulhas Current system affects storm track stations and storm development, as well as regional atmospheric cycles (Reason, 2001; Nakamura and Shimpo, 2004), combined with extreme rainfall and tornadoes over southern Africa (Rouault et al., 2002). Uniquely among the WBC, the Agulhas Current system is thought to be an important source of continental moisture (Gimeno et ai., 2010). Over Africa, the rains correlate with SST anomalies in the larger Agulhas Current system associated with the Indian Ocean dipole and El Niño/Southern Oscillation cycles. The overall warming of the system since the 1970s may have increased the sensitivity of African precipitation to these cycles (Behera and Yamagata, 2001; Zinke et al., 2004). Lisan Yu, encyclopedia of Ocean Sciences (Third Edition), 2019Latent and rational heat changes are assessed for wind speed and sea air humidity and temperature differences using the following mass parameters (Fairall et ai., 2003):where Le is the latent heat of vaporisation and a function of the SST (TS), expressed as le = (2.501-0.00237 × Ts) × 1.06. cp is the specific thermal capacity of the air at constant pressure, ce and ch are the replacement factors for turbulents depending on stability and height for latent and rational heat. Ta and qa are temperature and specific humidity at a reference height of 2 m above sea level. qs is saturation humidity in TS. To calculate a latent and rational heat wave, you need to enter four variables, W, Ts, qa and Ta. The satellite can provide direct searches for W and Ts. SST remote sensing uses infrared and microwave radiomets in space to detect thermal radiation from the ocean surface. Infrared radiometers, such as the five-channel Advanced Very High Resolution Radiometer (AVHRR), use wavelengths between 3.5 and 4 μm and 10-12 μm, which has a high transmission in a cloudless atmosphere. In these wavelength bands, clouds are opaque to infrared radiation and can effectively mask radiation from the sea surface. Due to the cloud effect, it requires or 2 weeks to get the perfect global SST field from the AVHRR, although the satellite orbits Earth 14 times a day from a height of 833 kilometers above its surface and each satellite's passage provides a 2,399km-wide sweep. Clouds, on the other hand, have little effect on microwave radiometres. The microwave SST retriever can be made in all weather conditions except rain. The first satellite sensor capable of measuring the SST through the clouds was the 1997 launch of the TRMM microwave imager (TMI), the entire set of channels ranging from 10.7 GHz to 85 GHz. However, the low incense equatorial orbit limits TMI coverage up to a latitude of approximately 38 degrees. The AMSR-2 of Nida's EOS Aqua spacecraft (AMSR-E, 2002-2011) and JAXA's GCOM-W1 spacecraft (forward 2012) allowed global cloud YT meters to be measured. The near wind speed can only be retrieved in a microwave electromagnetic system. The conmissivity of the ocean surface at the infrared wavelength is so high that it is not sensitive to changes in wind-induced sea surface roughness or fluctuations in humidity in the lower atmosphere. The speed pick-up of the microwave wind is provided by a special sensor microwave/imager (SSM/I) flown by a series of operational spacecraft in polar orbit of the Defense Aerospace Program (DMSP) since July 1987. SSM/I has a wide surface area (~1,400 km) and 82% of the earth's surface in 24 hours. Unlike a scattering meter measuring wind speed and direction, the SSM/I is a passive microwave sensor that offers only wind speed reversals (Wentz, 1997). However, latent and mass change parameterization of sensible heat changes requires wind speed, but not wind direction. High space-time accuracy, near-global daily coverage and continuous recording have made SSM/I the primary input dataset for calculating surface turbulence heating belts. The SSM/I instrumentation was replaced by a new conical scan of passive microwaves by scanning images and sounders (SSMIS) from 2003 onwards. SSMIS brightness temperature measurements are calibrated to the level of SSM/I measurements, and SSMIS continues the SSM/I data record. Unlike the SST and wind speed, the humidity and temperature qa and Ta on the near surface cannot be directly detected by satellite. Retrieving TA and qa from a height of a few meters above the surface proves difficult for space technology, as radiation emits from relatively thick layers of the atmosphere rather than single-level. Liu (1988) used the total water vapour column measured by the satellites, i.e. total water vapour (PW), to assess qa and Ta, indicating that most of the regional and tempor variations in water vapour are limited to the lower part of the water vapour. Column. Removing the atmspheric boundary layer from the higher atmosphere determines the surface level of the correlation between qa and total PW observations. Different algorithms have since been developed to utilise measurements provided by passive microwave radiometers such as SSM/I, SSMIS, AMRE-E and AMSR-2. The launch of an advanced microwave sound unit (AMSU) into the NOAA series of polar-orbiting meteorological satellites in May 1998 has provided further measurements. AMSU is a microwave radiometer capable of detecting temperature and humidity at different levels of the atmosphere by passively recording atmospheric microwave radiation at 15 wavelengths. The AMSU channel at 52 GHz is close to the specific oxygen absorption peak and contains information on the physical temperature of the molecules in the atmosphere and its perspective profiles. This channel is most useful in Ta-noud. Algorithmic development to retrieve Ta and qa can be loosely categorized into three approaches. The first approach uses SSM/I measurements to determine water vapour at the lowest 500 m of the atmosphere and then to predict QA. This approach is due to the fact that water vapour from the well-mixed atmospheric boundary layer can be associated with qa through linear regression. The second approach produces qa-ethic from SSM/I Tb measurements made on 19, 22, 37 GHz channels (Figure 3A-C), as these channels are most sensitive to water vapour. Microwave spectroscopy has a weak water vapour absorption line centered at a frequency of 22 GHz, which allows for a better separation of the water vapour signal from the signal from the cloud (i.e. dew condensed water). The third approach will take advantage of atmospheric sounds such as amsu instruments (image.3D), high-resolution infrared radiation instrument (HIRS) and special sensor microwave water vapour profiler (SSM/T and SSM/T-2). The noticeable detailed profile information of the recording helps remove a variability from the total measurements in the column that is not related to the surface. An example of Ta and qa estimated with Tb pickups of SSMIS 19, 22, 37 GHz, and AMSU-A 52 GHz (Figure 3), based on multicolored regression with buoy qa and Ta measurements as training data (Yu and Jin, 2018). Figure 3. On 01 January 2010, SSMIS F17 channels detected daily 19 GHz (B) 22 GHz (C) at 37 GHz and AMSU-A channel (D) at 52 GHz. The daily mean fields are the up-and-coming and descending overtaking phases (E) qa and (F) Ta average, estimated using a multi-variation regression algorithm. Adapted from Yu, L., and Jin, X. (2018). Using a system-dependent regression model to retrieve air humidity and temperature close to the ground. Remotesens. Environ. 215(9).L. Yu, in the Enads of Marine Science (second 2009Latent and rational heat changes are the primary mechanism by which the ocean transfers much of the absorbed solar radiation back into the atmosphere. These two currents cannot be directly detected by space sensors, but can be estimated by bulk parameterisations of wind speed and sea air humidity/temperature differences:where Le is the latent heat of vaporisation and is a function of sea level temperature (SST, TS), expressed in Le=(2.501−0.002 37×Ts)×1.06. cp is the specific thermal capacity of the air at constant pressure; ce and ch are turbulent exchange factors depending on stability and height for latent and rational heat. Ta/qa is a temperature/specific humidity with a reference height of 2 m above sea level. qs is the saturation humidity of Ts and is multiplied by 0,98 taking into account the reduction in vapour pressure from brine. These two variables, Ts and W, eqns [2] and [3] are retrieved from satellites, so qs are known. TS remote sensing is based on techniques by which infrared and microwave radiometers spreading in space detect thermal radiation emitted from the surface of the sea. Infrared radiometers, such as the five-channel advanced high-resolution radiometer (AVHRR), use wavelengths between 3.5 and 4 and 10-12 μm with high transmission to the cloudless atmosphere. The downside is that clouds are opaque to infrared radiation and can effectively mask radiation from the sea surface, affecting temporal resolution. Although the AVHRR satellite orbits Earth 14 times a day from a height of 833 km and each satellite's passage provides a 2,399km-wide sweep, it usually takes 1 or 2 weeks to get complete global coverage depending on the actual cloud coverage. Clouds, on the other hand, have little effect on microwave radiators, so TS pick-ups of microwaves can be made under total cloud cover except for rain conditions. Launched in 1997, the TRMM microwave image (TMI) has a full set of channels ranging from 10.7 to 85 GHz and was the first satellite sensor to accurately measure the SST through the clouds. However, a steady orbit of low inceditiveness limits TMI coverage to a latitude of approx. 38°. After TMI, Neda's Advanced Microwave Scanning Radiometer (AMSR) enabled the first polar microwave radiometer capable of measuring the global cloudy SST in 2002.Although the SST can be measured in both infrared and microwave areas, the wind speed of the near surface can only be retrieved from microwave areas. The reason is that the conmissivity of the ocean surface at a wavelength of approximately 11 μm is so high that it is not sensitive to changes in wind-induced sea level roughness or moisture fluctuations in the lower atmosphere. wind speed pick-up is provided by a special sensor microwave/imager (SSM/I) flown by a series of operational spacecraft in polar orbit of the Defence Aerospace Program (DMSP) since July 1987. SSM/I has a large area (∼ 1400 km) and 82% of the earth's surface within 1 day. But unlike scattering meters, SSM/I is a passive microwave sensor and cannot provide information about wind direction. This is not a problem with the eqns [2] and [3] calculation, which only requires wind speed observations. In fact, the SSM/I's high-time space accuracy and good global reach have made it a primary database for calculating the latent and rational thermal flow of the ocean over the last 20 years. Currently, wind speed measurements are also available from several NASA satellite platforms, including TMI and AMSR. The most difficult problem with the satellite-based change assessment is the retrieval of air humidity and temperature, i.e. qa and Ta, several metres above the surface. This problem is inherent in all passive radiometres in space, since the measured radiation comes from relatively thick layers of the atmosphere and not from a single plane. One common practice for extracting satellite qa is to relate qa to the observed column of integrated water vapour (IWV, also called the total amount of prejuutative water) from SSM/I. However, the approach produces large systematic biases of more than 2 g kg−1 in tropics and in medium and high latitudes in summer. This is due to the impact of water vapour convergence, which is difficult to assess in areas where surface air is almost saturated, but the total amount of IWV is small. In such situations, the IWV is not able to reflect the actual vertical and horizontal humidity variations in the atmosphere. Various remedies have been proposed to improve the Qa-IWV relationship and improve it to synoptic and shorter deadlines. There are methods to increase geophysical variables, replace with IWV with IWV at the lower 500 meters of the planetary layer and/or use empirical orthopaedic functions (EOF). Although overall improvements were achieved, accuracy is still poor due to the fact that there is no detailed information on humidity profiles in the air. Retrieving Ta from satellite observations is even more challenging. Unlike humidity, there is no uniform vertical temperature structure in the atmosphere. Radiometers that sound like satellite temperatures do little to help, as they are usually designed for retrieval in large vertical layers. Sounder Low Data Content a lower atmosphere does not allow the temperature of the close surface air to be retrieved with sufficient accuracy. Different methods have been tested to make Ta come from the inferped qa, but all showed little success. Due to the analytical difficulties of QA and Ta, the latent and rational change estimated from satellite measurements has major uncertainties. Three methods have been tested to get better qa and Ta to improve estimates of latent and rational change. The first approach is to improve knowledge of the temperature and humidity of the lower troposphere. This is achieved by combining SSM/I data with other microwave sound data, originating from instruments such as the Advanced Microwave Sound Unit (AMSU-A) and the Microwave Humidity Silencer (MHS) flown from satellites in polar orbit of the National Oceanic and Atmospheric Administration (NOAA), as well as from a special sensor microwave temperature silencer (SSM/T) and (SSM/T-2) of DMSP satellites. Although silencers do not directly provide low surface measurements, the detailed profile information provided by the recording can help eliminate variability in total column measurements that are not related to the surface. Another approach is to take advantage of progress in numerical weather forecasting models that blend healthier observations into a physically based system. The qa and Ta estimates of the models contain less ambiguity related to the vertical integration of different parameters and the high regional average, although they are subject to systematic bias due to the parameters of the model subnet. The third approach is to get a better assessment of qa and Ta with a combination of optimal satellite search and model outputs, which has been trialed in an objectively analyzed air-to-sea current (OAFlux) project at the Woods Hole Oceanographic Institution (WHOI). The efforts have led to an improvement in daily assessments of global air-sea latent and rational change. Axel Kleidon, encyclopedia of Ecology (Second Edition), 2019 The latent heat wave of the surface's energy account is directly related to evaporation that moistens the atmosphere. Dehydration of the atmosphere is achieved by disenging, which releases latent heat into the atmosphere, causing a strong heating source and moist convection. The zone variation in evaporation strongly follows the zone variation in solar radiation, but precipitation is more concentrated in the tropics and middle latitude (Fig. 4c). The difference between evaporation and pretext indicates that moisture is transported through the circulation of the atmosphere (grey shading in Figure 4c). In the tropics, precipitation exceeds evaporation because the atmosphere brings moisture from subtropical substances and compresses it into a relatively narrow band of tropics within internal convergence Large-scale atmospheric circulation also carries moisture from subtropical substances to the middle of latitudes, which leads to precipitation exceeding evaporation even at these latitudes. Thus, hydrological cycling follows directly from the latent thermal railing of the energy balance, but there is still a strong mark on the atmospheric cycle. Dennis L. Hartmann, Global Physical Climatology (Second Edition), 2016 Delayed heat wave depends sensitively on temperature depending on saturation vapour pressure to temperature. On top of the surfaces of water or coo, we can assume that the mixing ratio of the surface water vapour is equal to the mixing ratio of saturation at q*surface temperature. With saturated air, the steam mix ratio at the reference height can be approximated with the first-class Taylor series. (4.29)qa*=q*(Ts)+∂q*∂T(Ta−Ts)+... The actual vapour mixing ratio of the air at the reference height can be expressed as relative humidity at this level. (4.31)qa≅RH(q*(Ts)+∂q*∂T(Ta−Ts))Substitution (4.31) at (4.27) gives a temperature difference to surface heat loss through evaporation and terms of relative humidity,(4.32)LE≅ρ L CDE q*(Ts) (1−RH)+RH Be−1 cpL(Ts−Ta), where the Bowen ratio is the ratio of rational cooling to latent cooling of the surface. When comparing (4.32) and (4.26), we see that when the surface is wet and the air is saturated, RH = 1, and assume that cdH = CDE, the Bowen ratio receives a special value:When the surface and air at the reference plane are saturated, the Bowen ratio approaches the value given (4.33), which can be called the bowen equilibculation ratio. We must assume that the variation in humidity from the boundary layer to the free atmosphere is sufficient to balance the humidity from the surface of the upward height so that the humidity of the reference height is balanced with the saturation value. The Bowen ratio in such a balance is inversely compared to the rate of change in water vapour impregnation mixture and temperature (4.33). The rate of change in the saturation-mixing ratio with the temperature is very sensitive to the temperature itself. The approximate formula (1.9) shows that the exponential dependence on the temperature of the ratio of saturation is much higher than the inverse square of temperature (4.35), so the balance bowen ratio decreases exponentially with the temperature. The temperature dependency of the saturation mixing ratio and the bowen equilibration ratio is graphically presented as a log-linear plot in Figure 4.10. Bowen's equilibility ratio is in unity at about 0 °C and decreases to approximately 0,2 at 30 °C. When (4.32) relative humidity decreases from 1 to lower values, evaporative cooling increases so that the balance the ratio is the maximum Bowen ratio to the wet surface. The actual Bowen ratio to the wet surface is usually lower than the bowen balance ratio, since the air at the reference height is usually not saturated. As a result of the strong temperature dependence of saturation vapour pressure, latent cooling of the surface controls sensible cooling from the wet surface, for example, in the tropics, but at high latitudes in winter, rational heat transport can be very important. To show this, assume a wet surface and saturated atmosphere, so that the actual Bowen ratio is the balance of the bowen ratio, we can write thatFigure 4.10. Saturation-specific humidity q*(g kg−1) and balance bowen ratio Be as temperature functions. Be = 1 at approximately 278K. At much warmer temperatures, ≪ 1 and most surface cooling is by evaporation. At a much colder ≫ 1 and most surface cooling is a sensible heat transfer. The previous debate is strictly applied only to conditions where the surface is wet, in which case evaporation cooling is not limited by a lack of moisture on the surface. On land, evaporative cooling may be significantly reduced when moisture cannot be supplied from below the surface quickly enough for air to come into contact with the surface. In desert areas, the surface is typically so dry that evaporative cooling is low regardless of temperature, so sensible cooling and long-wave emissions must balance solar heating. In vegeted terrain, evaporation of cooling and through the leaves is controlled by the physical and biological status of the canopy of plants and the water content of the soil. The role of soil and vegetation in surface water and the energy balance is discussed in more detail in Chapter 5.RolandStull , in Atmospheric Science (Second Edition), 2006Then subsead describes a method that can be used for rational and latent heat on the earth's surface. This so-called bulk aerodynamic method also allows us to estimate the frictional stroke of surface winds. The rational heat flow between the surface and the air above is controlled by two processes. Within a few millimeters of the atmosphere, very large vertical temperature gradients that cause molecular conductivity of heat away from the surface into the air. There is no turbulentness at the bottom of this molecular layer (e.g. on the surface of the earth), since soil blockages do not usually dance eddy dancing. But from the top of this molecular layer or microlayer to the top of the boundary layer, molecular management is low, while turbulent convection takes over, moving warm air upwards to distribute rational heat throughout the boundary layer. Because the microlayer is so thin compared to the depth of the boundary layer and because the microlayer through-dye is almost constant and equal to the sum of the turbulent eddy at the top of the microlayer, it is possible to determine an effective turbulent flow that is the sum of molecules and actual turbulent components. In practice, the word effective is often omitted, and this amount is simply called a turbulent change of surface. Efficient rational heat flow is often parameterized by the temperature difference between surface and air. If the surface skin temperature, I.e. known, the sensible thermal current (in kinematic units K m s21) from ground to air can be parametered(9.19a)FHs=CH| V| (Ts−Tair) where CH is an unsable heat and | V| and Tair are wind speed and air temperature at constant surface measurement heights (10 and 2 m). In order to be converted from kinematic to dynamic thermal flow rate (W m22), FH shall be multiplied by an air density multiplied by the constant pressure of the specific heat (r cp). Under static neutral conditions, flat surfaces have a moderate amount of turbulence that changes slow-moving air near the ground and faster moving air in the boundary layer, producing values of 0,001 to 0,005 for CH in the range (designated CHN to indicate neutral conditions). The exact value of chN depends on the roughness of the surface, similar to cdnshown's roughness dependency in Table 9.2. On the other hand, as the air becomes statically more stable, Richardson's number increases toward its critical value and the kinetic energy of turbulence decreases toward zero, causing ch also to decrease toward zero. When assessing a vertical heat wave, one would have expected Eq. (9.19a) to operate at a vertical turbulent transport speed wT times the temperature difference. But for this first order close, wT is parameterized CH| A|, which assumes that strong winds near the ground cause stronger turbulence, causing stronger storms. By combining EQs. (9.17–9.19a), we see that the skin temperature on the ground on sunny days is really the answer to solar heating and not an independent driving force for heat change. On a day of light winds, for example, the net radiation budget causes a certain energy input into the ground, causing the surface skin temperature to rise under the first law of thermodynamics. As the skin warms up, a sensible heat wave increases according to Eq. (9.19a), as does evaporation and heat transfer to the ground. Since the winds are light, (9.19a) indicates that the skin temperature must be quite slightly warmer than the air temperature in order to drive a sufficiently sensible thermal current FH to help surface heat budget. However, the heat flow required on a windy day is achieved at the surface skin temperature, which is only slightly warmer than the air temperature. When warmer air is used on a cooler surface or when the ground is cooled at night with longwave radiation, Ts < Tair, and the heat flow comes down. This cools the bottom of the boundary layer and leads to subdiabate sunset rates and reduced or dampening of turbulence. Due to the decrease in turbulence, cooling is limited to the bottom of the boundary layer, creating a low stable boundary layer embedded in an old, deeper boundary layer. Similar equations, called a set of aerodynamic relationships, can be led from a stream of moisture across oceans, lakes and saturated soils. It can be assumed that the specific humidity near the surface qs is equal to the saturation value determined by the clausius-clapeyron equation based on the temperature of the air near sea level. Namely, humidity flux Fwater [in kinematic units (kg water vapour/kgair) (m s21)] on the surface is(9.19b)Fwater=CE| V| [qsat(Ts)−qair], where CE is the measurable humidity mass transfer factor (CE ≈ CH). This moisture shed is directly related to latent heat change (FES, in kinematic units K m s21) on the surface of the water and evaporation rate E (mm/day) (9.20)Fwater=γ FEs=(ρliq/ρair) E where g = cp/Lv = 0,4 [(gwater vapor/kgair)/K] is a psychometric constant and rliq is the density of pure liquid water (not seawater). The ratio of sensible and latent thermal change on the surface is called the Bowen ratio6: B = FHs/FES. Due to the nonlinearity contained in the Clausius-Clapeyron equation, Bowen's relationship with the oceans decreases as sea surface temperatures rise. Typical values range from about 1.0 ± 0.5 ice edges to less than 0.1 tropical oceans, where latent heat streams dominate due to sea surface heat. On land, the rate of evaporation, and therefore the Bowen ratio, depends on the availability of water in the soil and the makeup of vegetation, which carries water from the soil through osmosis. Plants release water vapour into the air by crashing through the open stomama (pores) of the leaves. Thus, Bowen's ratio ranges from about 0.1 to tropical oceans, 0.2 to irrigated crops, 0.5 to grassland, 5.0 compared to half-time regions and 10 across deserts. For momentum, a set of aerodynamic approach provides a traction law with a CD with an un dimensional tension factor ranging from 1023 to a smooth surface of 2,÷,1022 for rough ones (Table 9.2), and you * 2 is the amount of momentum lost to the ground. The CD is affected not only by skin friction (viscous pulling), but also by pulling the shape (pressure gradients in the headwinds and headwinds, such as trees, buildings and mountains), and Drag. Therefore, the CD may be greater than CH. The tension factor CD varies in relation to its neutral value CDN in the same way as CH; stained border layers of cd and stable border layers of CDN. Over the oceans, the increase in wind speed leads to an increase in wave height, which also increases drag (see Box 9.1). Figure 9.13 shows how the transfer factors for bulk motion, heat and humidity vary according to wind speed measured at z = 10 m above the oceans. At wind speeds above 5 m s21, the heat and humidity transfer factors gradually decrease as wind speed increases, while the draught factor CD increases. For wind speeds far below 5 m s21, loose formulae cannot be used because vertical turbulent transport between surface and air depends more on convactative heat sources than wind speed.9.1A Surface wind gusts passing over water produce small capillary waves of detectable patches with brushes perpendicular to the surface wind vector. Because capillary waves are short-lived, their distribution at any time reflects the current distribution of surface wind. Remote sensing of capillaria altars with satellite testing meters, called scatter meters, provides the basis for global monitoring of ocean surface winds. As surface winds force waves from hours to days, different wavelengths and directions interact with each other to produce a continuous spectrum of ocean waves spanning hundreds of meters of wavelengths. The stronger and more durable the winds, the greater the amplitude of longer wavelengths. Wind waves with shorter wavelengths tend to spread in the same direction as winds. By contrast, the faster-increasing long wavelength levels radiate outward from areas of strong winds to swell and can thus be the first sign of an approaching storm. The intestion of wave fracture increases at wind speed. At speeds exceeding 50 m s21, the breaking of the wave becomes so strong and wide that the air-sea interface becomes fragmented and difficult to define. Figure 9.13. Variation in mass transfer factors for drag (CD), heat (CH) and humidity (CE) at wind speed over the ocean. [Adapted from a manuscript published by M. A. Bourassa and J. Wu (1996).] Copyright © 1996 Chapter 7 showed how winds can be predicted by looking at the sum of all airborne forces. Turbulent pulling, as has just been discussed, is one such force that always works against the wind direction (that is, it slows down the wind). More importantly, we see from the (9.19c) principle that the strength of the traction is proportional to the square of wind speed, so doubling the wind speed quadruples the drag. Through these atmospheric inversions through the surface are impressed with the air inside the atmospheric boundary layer, but not in the air in free air. On earth, the turbulence of these varying parts spreads throughout the boundary layer to the depth, causing varying vertical profiles as described in the following section. Consider the air column, which is initially vertically uniform u over cold ground, adorned with a very strong temperature reversal that prevents the boundary layer from growing. This air column stars at speed U over the surface of a warmer ocean with a potential temperature. a) How does the temperature vary depending on the distance x from the beach? b) How does the air temperature vary depending on wind speed at a fixed distance x from the shore? [Tip: Use Taylor's seven hypotheses: ∂(1)∂t=U∂(1)∂x.] If the only heat to the air column is from the surface, the change in air temperature over time can be found in the heat budget Eq. (9.10), which is integrated over the depth of the boundary layer: ∂u/∂t = FHs/zi, where zi is constant. Combining this with Taylor's hypothesis ∂∂x=1UFHsziThen, assessment of surface heat flow using bulk aerodynamic methods (Eq. 9.19a) and approximation (Ts - T) by (me - u) provides a) separate parameters and integrates: u = me - (we - u0) exp[-CH x/zi], where u0 is the potential initial air temperature above ground. Thus, the air temperature rises at tailwind distance x from the shoreline, initially quickly, but gradually downstream as the air temperature approaches as the air temperature unsymedly approach sea surface temperature. b) Surprisingly, the air temperature at a fixed distance from the shore is independent of wind speed. The reason is that while faster winds cause higher thermal currents and faster warming of the boundary layer, faster winds also reduce the time available for warming before the air reaches a distance x from the shore. Kristina B. Katsaros, encyclopedia of Ocean Sciences (3rd edition), 2019 Sea evaporation/latent thermal flow assessment using satellite data is also based on bulk formula. Calculating latent thermal change using a bulk aerodynamic method requires SST, wind speed (U'10N) and humidity at the level of the surface layer qa 1, as shown in Eq. (3). Therefore, three variables from space must be assessed. Over the ocean, the U'10N and SST have been retrieved directly from satellite data, but there is no QA. In the 1980s, a method for assessing qa and latent heat flow from the sea was first proposed using microwave radiometer data from satellites (Liu, 1984) and has been further developed (e.g. 1984). It is based on an empirical relationship between integrated water vapour W (measured by microwave radii in space) and qa over a monthly interval. The physical justification is that the vertical distribution of water vapour throughout the depth of the atmosphere is consistent for more than a week. the relationship does not work well in a synoptic and shorter schedule, and it also fails in some areas in the summer. This method has been proposed by converting more geophysical parameters into it, but the inherent limitation is the lack of information on the vertical distribution of q near the surface. Two possible improvements to E-retrieval are the acquisition of information on the vertical structures of moisture distribution and the acquisition of a direct relationship between E and the brightness temperatures (TB) measured by the radiometer. Recent events provide an algorithm boundary layer for direct searching for water vapour from rays detected by a special sensor microwave/graph (SSM/I) on operational satellites in a defense satellite program since 1987. This sensor has four freams, 19.35, 22, 37 and 85.5 GHz, all but 22 GHz, used for both horizontal and vertical polarization. The 22 GHz channel of vertical polarization is in the middle of a weak water vapour absorption line without saturation, even at high humidity. Measurements are only possible over the oceans, as the oceans serve as a relatively unified background reflecting the background. On earth, earth's signals are taking over water vapor data. Since all three geophysical parameters, U'10N, W and SST, can be retrieved from the rays at frequencies measured on an older microwave radiometer, launched in 1978 and operated in 1985 – Scanning Multichannel Microwave Radiometer (SMMR) on Nimbus-7 (similar to SSM/I, but also on 10,6 and 6,6 GHz channels and not on 85 GHz channels)– E was demonstrated directly from the measured rays. SMMR measures on 10 channels, but only 6 channels were found to be significantly useful for the assessment of E. SSM/I, the functional microwave radiometer following the SMMR, is not a low frequency channel sensitive to the SST and therefore it is impossible to retrieve E from TB directly. The tropical precipitation measurement (TRMM) microwave image (TMI), launched in 1998, showed low frequency measurements sensitive to the SST and could allow for direct estimates of evaporation volumes. Figure 3 gives an example of global monthly average humidity obtained exclusively by SSM/I satellite data. Figure 3. The global distribution of monthly latent heat change in W m− 2 in September 1987 was repeated with the permission of Schulz, J, Meywerk, J, Ewald, S., and Schlüssel P (1997). Latent thermal leaking of satellite derivatives. Rough sea surface temperature data, such as data provided operationally by the US National Weather Service based on infrared observations from Advanced Very High Resolution Radiometer (AVHRR), may also be used to calculate Journal of Climate 10, 2782-2795.Qs. polar satellites. Accurate random timing is not so important for the SST, as the SST fluctuates slowly due to the high thermal capacity of the water, and this method can provide useful focus only when the averages are taken from 5 days to a week. Wind speed is best obtained from scatter meters instead of microwave radiometers in heavy rain or rain areas, as scatter meters (which are active radars) penetrate the clouds more efficiently. Scatterometers 1 and 2 were launched in 1991 and 1995 by the European Space Agency (ESA) and the Us National Aeronautical and Space Administration (NASA), NASA scatter meter NSCAT with Japanese short-lived satellite in 1996 and QuikSCAT satellite in 1999) (see, for example, Bentamy et al., 2003). In addition, microwave radiometers provide a wind speed that is sufficient (because vectors are not needed for evaporation estimates), so windsat by a polar orbiting satellite by the U.S. Navy and NOAA provides this new additional information (Gaiser et al., 2004).L. Jia, ... M. Menenti, in Comprehensive Remote Sensing, 2018 The exchange of energy between the ground and the atmosphere is a significant factor in the processes of the atmospheric boundary layer and terrescal ecosystems. It is crucial to accurately determine the distribution of available energy between the reasonable density of heat change (surface heating or cooling) and the latent thermal cycle density over a wide range of space and temporal scales. Actual terresanal evapotranspiration (ET), the sum of water from the ground and reaching the soil through evaporation from soil, vegetation and water surface, and vegetation from the canopy through transpiration, also called latent heat change during energy exchange, is an important part of water, energy and biogeochemical cycles. Accurate assessments of terresanal ET are therefore crucial for applications such as global and regional climate change research, drought monitoring, water resource management and sustainable agricultural development. In recent decades, a number of global and regional ET assessment methods and ground models have been proposed, data products produced and earth observation are expected to provide regionally and temporally continuous information on ground parameters/parameters necessary for large-scale ET assessment. However, ET remains the part with the most problems with water cycle processes due to the complex control factors and heterogeneity of the landscape (Lettenmaier and Famiglietti, 2006; McCabe et al., 2015). Observation and modelling of stormy heat waves on the ground has been a very active research area since at least Bowen's (1926) work on the relative size of heat transfer on dry and dry surfaces (Monteith, Feddes, 1971; Verma et al., 1976; Hall et al., 1979; Price, 1982; De Bruin and Jacobs, 1989; Beljaars and Holtslag, 1991; 1994). Most conventional techniques using point measurements to assess components of the energy balance represent only local scales and cannot be extended to large areas due to ground heterogeneity, dynamic nature and regional distribution of heat transfer. Radiometric measurements taken at a distance from evaporative organs have been used for about 50 years to measure water use: qualitatively or quantitatively. Observable variables are not fully characterized by the state of the volatile body, and research in this area of science and applications has evolved along different lines by focusing on different biophysical processes affected by evaporation. This leads to the use of remote sensing strokes and alternative parameterisation of processes. A few global real evapotranspiration data products (ET) have been developed and are currently being evaluated. Remote sensing, which covers large and frequent, has become a widely used and effective tool for monitoring changes in land and the environment. Ground characteristics such as surface albedo, bracking vegetation and ground temperature (LST), obtained from radiometric data in the optical area, i.e. visible, near infrared to thermal infrared, have been used in many models of hydrological, meteorological and ecological processes for decades (see, for example, Menenti, 1984, 2000). In accordance with the principle of energy saving, the available energy, i.e. the net radiation energy on the ground minus the energy obtained in the soil, must be dissiped by sound heat and latent heat change in the case of non-storage of heat and photosynthesis energy. In theory, sensible and latent thermal currents can be determined near the surface using slope measurements of wind speed, air temperature and air humidity when these measurements are available. Algorithms for assessing rational and latent heat flow by remote sensing can be grouped into two broad categories: analytical and (semi)empirical (see, inter alia, Menenti, 2012 and Menenti et al., 2012). A common approach for all methods is a two-step approach:(1)Assess the mandatory maximum and minimum flux densities;(2)Estimate the actual frequency of changes by remote sensing with a detectable space variable to scale the actual value between maximum and minimum values. Earth evapotranspiration has a significant impact on three biophysical processes in the Earth's system:–the earth's energy balance (Norman et al., 1995; Publisher and Others, 1996; Anderson et al., 1997, 2004; Bastiaanssen et al., 1998a,b; Sun, 2002; Jia et al., 2003a,b; Jia, 2004; van der Kwast et al., water balance (Miralles et al., 2011; Cui, 2015);–plant growth (Mu et ai., 2007, 2011; Hu and Jia, 2015; Zheng et al., 2016). All three have been used to develop methods for evaluating and monitoring evacuation in the country. In all cases, the ground energy account is considered to be a constraint, often cast as a Penman-Monteith composite equation or its simplified form (e.g. Penman-Monteith). Regardless of biophysics, a measure shall be established to reduce the rate of evapotranspiration below the maximum speed for unlimited water availability, taking into account the radiation and limit layer. (1) Energy balance on the ground The basic physsis of determining water use is the principle of energy saving on the volatile surface. However, the energy activity densities are parameterised using parameters that can actually be taken by radiometric measurements. Relative size of latent and rational thermal change (see e.g. This causation relationship led to previous experimental studies (Fuchs and Tanner, 1966, 1968) and previous methods for assessing actual evapotranspiration (ET) by remote measurements of radiometric surface temperature (e.g. Jackson et al., 1977). Initially, homogeneous patches were made and direct relationships between evaporation and surface temperature were established. Over the next 20 years, methods have been put forward to apply and extend such direct relationships to larger, heterogeneous land areas (see, for example, Menenti, 2000). However, both field tests and remote sensing studies lead to the conclusion that soil evaporation according to ground temperature must be taken into account regional heterogeneity in radiant coercion and boundary layer conditions (Menenti, 2000; Kalma et al., 2008). Because of the radiant network power and boundary layer conditions, the ground temperature is fully reflected in the earth's response to water availability, providing an effective way to determine the real – rather than the greatest evaporation of the earth. (2) Soil water balance The dynamic balance of inflows and outflows of water determines the amount of water stored in soil and deeper groundwater reservoirs. Feedback on soil water levels from soil evaporation is significant. Over days or weeks, the soil water tank determines the actual evaporation. Feedback mechanisms are fundamentally different when considering evaporation from bare soil or plant transpiration. For simplicity, in both cases we can consider a 1 m thick layer of soil. The water content of the soil in this soil layer describes the state of the land – in terms of water availability and actual soil evaporation scales the contents of this layer — when the surface (excess energy) is forced and the characteristics of the soil and plants are taken into account (see, for example, Miralles et ai., 2011). A stressor based on actual and maximum soil water concentration in the root zone is used to parameterize the reduction in actual evaporation, ETact, below the maximum et speed for unlimited water availability. The total soil water content of a 1 m deep soil layer cannot be detected directly from a remote surface. However, continuous observations of the water content of the Highland soil can be used to force the soil's water balance model and thus assess soil evaporation. (3) Plant growth The transpiration of plants depends on the energy balance and leaf area of the leaf level and is controlled by the led of the avant. The latter's dependence on environmental conditions can be created in semi-empirical proportions and can be used to parameter the leaf level flows of water and the accumulation of CO_2 and biomass by photosynthesis (Jarvis, 1976). Mu et al. (2007, 2011) developed an algorithm for evaluating true ET in this direction. The energy balance limit is set using the Penman-Monteith composite equation. The reduction in actual evaporation below the maximum speed is parameterised by its dependence on the direction of the avant-canopy to environmental conditions, in particular air temperature, vapour pressure deficiency and absorbable photosynthetic to active radiation. The leadership of the canopy was scaled by the leaf area index. This parameter set parameter parameters paramethroses both transpiration and photosynthesis. Photosynthesis.

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