VREMENSKE ĆUDI ZAVIŽANA
THE TEMPER OF ZAVIŽAN WEATHER

Planinarski dom i meteorološka postaja Zavižan ljeti i zimi - dva lica iste priče.
Two faces of the same place - Zavižan mountain house and Meterological station in summer and winter.

Poučna meteorološka staza **"VREMENSKE ĆUDI ZAVIŽANA"** među prvima je takve vrste u Hrvatskoj. Dužina joj je 630 m, a visinska razlika koju treba savladati je oko 100 m. Na stazi je **17 POUČNIH TABLI**, a vrijeme potrebno za njezin obilazak je oko pola sata.

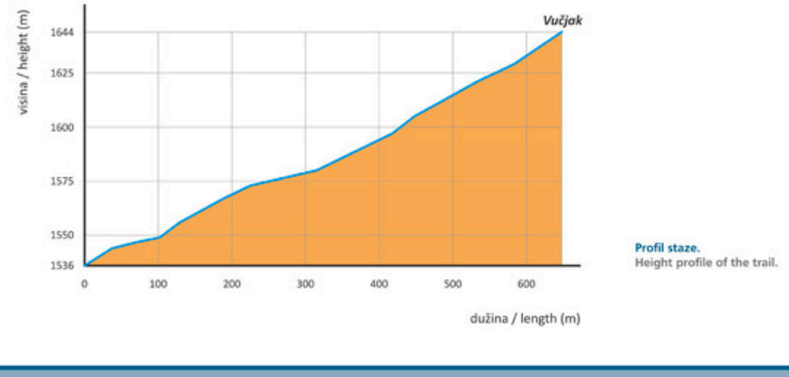
Cilj je ove staze upoznati posjetitelje Nacionalnog parka Sjeverni Velebit s **OSNOVAMA METEOROLOGIJE** kao znanosti, ali i s **ĆUDIMA VREMENA** ovog planinskog područja. Nastala je kao plod suradnje Državnog hidrometeorološkog zavoda i Javne ustanove Nacionalni park Sjeverni Velebit. Staza je postavljena uz potporu Hrvatske turističke zajednice.

Educational meteorological trail **„THE TEMPER OF ZAVIŽAN WEATHER"** is among the first of a kind in Croatia. It is 630m long, with height range of approximately 100 m. It will take you about half an hour to make a tour along the trail with its **17 EDUCATIONAL PANELS.**

The goal of the trail is to present the **BASICS OF METEOROLOGICAL SCIENCE** to the visitors of Northern Velebit National Park, but also to show them the **TEMPER OF WEATHER** in this mountain area. It is created in co-operation between Meteorological and Hydrological Service of the Republic of Croatia and Northern Velebit National Park Public Institution. The project was supported by Croatian National Tourist Board.

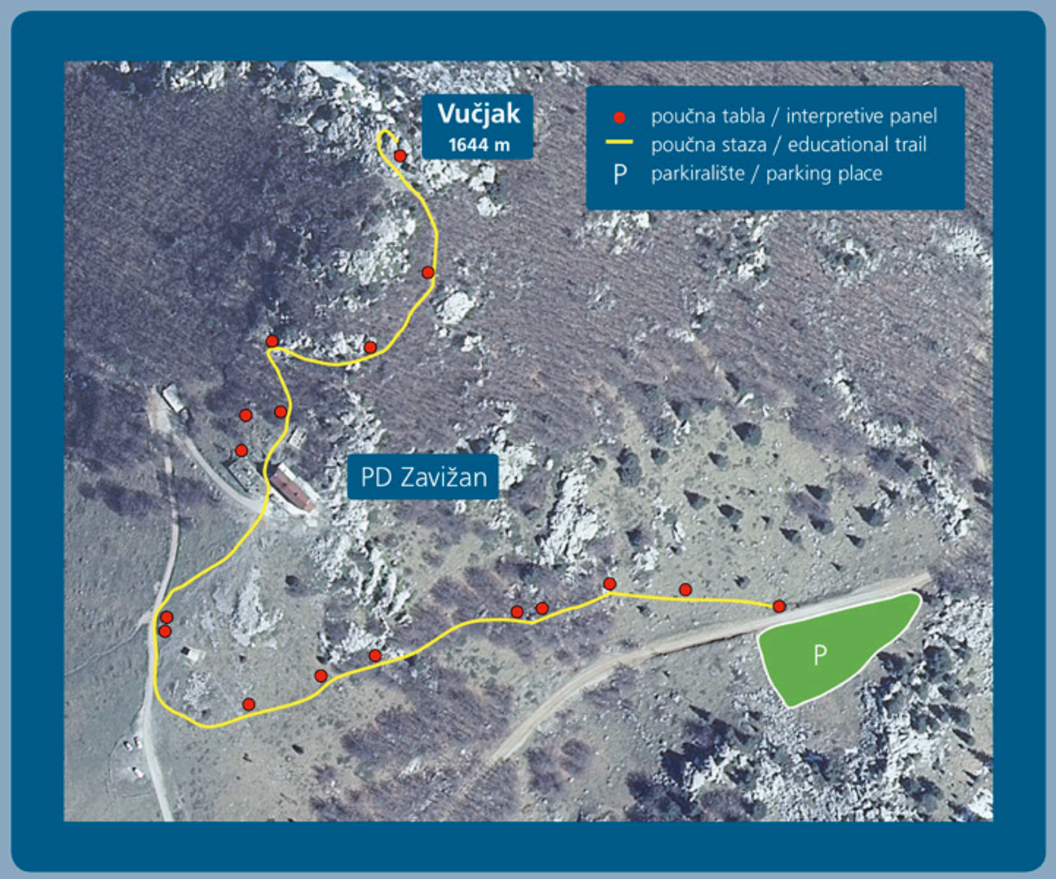
Nacionalni park Sjeverni Velebit

DHMZ

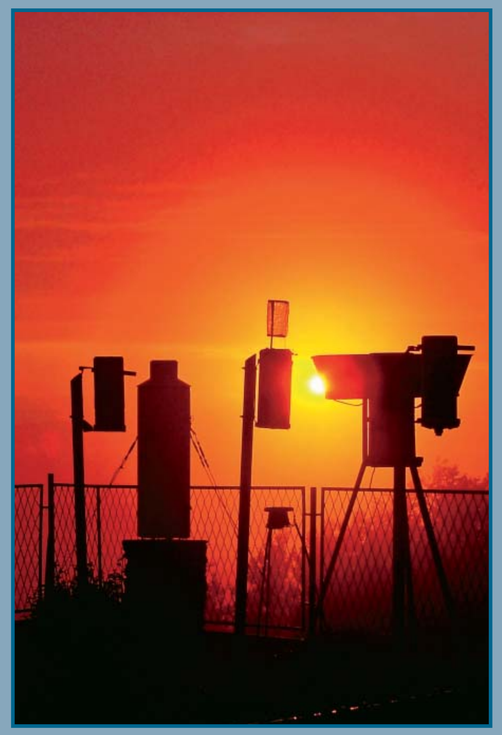


Profil staze.
Height profile of the trail.

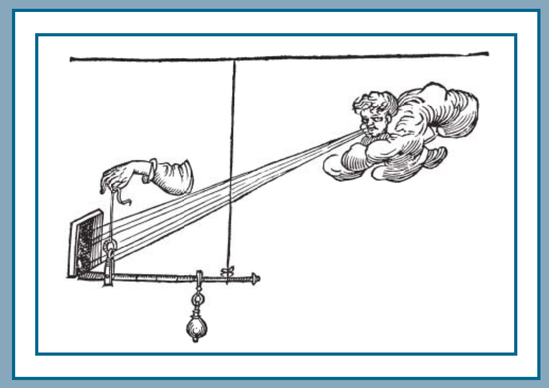
Karta staze.
Map of the trail.



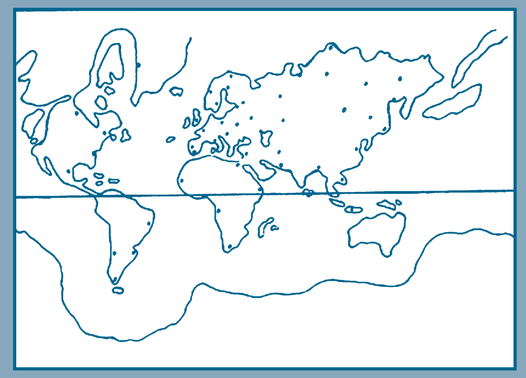
METEOROLOGIJA ILI VREMENOSLOVLJE
METEOROLOGY OR WEATHER SCIENCE



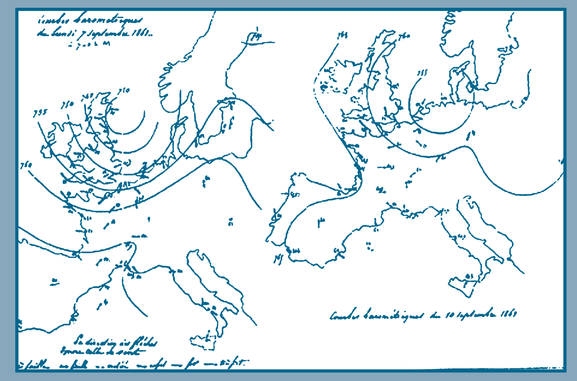
Mjerenja u sprezi prirode i vremena.
Measuring where nature and weather ally.



Santorio-ov anemometar iz 1625. godine. Santorio je bio profesor medicine u Padovi, a djelovao je također na području današnje Hrvatske.
Santorio's anemometer from 1625. Santorio was a professor in Padova but he also spent some time on today's Croatian territory.



Lambertov prijedlog globalne motriteljske mreže iz 1771. godine.
Lambert's proposal for the global observation network from 1771.



Prva sinoptička karta za 7. i 10. rujna 1863. godine. Sinoptička karta je geografska karta na kojoj se prikazuju elementi vremena: tlak i temperatura zraka, vjetar, naoblaka itd.
The first synoptic map for 7 and 10 September 1863. Synoptic map is a geographic map which shows weather elements such as air pressure and temperature, wind, cloudiness etc.

METEOROLOGIJA ili **VREMENOSLOVLJE** je znanost o Zemljinoj atmosferi, to jest znanost o vremenu i klimi.

VRIJEME je stanje atmosfere na nekom mjestu u razdoblju ne duljem od nekoliko mjeseci. Ono je određeno vrijednostima meteoroloških elemenata – to su **VELIČINE STANJA ATMOSFERE** kao što su temperatura ili tlak zraka i **ATMOSFERSKE POJAVE**, kao što su oborina ili magla.

KLIMA ili **PODNEBLJE** je ukupnost (sinteza) svih vremenskih prilika na nekom području u dugogodišnjem razdoblju, najčešće 30-godišnjem.

Meteorologija kao znanost se počinje razvijati tek od sredine 19. stoljeća otkad postoje sustavna meteorološka motrenja (mjerenja i opažanja) na meteorološkim postajama diljem svijeta kao i u Hrvatskoj. Otkriće telegrafa 1843. godine omogućuje brzu razmjenu meteoroloških podataka pa se uskoro nakon toga organiziraju trajne motriteljske službe, osobito u zemljama zapadne i srednje Europe te Sjedinjenim Američkim Državama.

METEOROLOGY is the science of the Earth's atmosphere i.e. the science of weather and climate.

WEATHER is the state of the atmosphere at a certain location during a period not longer than three months. It is determined by meteorological elements – these are **ATMOSPHERIC QUANTITIES**, such as air temperature or pressure, and **ATMOSPHERIC PHENOMENA** such as precipitation or fog.

CLIMATE is the synthesis of weather on a certain territory during a multiannual period e.g. 30 years long.

Meteorology started developing as a science in the middle of the nineteenth century when systematic weather observation (visual and instrumental) on weather stations started worldwide including Croatia. After the discovery of telegraph in 1843, a fast exchange of weather data became possible, which speeded up the establishment of national weather services particularly in Western and Central Europe, as well as in the United States.

JESTE LI ZNALI?
Motrenje vremena i klime obavlja se po jedinstvenim pravilima u čitavom svijetu koje propisuje Svjetska meteorološka organizacija (SMO) sa sekreterijatom u Ženevi.

DID YOU KNOW?
Weather and climate observations are made using unique rules which are applied worldwide and established by the World Meteorological Organization (WMO), whose headquarters are located in Geneva.

METEOROLOŠKA MOTRENJA
METEOROLOGICAL OBSERVATIONS

Raspored instrumenata na glavnoj meteorološkoj postaji: 1 - snjegomjeri, 2 - daska za novi snijeg, 3 - površina za uzimanje uzoraka za mjerenje gustoće snijega, 4 - skupljači uzoraka za kemizam oborine, 5 - meteorološka kućica, 6 - meteorološka kućica, 7 - stup za heliograf i solarigraf, 8 - stup (postolje) za komponente Sunčevog zračenja, 9 - stup za rezervni kišomjer, 10 - kišomjer, 11 - ombrograf, 12 - anemometar za mjerenje prijeđenog puta, 13 - isparitelj klase "A", 14 - termometri u tlu, 15 - minimalni termometar na 5 cm iznad tla, 16 - stup za anemograf i vjetrokaz.
Order of instruments at a meteorological station: 1 - snow stake, 2 - snow board, 3 - a surface for snow samples, 4 - collectors for precipitation chemistry samples, 5 and 6 - meteorological screen, 7 and 8 - post for sunshine radiation, 9 and 10 - post for rain gauges, 11 - ombrograph, 12 - anemometer at 2m above ground, 13 - evaporimeter, 14 - thermometers in the soil, 15 - thermometer at 5cm above ground, 16 - anemometer and wind vane at 10m above ground.

Zgrada realne gimnazije u Zagrebu na Griču za vrijeme uspostavljanja meteorološke postaje 1861. godine.
Building of the high school at Grič in Zagreb in time when meteorological station was established i.e. 1861.

METEOROLOŠKO MOTRENJE je standardizirani postupak za dobivanje meteoroloških podataka mjerenjem pomoću instrumenata i vizualnim opažanjem.

METEOROLOŠKE POSTAJE su mjesta na kojima se obavljaju meteorološka motrenja, a dijele se na: glavne (sinoptičke), obične (klimatološke) i kišomjerne.
Na glavnim meteorološkim postajama motrenja se obavljaju svaki sat vremena po svjetskom vremenu, na klimatološkim postajama u 7, 14 i 21 sat po lokalnom vremenu te na kišomjernim u 7 sati ujutro po srednjoeuropskom vremenu.

Podatke meteoroloških opažanja i mjerenja meteorološke postaje dostavljaju Državnom hidrometeorološkom zavodu Republike Hrvatske.

METEOROLOGICAL OBSERVATION is standardised procedure for obtaining meteorological data by means of instrumental measurement and visual observation.

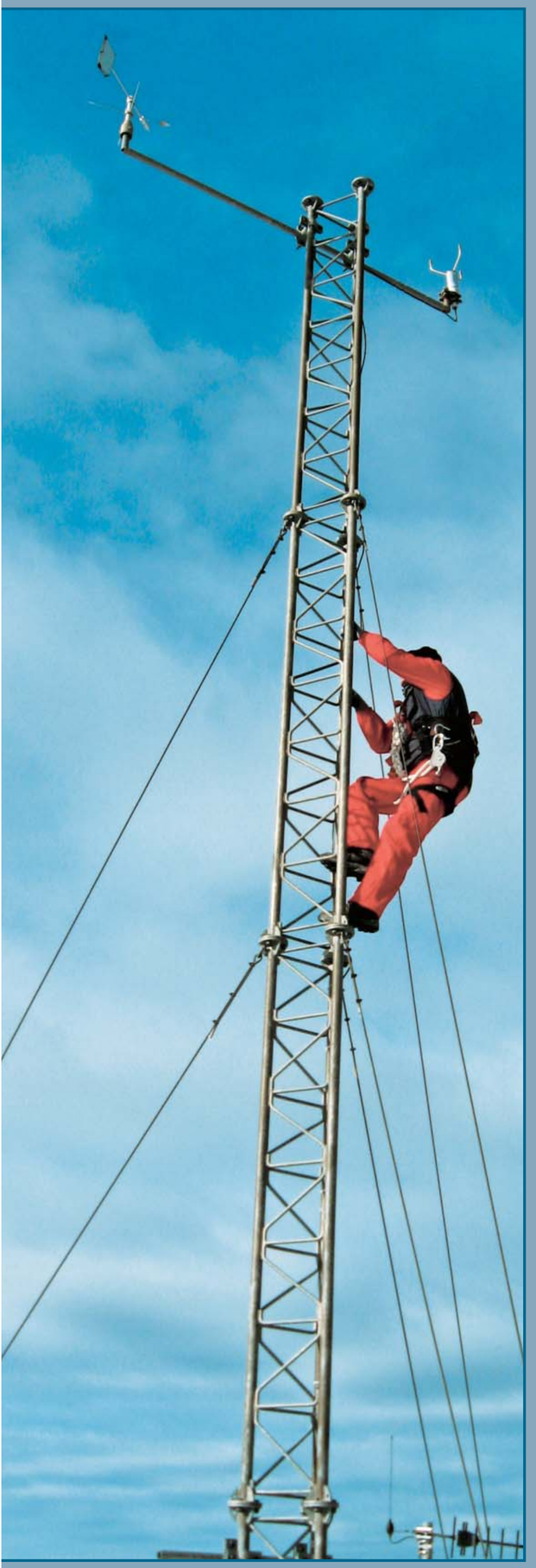
METEOROLOGICAL STATIONS are locations where meteorological observations are made. There are main (synoptic), climatological and rainfall meteorological stations.
Meteorological observations are made every hour at main meteorological stations according to universal time, at 7, 14 and 21 o'clock local time at climatological and at 7 o'clock of Central European Time.

Observational data are collected in *Meteorological and Hydrological Service* of the Republic of Croatia.

Raspored instrumenata u meteorološkoj kućici:
1 - suhi i mokri termometar
2 - minimalni i maksimalni termometar
3 - termograf
4 - higrograf
5 - aspirator
Order of instruments in a meteorological screen:
1 – dry and wet thermometer
2 – minimum and maximum thermometer
3 – thermograph
4 – hygrograph
5 – aspirator

JESTE LI ZNALI?
U Hrvatskoj prva službena motrenja počinju u Dubrovniku 1851. godine, a najdulji niz meteoroloških podataka u Hrvatskoj raspoloživ je za Zagreb-Grič – od 1861. godine do danas, bez prekida.

DID YOU KNOW?
First official meteorological observations in Croatia started in Dubrovnik in 1851, while the longest time series of weather data exists for Zagreb-Grič i.e. since 1861 up to now.



Održavanje mjerne spremnosti vjetrokaza i anemometra.
Maintenance of wind vane and anemometer.

VELIČINE STANJA ATMOSFERE
QUANTITIES OF ATMOSPHERIC STATE

Anemometar – instrument za mjerenje brzine vjetra.
Anemometer – instrument for measuring wind speed.

JESTE LI ZNALI?
Buys-Ballotovo pravilo: "Ako je promatrač okrenut tako da mu vjetar puše u leđa, onda mu se niži tlak zraka nalazi naprijed s lijeva, a viši otraga s desna".

DID YOU KNOW?
Buys-Ballot's rule: "If the wind blows into the observer's back, then lower pressure is in front of him on his left side, while high pressure is behind him on his right side".

VELIČINE (VARIJABLE) STANJA ATMOSFERE su meteorološki elementi koji se određuju pomoću instrumenata, kao što su na primjer tlak ili temperatura zraka.

TEMPERATURA ZRAKA (°C) je ona temperatura koju pokazuje termometar izložen u zraku na visini od 1 do 2 m iznad tla i zaklonjen od izravna Sunčeva ozračenja.

RELATIVNA VLAŽNOST ZRAKA (%) označava omjer stvarne količine vodene pare u odnosu na maksimalno moguću količinu vodene pare u zraku pri određenoj temperaturi zraka.

TLAK ZRAKA ili **ATMOSFERSKI TLAK** (hPa) je sila na jediničnu površinu plohe koja potječe od neprekidnog gibanja molekula zraka.
Središta sniženog tlaka zraka nazivaju se **DEPRESIJE (CIKLONE)**, a povišenog **ANTICIKLONE**.

Kao posljedica razlike u tlaku zraka nastaje strujanje zraka koje se naziva **VJETAR**. Vjetar je određen **BRZINOM, SMJEROM I JAČINOM** to jest učincima na okoliš.

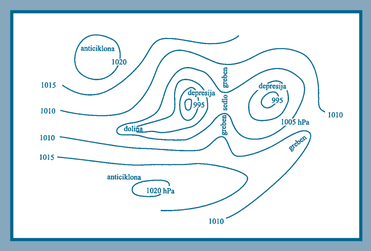
QUANTITIES (VARIABLES) OF ATMOSPHERIC STATE (e.g. air pressure and temperature) are meteorological elements determined by instruments.

AIR TEMPERATURE is the temperature shown by a thermometer exhibited in the air on a height between 1 and 2 m above ground and protected from direct sunlight.

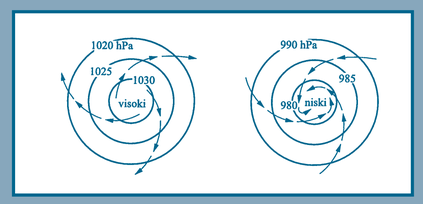
RELATIVE AIR HUMIDITY (%) indicates a percentage of possible water vapour content in the atmosphere for a given air temperature.

AIR PRESSURE or **ATMOSPHERIC PRESSURE** is a force on a surface unit which results from air molecule motion.

As a consequence of differences in air pressure a motion of air appears, which is called **WIND**. It is determined by **SPEED, DIRECTION AND STRENGTH** *(*by its effect on environment).



Primjer prikaza prostorne razdiobe tlaka zraka u horizontalnoj ravnini pomoću linija istih vrijednosti tlaka (izobara). Izobare se također prikazuju na sinoptičkim kartama.
An example of air pressure distribution on horizontal surface using isobars - lines of equal atmospheric pressure. Isobars are also drawn on synoptic maps.



Ilustracija smjera vjetra oko središta visokog tlaka zraka to jest u anticikloni (lijevo) i središta niskog tlaka to jest u cikloni (desno).
Illustration of wind direction in region of high atmospheric pressure - anticyclone (left) and region of low atmospheric pressure - cyclone (right).

ATMOSFERSKE POJAVE
ATMOSPHERIC PHENOMENA

Suživot snijega na tlu i planinskog cvijeća.
Coexistence of snow on the ground and mountain flowers.

Tuča
Hail

Nakupina inja na heliografu - uređaju za registraciju osunčavanja na meteorološkoj postaji Zavižan.
Rime deposit on the instrument for sunshine registration at Zavižan weather station.

Oblačna koprena iznad Zavižana s radijalnim brazdama.
Cloudiness veil above Zavižan with radial groves.

ATMOSFERSKE POJAVE su meteorološki elementi koji se najčešće određuju vizualnim opažanjem.

OBLAK je dio prostora u atmosferi koji je neproziran ili poluproziran jer sadrži brojne mikroskopski sitne kapljice ili kristaliće nastale kondenzacijom vodene pare. Oblak pri tlu je **MAGLA**.

KIŠA je oblik oborine iz oblaka u tekućem stanju.

TUČA je oblik krute oborine sastavljen od ledenih zrna, i nikada ne pada pri temperaturi zraka nižoj od 0°C.

SNIJEG je oblik oborine u čvrstom stanju koji pada pri temperaturi zraka oko ili nižoj od 0°C.

INJE je naslaga ledenih kristalića na granama drveća i predmetima.

GRMLJAVINU predstavlja svjetlost (sijevanje) i zvuk (grmljenje) prouzročeni električnim izbijanjem (pražnjenjem).

GROM predstavlja električno pražnjenje (munju) između oblaka i tla.

OLUJA ili **OLUJNO NEVRIJEME** je jako poremećeno stanje atmosfere uz olujni vjetar, prolom oblaka, tuču, grmljavinu, mećavu itd.

ATMOSPHERIC PHENOMENA are meteorological elements mostly determined by visual observation.

CLOUD is a part of the space in the atmosphere which is opaque or semi-opaque because it contains plenty of microscopic parts of rain droplets or ice crystals which are formed by water vapour condensation. **FOG** is a cloud near the ground.

RAIN is a precipitation type in liquid form.

HAIL is a precipitation type consisted of hail grains and never appears at air temperature below 0°C.

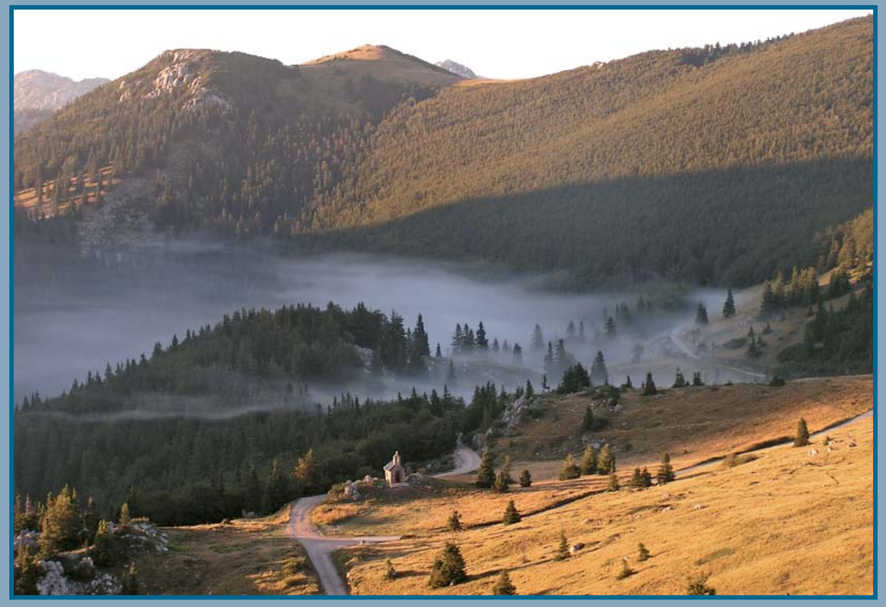
SNOW is a solid precipitation which appears at air temperature near or below 0°C.

RIME is a transparent deposit of ice crystals on tree branches and vertical objects.

THUNDERSTORM consists of light (lightening) and sound (thunder) caused by electrical discharge.

THUNDER STROKE is an electrical discharge between the cloud and the ground.

STORM is a strongly disturbed atmosphere including strong wind, strong rainfall, hail, thunderstorm, blizzard etc.

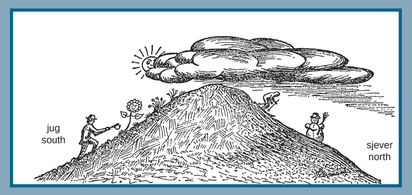


Maglica nad Zavižanskom kotlinom.
Fog in the Zavižan valley.

JESTE LI ZNALI?
Jačina električne struje u munji iznosi do 20 tisuća ampera što je za tisuću puta više od jačine struje koja napaja većinu kućanskih aparata.

DID YOU KNOW?
The strength of electrical current in a flash of lightning is thousand times higher than the strength of a current which feeds household appliances.

Meteorološka kućica okovana snijegom i injem.
Meteorological screen bound with ice and rime.



Shematski prikaz mogućih mikroklimatskih razlika uvjetovanih orijentacijom planinskih obronaka. Dok se na sjevernoj strani zadržava snijeg istovremeno na južnoj može rasti cvijeće.
Schematic representation of possible microclimatic conditions caused by orientation of the mountain slopes. While there is some snow on the northern side, at the same time a flower can grow on the southern side.

PROHLADNI ZAVIŽAN
COOL ZAVIŽAN

JESTE LI ZNALI?
Apsolutna minimalna temperatura zraka na Zavižanu izmjerena je u 1956. godine i iznosila je -28,6°C. Apsolutna maksimalna temperatura zraka iznosila je 27,6°C, a izmjerena je u srpnju 1983. godine.

DID YOU KNOW?
Absolute minimum air temperature of -28,6°C at Zavižan was measured in 1956., while an absolute maximum air temperature of 27.6°C was measured in July 1983.

TEMPERATURA ZRAKA je pokazatelj toplinskog stanja Zemljine atmosfere.
Temperatura zraka se smanjuje s visinom u prosjeku oko 0,6°C na 100 m visine. Izuzetak čine situacije kad je temperatura zraka konstantna s visinom, što predstavlja **IZOTERMIJU**, ili kad raste s visinom, što predstavlja **INVERZIJU** ili **OBRAT**.

Pored temperature zraka na **OSJET UGODE** utječe jačina vjetra kao i vlažnost zraka. Ako je relativna vlažnost zraka visoka, uz visoku temperaturu nastaje **SPARINA**.

Općenito, klima je ugodnija na obroncima planina okrenutim prema jugu, nego na onima okrenutim prema sjeveru.
Orijentacija planinskih obronaka također u izvjesnoj mjeri određuje i razlike u tipu vegetacije.

LEDENI DANI su dani s minimalnom temperaturom zraka nižom od -10°C. **STUDENI DANI** su oni u kojima najviša temperatura zraka ne prelazi 0°C, a **HLADNI DANI** oni u kojima najniža dnevna temperatura zraka ne prelazi 0°C.

Za **TOPLIH DANA** maksimalna temperatura zraka prelazi 25°C, a **VRUĆI DANI** su oni s maksimalnom temperaturom višom od 30°C.

NAJHLADNIJI mjesec na Zavižanu je **VELJAČA** čiji je višegodišnji srednjak mjesečne temperature zraka -4,3°C. Ledenih dana na Zavižanu u prosjeku ima 29 godišnje, a studenih je 73.

NAJTOPLIJI mjesec u godini je **SRPANJ** čija je srednja mjesečna temperatura 12,2°C. Toplih je dana na Zavižanu u prosjeku samo 6 godišnje, a nikad nije zabilježen ni jedan vrući dan.

AIR TEMPERATURE is an indicator of thermal state of the Earth's atmosphere.
Air temperature decreases with height on average about 0.6°C per hundred meters. Exception is **ISOTHERMY**, which occurs when air temperature is constant with the height and **INVERSION**, which occurs when air temperature increases with height.

COMFORT INDEX depends on both wind force and air humidity in addition to air temperature. When both relative humidity and air temperature are high, **SULTRINESS** occurs.

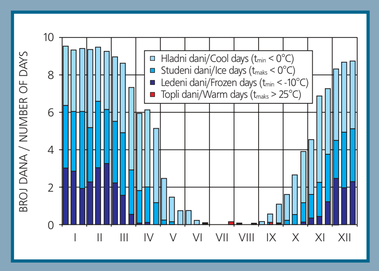
In general, climate is milder on the slopes which are oriented toward the south than those oriented toward the north.
Orientation of the mountain slopes also determines the type of vegetation to some extent.

FROZEN DAYS are those with minimum air temperature less than -10°C. **ICE DAYS** are indicated as days during which air temperature is not higher than 0°C, while **COOL DAYS** are those days with minimum air temperature not higher than 0°C.

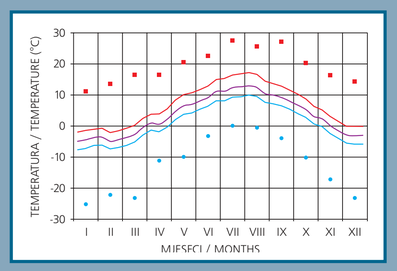
During **WARM DAYS** maximum air temperature is higher than 25°C, and **HOT DAYS** are those with maximum air temperature higher than 30°C.

THE COLDEST MONTH at Zavižan is **FEBRUARY** with a multiannual monthly average temperature of -4.3°C. There are on average 29 frozen days, and 73 ice days per year.

The **WARMEST** month of the year on average is **JULY** with an average temperature of 12.2°C. There are on average only six warm days per year at Zavižan, and a hot day has never been recorded.

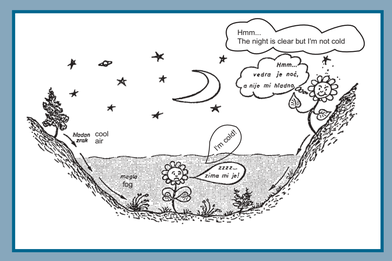


Godišnji hod broja dana s različitim temperaturnim rasponima za Zavižan za razdoblje 1961-1990.
Annual course of the days with different air temperature ranges for Zavižan for the period 1961-1990.



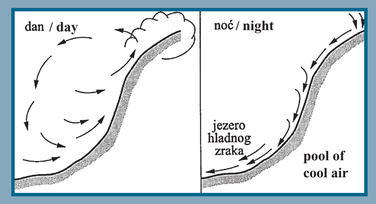
Srednje, srednje minimalne i maksimalne temperature zraka te apsolutna minimalna i maksimalna mjesečna temperatura zraka za Zavižan za razdoblje 1961-1990.
Average, average minimum and average maximum air temperature including absolute minimum and maximum monthly air temperature for Zavižan for the period between 1961 and 1990.

Ilustracija noćnog hlađenja u udolini za vrijeme vedre noći kad nastaje inverzija (obrat) s obzirom na temperaturu zraka.
Illustration of night time cooling in a valley when the air temperature inversion appears.



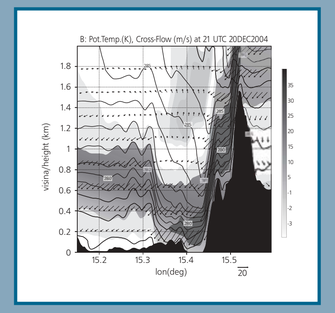
GOROPADNI VJETAR – TEORIJA
FORCEFUL WIND – THEORY

Bura razbija valove o strme obale otoka Raba - pogled sa Zavižana.
The Bora wind breaks waves against the steep coast of the Rab island. – view from Zavizan



Shematski prikaz cirkulacije zraka iznad obronka terena - vjetar obronka.
Schematic representation of air circulation above terrain slope.

Razdioba vektora vjetra za vrijeme bure na zamišljenom vertikalnom presjeku preko Velebita za 20. prosinca 2004. godine dobivena numeričkim atmosferskim modelom.
Distribution of wind vectors during Bora on an imaginary vertical cross-section of the Velebit mountain for 20 December 2004, obtained by a numerical atmospheric model.



Zbog dnevnog zagrijavanja ili noćnog hlađenja obronka planine razvija se **VJETAR OBRONKA** koji danju puše uz obronak, a noću niz obronak.

Zbog nedostatka mjerenja vjetra osobito na planinama, teorijske procjene vjetra na takvim područjima dobivaju se pomoću atmosferskih modela čiji se proračuni izvode na posebno jakim računalima.

Mjerenja vjetra su početni podaci za rješavanje pripadnih jednadžbi gibanja i jednadžbi termodinamike Zemljine atmosfere.

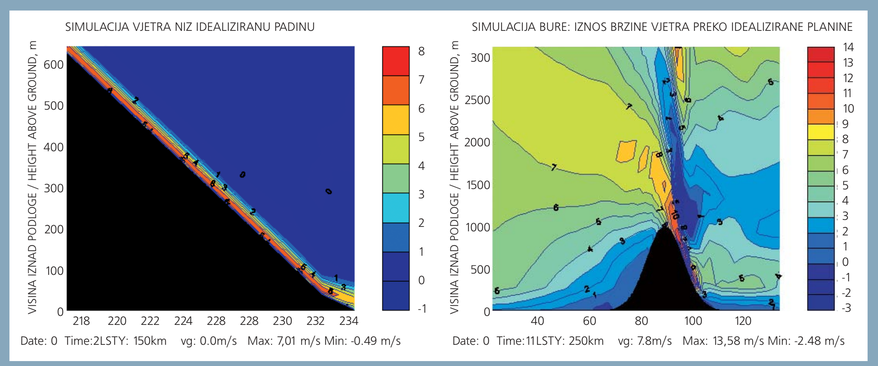
MLAZNA STRUJA je relativno usko područje jakog vjetra duž horizontalne osi u višoj troposferi, oko 10 km visine iznad tla. Brzina vjetra u mlaznoj struji je veća od 30 m/s (preko 100 km/sat), a zbog nagle promjene brzine vjetra pojavljuje se **TURBULENCIJA** koja utječe na zračnu plovidbu.

Due to the daytime heating and the nighttime cooling of the mountain slopes, the **SLOPE WIND** develops. It is the wind that blows up the slope during the day and down the slope during the night.

Because of the lack of wind observation, particularly in mountainous regions, theoretical estimation of wind over such areas has been performed by means of atmospheric models which are run by exceptionally strong computers.

Wind observations are the initial data for solving the corresponding equations of motion and thermodynamics of the Earth atmosphere.

JET STREAM is a relatively narrow zone of strong wind along the horizontal axes in the upper troposphere – about 10 km above ground. Wind speed is higher than 30 m/s (more than 100 km/hour), and because a sudden change in wind speed, **TURBULENCE** appears, which can influence air transportation.



Ilustracija idealizirane teorijske procjene jačine bure s pogledom na sliku približno od smjera sjevera k jugu. Iznos brzine vjetra je prikazan legendom na desnoj strani. Osnovno strujanje ide s lijeva u desno, približno od istoka k zapadu. Donja horizontalna os je udaljenost u km. Idealizirani teren je prikazan crno.
Illustration of idealised theoretical estimation of Bora wind speed with a view on the figure approximately from north to south. Wind speed is indicated by a legend on the right side. The basic flow is from the left to the right i.e. from east to west. Lower horizontal axis indicates distance in kilometres. Idealised terrain is shown in black.

Ilustracija idealizirane teorijske procjene silaznog vjetra niz obronak (donji lijevi crni dio) u početno mirnoj atmosferi (uglavnom plavi dio). Iznos brzine silaznog vjetra je prikazan bojom (desno, ms^{-1}). Pogled na sliku je približno u smjeru sjevera. Ovaj vjetar uzrokuje relativno jače hlađenje podloge (obronka) od hlađenja okolne atmosfere. Donja horizontalna os je udaljenost u km. Prikazana procjena može se na određeni način primjeniti na "istočnu" stranu Velebita za vedra i razmjerno tiha vremena na širem području.
Illustration of the idealised theoretical estimate of the downslope wind (black part on the bottom left) in the initially stable and calm atmosphere (mostly in blue). The speed of the downslope wind is illustrated in color on the right (ms^{-1}). The view of the picture is approximately towards north. This wind causes relatively stronger cooling of the terrain (the slope) than of the surrounding atmosphere. The lower horizontal axis represents the distance in kilometres. This airflow can be representative for the eastern side of Velebit during cloudless and generally calm conditions over the area.

JESTE LI ZNALI?

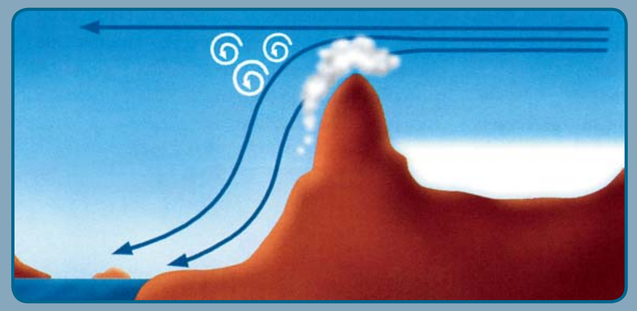
O smjeru vjetra izvješćuju nas vjetrokazi. Neki su od njih postali pravim umjetničkim djelima, poput poznatog zadarskog anđela ili rovinjske Sv. Eufemije. Od antičkih je spomenika arhitekture sačuvana osmokutna Kula vjetrova u Ateni. Sagradio ju je Androkinos u 1. st. pr. Kr. Njezine bokove ukrašavaju kipovi koji prikazuju vjetrove. Na vrhu je kule bio pokretan kip čovjeka koji je pokazivao smjer vjetra.

DID YOU KNOW?

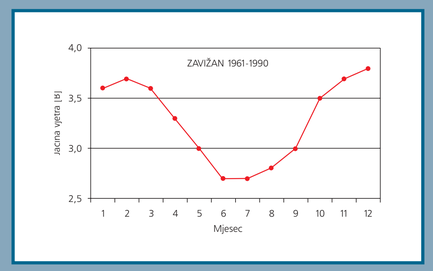
Wind vanes give information on wind direction. Some of them have become true works of art, e.g. the famous angel in Zadar or St. Eufemia in Rovinj. Among the ancient monuments of architecture the octagonal tower of winds in Athens has been preserved. It was built by Androkinos in the first century B.C. Its sides are ornamented by sculptures which indicate wind directions. A moveable man-like sculpture was installed at the top to show the wind direction.

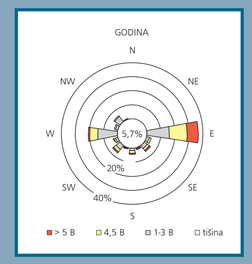
BURNI ZAVIŽAN
WINDY ZAVIŽAN

Vijavica na Zavižanu. Blizzard at Zavižan.



Shema općeg mehanizma nastanka bure ilustrirana na zamišljenom vertikalnom poprečnom presjeku Velebita.
Scheme of the general mechanism for Bora wind generation on imaginary vertical cross-section of the Velebit mountain.





Godišnji hod jačine vjetra na Zavižanu.
Annual course of wind force for Zavižan.

Ruža vjetra za Zavižan. Ruža vjetra je grafički prikaz učešća pojedinih smjerova vjetra i prosječnih ili maksimalnih brzina vjetra u tim smjerovima.
Wind rose for Zavižan. Wind rose is graphic representation of wind directon frequencies, and average or maximum wind speeds for a certan wind direction.

Vjetar na Zavižanu ovisi o razdiobi tlaka zraka na širem prostoru, pod utjecajem je Jadranskog mora i kopnenog zaleđa, doba dana i godine te drugih faktora.

Zbog smanjenja trenja s porastom visine, jačina vjetra s visinom raste pa je vjetar na Zavižanu u višegodišnjem prosjeku jači nego u nizinama.

Izuzetak je **BURA** - vjetar koji je približno okomit na obalu sjevernog Jadrana. Jačina bure dodatno se pojačava zbog toplinskih razlika između razmjerno toplog mora i hladnijeg kopna, osobito zimi.

Posebno je poznata **SENJSKA BURA** koja se "obrušava" s prijevoja Vratnik kroz Senjsku dragu prema Senju.

Bura na Zavižanu puše iz smjera istoka, jer je njezin smjer modificiran položajem postaje pod vrhom Vučjak.

Wind at Zavižan depends on air pressure distribution on a regional scale, under the influence of the Adriatic Sea and continental hinterland, time of day, season and other factors.

Because of friction decreasing with height, force of the wind increases with height, thus wind is stronger at Zavižan, in a multiannual average, than in lowland.

An exception is a wind called **BORA**, which blows approximately perpendicular to the coastal line of the Northern Adriatic. Intensity of bora increases further because of the difference in thermal conditions between relatively warm sea and colder hinterland, especially during the winter time.

The **BORA OF SENJ TOWN** is especially famous, diving from Vratnik saddle across the valley of Senj towards the town of Senj.

At Zavižan bora blows from the east, because its direction is somewhat modified by the position of meteorological station beneath the Vučjak peak.

Specifičan položaj Senja u odnosu na okolnu topografiju utječe na povećanu čestinu i jačinu bure.
A specific location of the town Senj in reference to surrounding terrain causes higher frequency and force of Bora.

Prizemna sinoptička situacija sa zimskom burom od 8. prosinca 2001. u 00 UTC. Uobičajena razdioba tlaka zraka na širem području Europe: snažna anticiklona nad europskim kopnom (V) i oslabljena ciklona u istočnom Sredozemlju (N).
Surface synoptic situation during winter Bora wind on 8 December 2001 at 00 UTC (Universal Time Coordinated). Usual air pressure distribution on a wider Europe area: Strong anticyclone over the European continent (V) and weakened cyclone in the Eastern Mediterranean Sea (N).

JESTE LI ZNALI?
Na Zavižanu u prosjeku ima čak 85 dana godišnje s jakim vjetrom te 17 dana s olujnim vjetrom, a najčešći su u prosincu. Najviše dana s jakim (146) i olujnim (42) vjetrom zabilježeno je 1973. godine.

DID YOU KNOW?
At Zavižan there are on average as many as 85 days per year with strong wind and 17 days per year with stormy wind. They are the most frequent in December. Highest number of days with strong (146) and stormy wind (42) was recorded in 1973.

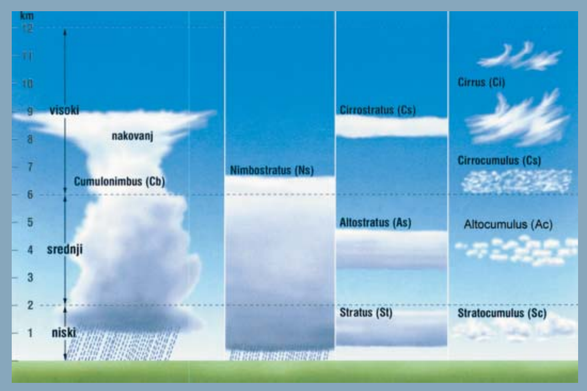
OBLACI BIJELI I MRKI
WHITE AND DARK CLOUDS

Razlikuje se deset rodova oblaka, a dijele se na visoke (iz kojih ne pada oborina), srednje i niske oblake.

VISOKI OBLACI:
- **Cirrus** (Ci) je visoki, vlaknast oblak u obliku bijelih niti koji ne baca sjenu na predmetima na tlu.
- **Cirrocumulus** (Cc) je skupina visokih oblačića sličnih sitnim bijelim grudicama pod nazivom male ovčice.
- **Cirrostratus** (Cs) je bjelkasta oblačna koprena koja izaziva pojavu halo – "dugu" u obliku kruga oko Sunca ili Mjeseca.

SREDNJI OBLACI:
- **Altocumulus** (Ac) je bezoborinski oblak sa skupinama nepravilnih oblačića pod nazivom velike ovčice.
- **Altostratus** (As) je jednoličan sloj sivkaste boje kroz koji se nazire položaj Sunca kao kroz mliječno staklo.
- **Nimbostratus** (Ns) je tipičan oborinski oblak srednje visine i neproziran za Sunce.

NISKI OBLACI:
- **Stratocumulus** (Sc) ima veće oblačne elemente od Altocumulusa i na nižoj visini od njega te obično ne daje oborinu.
- **Stratus** (St) je niski slojasti oblak koji može zaklanjati vrhove nebodera u urbanim područjima.
- **Cumulus** (Cu) je najljepši oblak u obliku tornjeva ili kupola. Zovu se oblaci lijepog vremena. Nastaju zbog vertikalnih uzlaznih struja te mogu prerasti u Cumulonimbuse.
- **Cumulonimbus** (Cb) je tipični grmljavinski oblak koji se može protezati od 1 do 15 km visine iznad tla.



Shematski prikaz rodova oblaka na vertikalnom atmosferskom presjeku.
Vertical distribution of cloud genera in the atmosphere.

Ten cloud genera can be distinguished and further divided into three classes – high clouds (bearing no precipitation), middle and low clouds.

HIGH CLOUDS:
- **Cirrus** (Ci) is a high, fibrous cloud in the form white threads which make a shadow on the object on the ground.
- **Cirrocumulus** (Cc) is a gathering of high small clouds like small white lumps known as *small sheep.*
- **Cirrostratus** (Cs) is a whitish cloudy veil which produces *halo* phenomenon – "rainbow" in form of a circle around Sun or Moon.

MIDDLE CLOUDS:
- **Altocumulus** (Ac) is a cloud producing no precipitation composed of gathering of irregular small clouds known as *great sheep.*
- **Altostratus** (As) is a uniform layer of gray colour through which the Sun position is visible like through a milky glass.
- **Nimbostratus** (Ns) is a typical precipitation cloud of middle height which obliterates the sunlight.

LOW CLOUDS:
- **Stratocumulus** (Sc) is a cloud with bigger cloud elements formed at a lower elevation than Altocumulus, and usually produces no precipitation.
- **Stratus** (St) is a low cloud which can cover tops of towers in urban areas.
- **Cumulus** (Cu) is the nicest cloud in a form of a tower or a dome. Cumuli are often referred to as the "nice weather clouds". They are the product of convective updrafts and can grow into cumulonimbi.
- **Cumulonimbus** (Cb) is a typical thunderstorm cloud whose altitude can range from 1 to 15 km above ground.

ZAVIŽAN – IZMEĐU OBLAKA I SUNCA
ZAVIŽAN – BETWEEN THE CLOUDS AND THE SUN

Zavižan u predvorju Cumulonimbusa - očekuje se nevrijeme.
Cumulonimbus over Zavižan – thunderstorm is expected.

NAOBLAKA se procjenjuje prema stupnju pokrivenosti neba oblacima. Mjeri se u desetinama pri čemu naoblaka 1 označava da je 1/10 neba pokrivena oblacima, a naoblaka 10 da je nebo potpuno pokriveno oblacima.

VEDRI DANI su oni dani u kojima je srednja dnevna naoblaka manja od 2 desetine, a **OBLAČNI** su oni dani u kojima je srednja dnevna naoblaka veća od 8 desetina.

U dijelu godine kada je naoblaka najviša, najmanji je broj sati sa sijanjem Sunca koje nazivamo **OSUNČAVANJE.** Dakle, najveći broj Sunčanih sati je tijekom ljeta i jeseni, a najmanji u proljeće i zimi.

Vedri dani se pojavljuju na Zavižanu u prosjeku 59 puta u godini dok je oblačnih dana u prosjeku 139. Najveći broj vedrih dana Zavižan ima tijekom ljeta i jeseni, a oblačnih tijekom zime i proljeća.

CLOUDINESS is estimated according to the ratio of the sky covered by clouds. It is measured in tenths - cloudiness of 1 indicates that 1/10 of the sky is covered by clouds and cloudiness of 10 means that the sky is fully covered by clouds.

CLEAR DAYS are those days during which a daily average cloudiness is less than 2 tenths while **CLOUDY DAYS** are those days during which a daily average cloudiness is higher than 8 tenths.

Clear days appear at Zavižan on average 59 times per year while the number of cloudy days on average is 139. The highest number of clear days appears during summer and autumn. Cloudy days are more frequent during spring and winter.

Heliograf - instrument za mjerenje trajanja sijanja Sunca.
Heliograph - an instrument for measuring the number of hours of sunshine during the day.

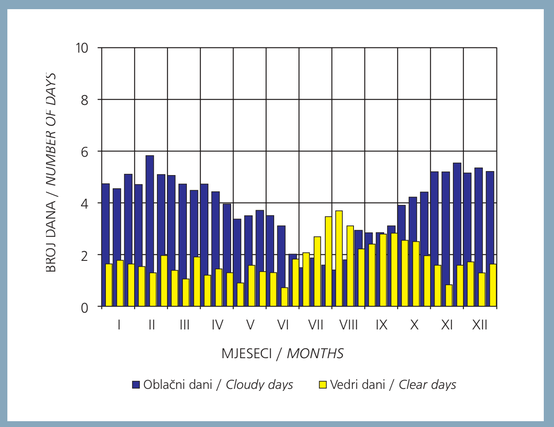
Oblak u obliku leće (Altocumulus lenticularis) iznad Velike kose.
A cloud in the form of a lens (Altocumulus lenticularis) above Zavižan.

JESTE LI ZNALI?
Katkad tijekom jednog mjeseca može biti i 20 vedrih te 25 oblačnih dana. Najdulje vedro razdoblje trajalo je 9 dana dok je najdulje oblačno razdoblje trajalo 15 dana.

DID YOU KNOW?
Sometimes, within a month, more than 20 clear days or more than 25 cloudy days can appear. The longest clear period lasted for 9 days while the longest cloudy period lasted for 15 days.

Godišnji hod broja vedrih i oblačnih dana po dekadama za Zavižan za razdoblje 1961-1990.

Annual course of the number of clear and cloudy days by decades for Zavižan in the period between 1961 and 1990.



METEOROLOŠKO "GNIJEZDO" PODNO VUČJAKA
METEOROLOGICAL "NEST" BELOW VUČJAK

Raspored meteoroloških instrumenata na klimatološkoj postaji Zavižan u razdoblju od 1953. do 1962. godine.
The order of meteorological instruments at climatological station of Zavižan during period 1953-1962.

Božidar Kirigin – osnivač glavne meteorološke postaje Zavižan.
Božidar Kirigin – the founder of Zavižan main meteorological station.

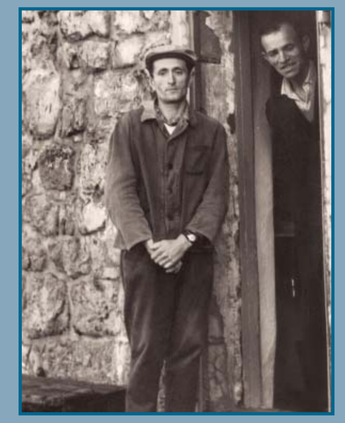
Suvremena meteorološka postaja Zavižan početkom svibnja 2007. godine.
Contemporary meteorological station of Zavižan, May 2007.

Službeni početak rada klimatološke postaje Zavižan s profesionalnim motriteljem je **1. LISTOPAD 1953. GODINE** na području starog planinarskog doma pod nazivom "Krajačeva kuća". Od 1. rujna 1964. godine Zavižan prerasta u **GLAVNU METEOROLOŠKU POSTAJU** u blizini obnovljenog planinarskog doma.

Postaja se nalazi neposredno ispod velebitskog vrha Vučjak, na visini od 1594 mnv. Osim standardnih meteoroloških parametara na postaji Zavižan obavljaju se i specijalna motrenja kemijskog sastava atmosfere i oborine koja služe za praćenje daljinskog prijenosa atmosferskih onečišćivača.

An official establishment of climatological station of Zavižan with a professional observer was on **1 OCTOBER 1953** in the area of mountain house known as "The House of Krajač".
On 1 September 1964 Zavižan became the **MAIN METEOROLOGICAL STATION** close to the renewed mountain house.

The station is located at the altitude of 1594 m. a. s. l., below the top of the Vučjak in the vicinity of Zavižan mountain house. In addition to the conventional meteorological observations, a set of special observations are made at Zavižan meteorological station, like chemistry of atmosphere and precipitation observations, which are used for monitoring of long-range atmospheric pollution.



Prvi motritelji Nikola Miškulin i Dražen Vukušić 5. srpnja 1962. godine.
The first observers – Nikola Miškulin and Dražen Vukušić, 5 July 1962.

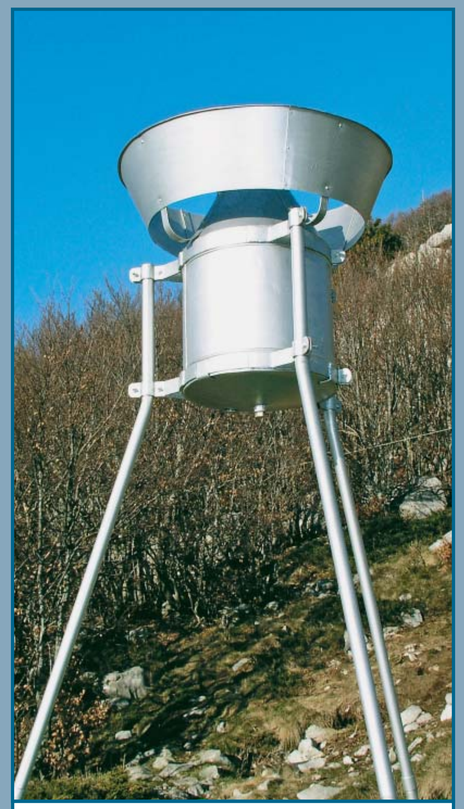
JESTE LI ZNALI?
Na meteorološkoj postaji Zavižan dosad je radilo ukupno 16 motritelja. Prvi je bio Nikola Miškulin, a najpoznatiji su svakako članovi obitelji Vukušić iz Gornje Klade koji ovaj posao obavljaju kroz tri generacije, već gotovo pola stoljeća, i dali su ukupno sedam motritelja.

DID YOU KNOW?
So far, there have been 16 meteorological observers at the Zavižan meteorological station. The first was Nikola Miškulin, but the most famous are the members of the Vukušić family from Gornja Klada village. They have been doing this job for almost half a century, through three generations and have yielded altogether seven observers.

Krajačeva kuća iz 1937. godine.
The House of Krajač from 1937.

Štefanija Vukušić – jedina motriteljica na meteorološkoj postaji Zavižan.
Štefanija Vukušić – the only woman observer at Zavižan meteorological station.

Novosagrađeni meteorološki krug iz 1964. godine uz obnovljeni planinarski dom Zavižan.
The rebuilt meteorological station from 1964 beside the renewed Zavižan mountain house.



Totalizator - „kišomjer“ koji sakuplja oborinu tijekom jedne godine, a prazni se tijekom jeseni.
Totalizer – a rain gauge that collects precipitation during one year period and is emptied in autumn.

OBORINSKI LABORATORIJ
PRECIPITATION LABORATORY

Mjerenje količine oborine u planinskim područjima je otežano zbog povećane čestine krutih oborina i jakog vjetra. Kako bi se utvrdile pogreške pri mjerenju, Državni hidrometeorološki zavod je na Zavižanu postavio različite **KIŠOMJERE:** standardni kišomjer tipa Hellman sa ili bez mrežice za oborinu od magle, brdski kišomjer sa ili bez obruča, totalizator itd.

Isparavanje vode s vodene površine mjeri se ispariteljem. **ISPARITELJ** je obična metalna posuda promjera oko 1 metar u kojoj se dva puta dnevno mjeri promjena razine i temperature vode.

Dio oborinske vode koju ne upije tlo i koja ne ispari otječe niz obronak.
Srednja godišnja količina oborine na Zavižanu izmjerena standardnim kišomjerom je 1919 mm dok je standardnim kišomjerom s mrežicom za sakupljanje oborine od magle izmjereno čak 3960 mm.

Najviša prosječna količina oborine je u studenom (223 mm), a najmanja u srpnju (96 mm).

Najviše vode prosječno ispari tijekom srpnja (96 mm), a najmanje u veljači (15 mm) dok niz planinu prosječno najviše vode otječe u studenom (193 mm), a najmanje u srpnju (26 mm).

U prosjeku se mjerljiva količina oborine (barem 0,1 mm) pojavljuje 165 dana godišnje. Najmanji broj oborinskih dana prosječno je u srpnju (10), a najviši u prosincu (16).

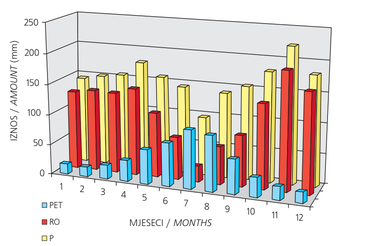
Measuring the amount of precipitation in mountainous regions is difficult because of frequent solid precipitation and strong wind. To estimate errors in the measurement, Meteorological and Hydrological Service has installed different **RAIN GAUGES** at Zavižan: a standard rain gauge of Hellman's type with or without the net for measurement of fog precipitation, mountain rain gauge with or without ring, totalizers etc.

EVAPORIMETER is an instrument that measures the rate of evaporation of water from a free water surface into the atmosphere. It is a plain metal tank, 1m in diameter, in which the water level and water temperature are measured twice a day.

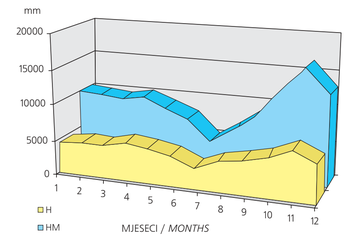
The part of precipitation that is not absorbed into the soil or evaporated into the atmosphere runs off down the slope.

Average annual precipitation amount at Zavižan measured by standard rain gauge is 1919 mm, while the amount of 3960 mm has been measured by the same rain gauge with the net for fog precipitation collection. The highest average monthly precipitation amount is measured in November (223 mm) and the smallest in July (96 mm).

The largest amount of water evaporates during July (96 mm) and the smallest in February (15 mm), while, on average, the largest amount of water runoff is during November (193 mm) and the smallest during July (26 mm).



Srednji godišnji hod komponenata vodne ravnoteže za razdoblje 1961-1990: P - oborina, PET - potencijalna evapotranspiracija i RO - otjecanje.
Average annual course of water balance components for the period 1961-1990: P - precipitation amount, PET - potential evapotranspiration and RO - runoff.



Usporedba ukupne količine oborine po mjesecima za razdoblje 1962-1991. godine izmjerene s dva različita kišomjera: standardnog Hellman bez mrežice za skupljanje oborine od magle (H) i s mrežicom (HM).
A comparison of total precipitation amounts per month for the period 1962 – 1991 measured by two different rain gauges: standard Hellman's without the net for fog collection (H) and with the net (HM).

Isparitelj klase A.
Evaporimeter.

Različiti kišomjeri na meteorološkoj postaji Zavižan.
Different rain gauges at Zavižan meteorological station.

Skupljači oborine od magle postavljeni na Zavižanu nedaleko od meteorološke postaje.
Fog precipitation collectors installed at Zavižan meteorological station.

JESTE LI ZNALI?
Uz povoljne uvjete od magle bi se uz pomoć dva skupljača (mrežice) površine 48 metara četvornih tijekom samo jednog dana moglo skupiti 10 tisuća litara vode.

DID YOU KNOW?
During favourable conditions, collectors for fog precipitation with a 48 square metre net can collect 10 thousand litres of water during one day only.

SNIJEG U GORI "ZELENOJ"
SNOW IN "GREEN" MOUNTAIN

Planinarski dom pod Vučjakom zimi. Zavižan mountain house during winter.

Vrata planinarskog doma zatrpana snijegom, početak ožujka 2006.
Entrance to Zavižan mountain house blocked by the snow, beginning of March, 2006.

Snijeg na Zavižanu 31. svibnja 2006. godine.
Snow at Zavižan on 31 May 2006.

S porastom nadmorske visine povećava se vjerojatnost zadržavanja snježnog pokrivača na obje strane Velebita. Zbog pojačanog vjetra se često stvaraju **ZAPUSI** pa je u tim uvjetima teško odrediti visinu snježnog pokrivača.

Zavižan je jedina meteorološka postaja u Hrvatskoj na kojoj je snježni pokrivač zabilježen **TIJEKOM SVIH MJESECI**.

Snježni pokrivač (snijeg na tlu barem 1 cm) može se očekivati od početka listopada do kraja svibnja.

Snježni pokrivač od oko 20 cm visine tijekom listopada i prve polovice studenog raste do oko 60 cm do kraja prosinca. Krajem siječnja doseže oko 100 cm, u veljači 130 cm, dok tijekom ožujka srednja visina snijega varira oko te vrijednosti. U travnju se snijeg topi razmjerno brzo i smanjuje na oko 80 cm da bi se tijekom svibnja u prosjeku smanjio na oko 50 cm te sredinom lipnja iščeznuo.

Visina snijega na Zavižanu je vrlo rijetko veća od 250 cm.

With the increase of elevation the probability for steadiness of snow cover increases on both sides of Velebit. Because of strong wind **SNOWDRIFTS** are often created, therefore the measurement of snow height is difficult.

Zavižan is the only meteorological station in Croatia at which snow cover has been registered **IN EACH MONTH**, including July, which is on average the warmest month of the year.

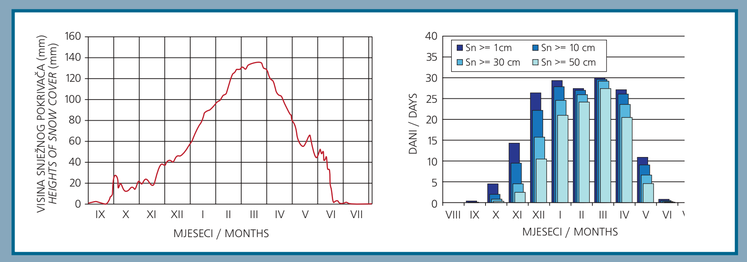
Snow cover (the snow on the ground of least 1 cm in height) can be expected from mid-October to mid-May.

Snow cover of about 20 cm during October and the beginning of November increases up to 60 cm by the end of December. At the end of January it reaches a height of 100 cm, in February 130 cm, while in March it varies around that value. During April snow melts relatively fast and its height decreases to about 80 cm becoming about 50 cm high in May and finally disappearing during June.

Snow height at Zavižan is very rarely higher than 250 cm.

JESTE LI ZNALI?
"U ožujku 1984. godine izmjerena je visina snijega od 3 m. Iste je godine ispod sedla Križića neslužbeno izmjeren snježni nanos visine 15 m. Nanos je izmjeren prema biljegu napravljenom na bukvi čija je visina određena kada se snijeg otopio." - izjavio je Dražen Vukušić, dugogodišnji motritelj na Zavižanu.

DID YOU KNOW?
"In March 1984 the height of snow was 3 m. In the same year, bellow the saddle of Križić the height of snowdrift of 15 m was observed unofficially. The snowdrift height was observed using a mark on a beech tree whose height was measured after snow melting."- said *Dražen Vukušić*, a long standing observer at Zavižan.



Srednji godišnji hod petodnevnih visina snježnog pokrivača za Zavižan za razdoblje 1961-1990.
Average annual course of five-day heights of snow cover for Zavižan (1961-1990.).

Srednji broj dana s različitim visinama snježnog pokrivača na Zavižanu za razdoblje 1961-1990.
Average numbers of days with different heights of snow cover for Zavižan (1961-1990).

Snjegomjerna letva.
Snow gauge.

Snježno nevrijeme u terminu motrenja.
Snowstorm during a meteorological observation.

"ŽESTOKE" GRMLJAVINSKE OLUJE
"FURIOUS" THUNDERSTORMS

Grmljavinska oluja je sustav strujanja zraka protegnut u visinu u kojemu su **VERTIKALNA GIBANJA ZNATNIJA OD HORIZONTALNIH**. Obično nastaje **NAD UGRIJANOM PODLOGOM**, na atmosferskoj fronti, koja predstavlja granično područje između tople i hladne zračne mase, ili pri prijelazu zraka preko planine.

Kako se zrak diže on se hladi, a toplina oslobođena kondenzacijom vodene pare dodatno potiče uzlazna gibanja. Zbog tih gibanja dolazi i do polarizacije električnog naboja što dovodi konačno do **ELEKTRIČNOG IZBIJANJA** odnosno **MUNJA** koje proizvode zvučne efekte (grmljenje) kao i svjetlosne (sijevanje).

Grmljavinske oluje na Zavižanu kao i drugdje u Hrvatskoj češće su u ljetnom nego zimskom dijelu godine.

Motritelj na Zavižanu godišnje u prosjeku zabilježi 34 dana s grmljavinom. Najviše grmljavina tijekom jednog mjeseca, čak 9, zabilježeno je u listopadu 1966. godine.

Thunderstorm is an airflow system stretched up in which **VERTICAL MOTION IS MORE SIGNIFICANT THAN THE HORIZONTAL.** It appears usually **ABOVE GROUND THAT HAS BEEN WARMED UP**, on atmospheric fronts and during air crossing a mountain.

As air is lifted up, it is its coolingand latent heat from the released condensation that stimulates uplifting motion. Because of such motion a differentiation of electrical charge appears, producing **ELECTRICAL DISCHARGE** or **LIGHTENING STROKE** with accompanying sound (thunder) and light effects (lightening).

Thunderstorms at Zavižan and other parts of Croatia are more frequent in summer than in winter.

An observer at Zavižan registers on average 34 days with thunder per year. The highest number of 9 days with thunder was observed in October 1966.

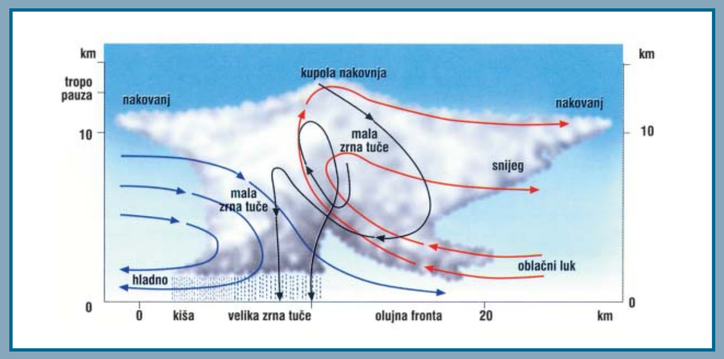
Cumulus pred oluju koji naglo raste (pupa).
A cumulus growing suddenly before a thunderstorm.

Stablo stoljetne jele nakon udara groma.
A trunk of hundred-year–old fir after a lightening stroke.

Munja.
Lightening strike.

JESTE LI ZNALI?
Uz pretpostavku da su na području olujnog oblaka prosječna uzlazna strujanja zraka 10 m/s na površini jednog četvornog kilometra, onda taj oblak u jednoj sekundi "usisa" 10 milijuna metara kubnih zraka.

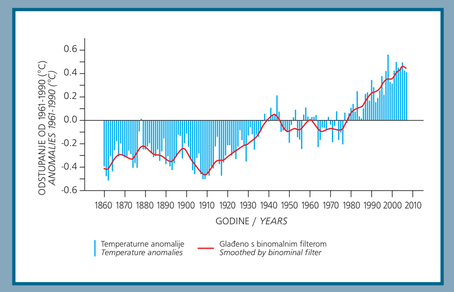
DID YOU KNOW?
With a presumption that average uplifting stream in the area of a storm cloud is 10 m/s per one square kilometre, then that cloud can "suck in" about 10 million of cubic meters of air in one second.



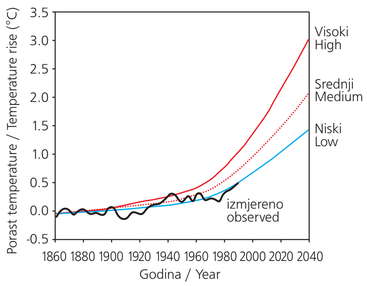
Cumulonimbus na vertikalnom presjeku. Područje uzlaznih struja su na prednjoj strani (crvene strujnice desno) i silaznih struja na stražnjoj strani Cumulonimbusa (plave strujnice lijevo).
Vertical cross-section of a cumulonimbus. The area of upward streams is ahead (red streamlines on the right) and downward streams on the back of the cumulonimbus (blue streams on the left).

PREDVIĐANJE VREMENA I KLIME
WEATHER AND CLIMATE FORECASTING

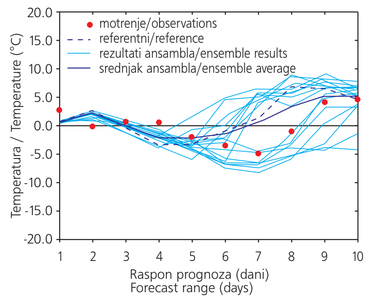
Oblak u obliku leće iznad meteorološke postaje Zavižan.
A cloud in a lens shape above Zavižan meteorological station.



Anomalije srednje globalne površinske temperature zraka u odnosu na prosjek 1961-1990.
Anomalies in the average surface global air temperature in reference to the period 1961-1990.



Scenarij globalnog zatopljenja.
A global warming scenario.



Primjer perjanice ansambl prognoze temperature zraka za 10-dnevno razdoblje.
A plume of air temperature ensemble forecast for a 10-day period.

Podaci s meteoroloških postaja dostavljaju se putem posebnih izvješća u središnje nacionalne sabirne centre odakle se nakon provjere kvalitete prosljeđuju u svjetske sabirne centre.

Nakon postupka analize meteoroloških podataka pokreću se **ATMOSFERSKI MODELI** pomoću kojih se proračunava buduće stanje atmosfere - to je **PROGNOZA VREMENA**.

Najbolje srednjoročne vremenske prognoze na svijetu, do deset dana unaprijed, proizvode se u Europskom centru za srednjoročne prognoze u Reading-u, u Velikoj Britaniji, kojega je Hrvatska član.

Detaljnije **KRATKOROČNE** prognoze vremena, do 3 dana unaprijed, dobivaju se u Državnom hidrometeorološkom zavodu Republike Hrvatske.

U posljednje vrijeme proizvode se **SKUPNE (ANSAMBL)** srednjoročne i dugoročne prognoze vremena i do 3 mjeseca unaprijed.

Praćenjem podataka o temperaturi zraka u pojedinim zemljama prati se prosječna globalna temperatura zraka na Zemlji.

The data from meteorological stations are delivered by means of special reports into national collection centres from where they are distributed into world collection centres after a quality control.

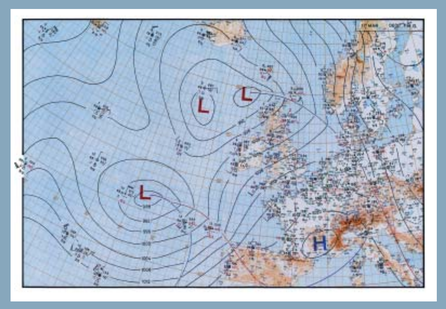
After an analysis procedure, **ATMOSPHERIC MODELS** are run, which help to estimate the future state of the atmosphere - that is a **WEATHER FORECAST**.

The best medium-range weather forecasts in the whole world, for ten days in advance, are produced in *European Centre for Medium Range Weather Forecasts* in Reading, United Kingdom, whose member is also Croatia.

More detailed **SHORT-RANGE WEATHER FORECASTS** (up to 3 days in advance) are produced in Meteorological and Hydrological Service of Republic of Croatia.

Since recently, medium and long-range weather forecasts, up to 3 months in advance, are performed – these are so-called **ENSEMBLE FORECASTS**.

Using the data from national meteorological services, a global average air temperature on Earth is being monitored.

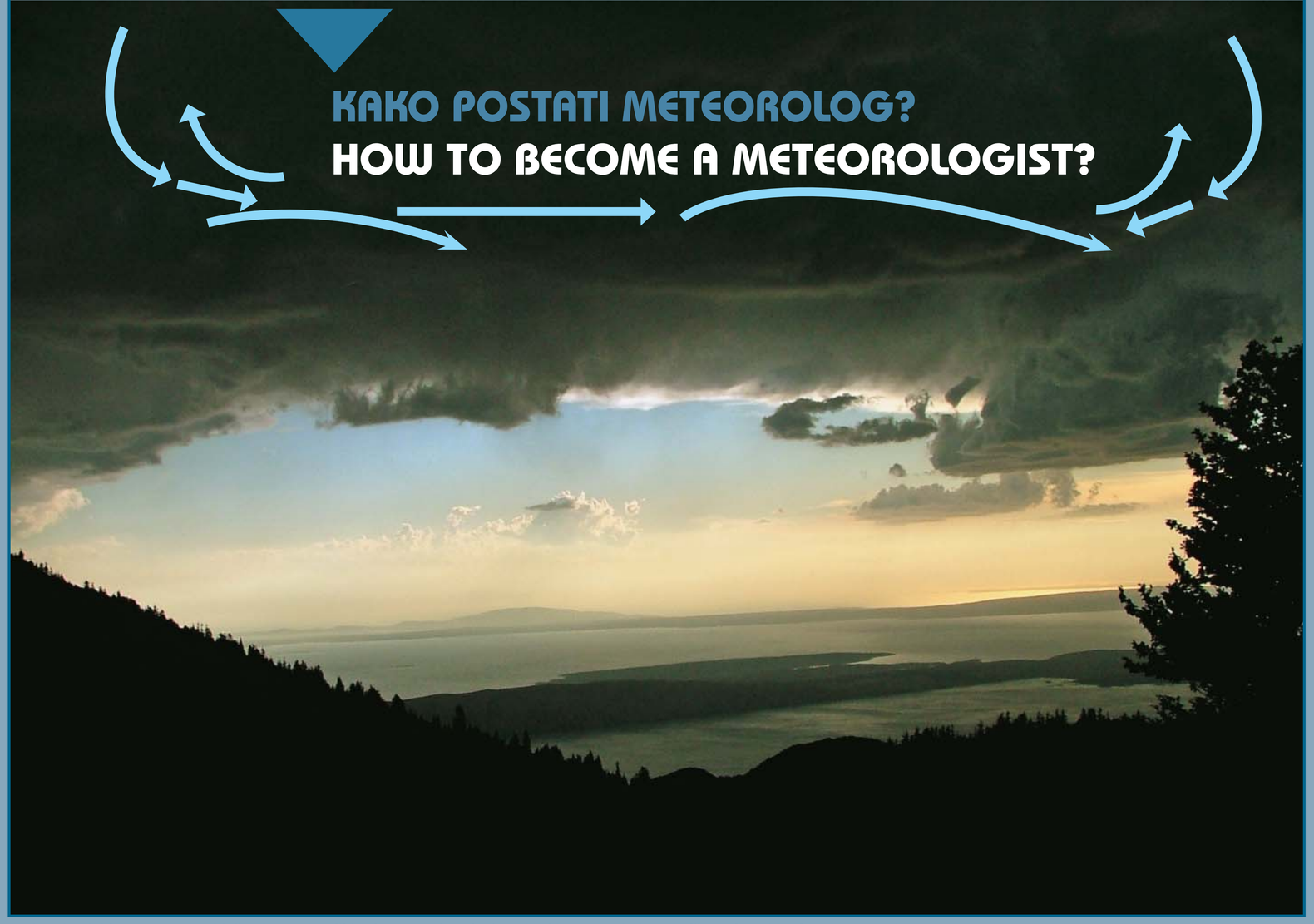


Prizemna sinoptička karta.
A surface synoptic map.

JESTE LI ZNALI?
U zadnjih 150 godina porast srednje globalne prizemne temperature zraka iznosi oko 1°C. Smatra se da je recentno globalno zatopljenje posljedica povećanja koncentracije **stakleničkih plinova** u atmosferi koje proizvodi čovjek svojom aktivnošću.

DID YOU KNOW?
The increase of average global surface air temperature of about 1°C has been recorded in the last 150 years. It is strongly believed that such global warming is a consequence of an increase of concentration of the **green house gases** in the atmosphere, produced by human activity.

KAKO POSTATI METEOROLOG?
HOW TO BECOME A METEOROLOGIST?



Kad nad Velebitom nastane oblačna kapa - brv ili brvina, na primorju će puhati bura. Pogled sa Zavižana, ispod brvine, prema Rabu.
When a cloudy cap forms above Velebit, then bora wind will blow along the coast. View from Zavižan, beneath the cap, towards the island Rab.

Ljudi čije su aktivnosti na otvorenome, pokušavali su od davnina prozrijeti ćudi vremena i klime. Za tu su svrhu koristili **"ZNAKOVE" VREMENA.** Na početku razvoja vremenoslovlja nije bilo posebno obrazovanih ljudi za tu struku. To su mahom bili svećenici, filozofi ili prirodnjaci.

U Hrvatskoj postoji dobro organizirani sustav naobrazbe za profesionalnog meteorologa uključujući najviše znanstvene stupnjeve. Meteorolog-tehničar se postaje nakon završene srednje meteorološke škole u "Šumarskoj i drvodjeljskoj školi u Karlovcu". Učenici koji to žele mogu nastaviti studij meteorologije na Prirodoslovno-matematičkom fakultetu (PMF) u Zagrebu, na smjeru geofizika.

Iskustvo pokazuje da studenti meteorologije stječu znanja koja im omogućuju uspješan doktorski studij na najboljim svjetskim sveučilištima, kao i relativno lako pronalaženje različitih poslova u struci.

People have been trying to explain the character of weather and climate since the ancient times. For that purpose they have used the so called **"WEATHER SIGNS"**.
At the beginning of the development of meteorology there weren't any people specifically educated for the subject. They were mostly priests, philosophers or nature scientists.

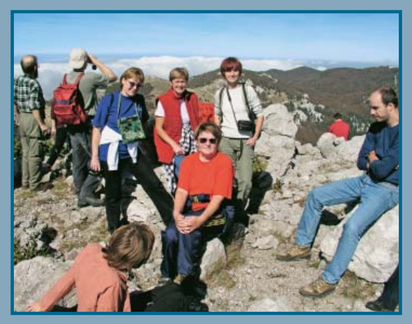
In Croatia a good educational system for professional meteorologists including the highest scientific degrees is established. One can become a **METEOROLOGICAL TECHNICIAN** after graduating from secondary meteorological school within the "Forestry and carpentry school" in Karlovac. Meteorology can be further studied at the **DEPARTMENT OF GEOPHYSICS** at the Faculty of Science in Zagreb.

Experience shows that students with the knowledge obtained at the Faculty of Science in Zagreb are able to continue postgraduate study at the best universities in the world or to find appropriate jobs easily.

Zgrada Geofizičkog zavoda "Andrija Mohorovičić" u Zagrebu.
A Building of "Andrija Mohorovičić" Geophysical Institute in Zagreb.

Šumarska i drvodjeljska škola u Karlovcu.
Forestry and carpentry school in Karlovac.

Meteorolozi na Velikom Zavižanu - terenski izlet povodom obilježavanja 50. obljetnice meteorološke postaje Zavižan i izdavanja monografije "Zavižan - između snijega, vjetra i Sunca".
Meteorologists on Veliki Zavižan – a field trip marking the fiftieth anniversary of the Zavižan meteorological station and the publishing of the monography "Zavižan – between the snow, the wind and the Sun"



Posao meteorološkog motritelja zahtijeva veliku predanost - gospodin Ante Vukušić radi na postaji Zavižan već gotovo četiri desetljeća.
Being a meteorological observer requires great dedication – Mr Ante Vukusic has worked at the Zavižan meteorological station for nearly four decades.

JESTE LI ZNALI?
Sloj u Zemljinoj utrobi između Zemljine kore i plašta - „Mohorovičićev diskontinuitet" - je dobio naziv po poznatom hrvatskom geofizičaru Andriji Mohorovičiću, koji je bio upravitelj meteorološkog opservatorija Zagreb-Grič od 1893. do 1914. godine. Po Andriji Mohorovičić u nazivaju se naftne platforme širom svijeta kao i jedan krater na Mjesecu.

DID YOU KNOW?
The layer in the interior of the Earth, between the Earth's crust and mantle, is named the Mohorovičić discontinuity, after Andrija Mohorovičić, a famous Croatian geophysicist. He was a director of Zagreb-Grič Meteorological observatory from 1893 to 1914. Several oil platforms worldwide bear his name as well as one crater on the Moon.

SPEKTAKULARNI VIDICI – VUČJAK
SPECTACULAR VIEWS – VUČJAK

Pogled prema unutrašnjosti - u daljini se vidi Klek, kod Ogulina.
A View towards the inland – Klek mountain near Ogulin can be seen.

Prizori koji oduzimaju dah - pogled prema Jadranu u suton.
Breath-taking scenery – the Adriatic in sunset.

Vrlo rijetko, sa Zavižana i okolnih vrhova mogu se vidjeti Apenini u Italiji.
Rarely, the Apenines in Italy can be seen from Vučjak.

VUČJAK je jedan od vrhova koji okružuju plato Zavižan na sjevernom Velebitu. Nadmorska visina mu je **1644 m**. S vrha se dobro vidi većina Kvarnerskih otoka i dio cjelokupne obale oko Senja. Također je lijep pogled na okolne i udaljene vrhove Velebita, a za povoljna vremena pogled se pruža čak do dalekih Alpa te zapadne jadranske obale u Italiji.

Položaj Vučjaka je idealan za **MJERENJE SMJERA I BRZINE VJETRA** jer je potpuno otvoren na sve strane. Nakon uspostave glavne meteorološke postaje Zavižan, bilo je pokušaja uspostave mjerenja vjetra, no ono se nažalost moralo prekinuti jer su udari groma bili tako česti da su ugrožavali život na meteorološkoj postaji.

Podaci o vjetru dobiveni s tako reprezentativnog mjesta bili bi izuzetno korisni kako za operativnu (na primjer svakodnevna analiza i prognoza vremena), tako i za primijenjenu meteorologiju (primjena meteoroloških podataka u istraživanju i gospodarstvu).

VUČJAK is just one of the peaks which surround the Zavižan plateau on the Northern Velebit. Elevation of the Vučjak is 1644 m. The islands of Kvarner bay as well as part of the coast around the Senj town are well visible from the top, as well as surrounding and remote peaks of the Velebit Sometimes even the Alps or Italian mountains stretching along Adriatic Sea can be seen.

Position of the Vučjak peak is perfect for the measurement of **WIND SPEED AND DIRECTION** because it is opened from all sides. Some attempts have been made to perform such wind measurements after the establishment of the main meteorological station at Zavižan. Unfortunately, these measurements had to be stopped because of the frequent lightening strikes which make living at the meteorological station dangerous.

Wind data obtained at such a representative location would be very useful for both operational (daily analyses, weather forecast) and applied (application of meteorological data in research and economy) meteorology.

Vrhovi Alpa pod snijegom u pozadini.
The peaks of the Alps in the background, covered with snow.

Pogled s Velikog Zavižana na vrh Vučjak s planinarskim domom u podnožju. Lijevo se vidi i Velika kosa.
A view from Veliki Zavižan peak towards Vučjak together with the Zavižan meteorological station.

Pogled prema moru s vrha Vučjak ljeti: Ivan Čačić i Ante Vukušić.
A view towards the sea from the top of the Vučjak in summer time: Ivan Čačić and Ante Vukušić.

JESTE LI ZNALI?
Zavižan je često zastrt oblacima pa je vidljivost nerijetko manja od 100 m. No kad atmosferske struje rastjeraju oblake, atmosfera može biti tako prozračna da se mogu vidjeti talijanske planine, što znači da vidljivost može biti i veća od 100 km.

DID YOU KNOW?
Zavižan is frequently occupied by clouds and as a consequence visibility is often lower than 100 m. When atmospheric streams chase clouds away, the atmosphere becomes very transparent so Italian mountains can be seen, meaning that the visibility can be higher than 100 km.

Pogled sa Zavižana prema otoku Rabu zimi.
A view from Zavižan toward the island Rab in winter time.