Handbook on Atmospheric Electricity Effects on biological systems

COST ACTION 15211: Atmospheric Electricity Network: coupling with the Earth System, climate and biological systems (Electronet)

DELIVERY 1 - Working Group IV (April 2018)
Chair: Pablo Fernández de Arróyabe Hernáez

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COST Association
Avenue Louise 149 I 1050 Brussels, Belgium
t: +32 (0)2 533 3800 I f: +32 (0)2 533 3890
office@cost.eu I www.cost.eu

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1. INTRODUCTION

According to the Memorandum of Understanding of the Action (MoU), approved by the Committee of Senior Officials through written procedure on 12 February 2016, the study of many environmental processes can benefit substantially by the inclusion of atmospheric electricity. There is emerging evidence that Atmospheric Electric Fields (AEF) variations may interfere with biological processes at multiple scales from micro level (nanomaterial charge) to a global Earth scale such as Schumann Resonances (SR)

The action is divided into 5 Working Groups (WG) being WG-IV in charge of studying the biological aspects and effects of the AEF on living organisms.

The first delivery of this group is presented here. It includes the first version of a Handbook that is formed by different sections:

- The List of Participants with their corresponding e-mails
- The WG-IV Conceptual Frame
- The List of Map Codes assigned to terms
- The Glossary section
- List of References (future development)

One of the first limitations for the COST Action development is the lack of normalized terms to confront a complex and interdisciplinary research such as the one proposed by the Cost Action 15211.

2. LIST OF PARTICIPANTS

NAME	EMAIL	
Prof. Pablo Fdez de Arróyabe	fernandhp@unican.es	
Prof. Snezana Savoska	snezana.savoska@fikt.edu.mk	
Dr. James Matthews	j.c.matthews@bristol.ac.uk	
Mr. Michel Vorenhout	m.vorenhout@mvhconsult.nl	
Dr. Lluis M. Mir	Luis.MIR@gustaveroussy.fr	
Prof. Kassomenos Pavlos	pkassom@uoi.gr	
Dr. Jens Olaf Pepke Pedersen	jopp@space.dtu.dk	
Dr. Michal Cifra	cifra@ufe.cz	
Prof. Kostas Kourtidis	kourtidi@env.duth.gr	
Dr. Susana Barbosa	susana.a.barbosa@inesctec.pt	
Ms. Xuemeng Chen	xuemeng.chen@helsinki.fi	
Snezana Dragovic	sdragovic@vin.bg.ac.rs	
Prof. Consoulas Christos	cconsoul@med.uoa.gr	
Dr. Ellard Hunting	e.r.hunting@cml.leidenuniv.nl	
Dr. Oscar van der Velde	oscar.van.der.velde@upc.edu	
Dr. Francesca Apollonio	apollonio@die.uniroma1.it	
Prof. Daniel Robert	D.Robert@bristol.ac.uk	
Dr. Anna Odzimek	aodzimek@igf.edu.pl	
Prof. Ashot Chilingarian	chili@aragats.am	
Dr. Dominic Roye	dominic.roye@gmail.com	
Hripsime Mkrtchyan	hripsime@yerphi.am	
Prof. Colin Price	cprice@flash.tau.ac.il	
Dr. József Bór	jbor@ggki.hu	
Dr. Christina Oikonomou	res.ec@frederick.ac.cy	
Dr. Marius-Victor Birsan	marius.birsan@gmail.com	
Dr. Milan Djordjevic	milan.djordjevic@pmf.ni.ac.rs	
Prof. Benedicto Crespo	crespob@unican.es	
Mr. Ciro Salcines Suarez	ciroluis.salcines@unican.es	
Dr. Amparo López	palopez@upv.es	

3. CONCEPTUAL FRAME AND ITS COMPLEXITY

The aims of the COST action in general and the WG-IV in particular are related to the study of complexity. A multidisciplinary and transdisciplinary approach is required for this purpose and a new conceptual scientific frame has been developed in order to organize the study of the interactions among the different aspects that play a key role on this COST Action 15211

Figure 1 presents a basic scheme of the key element and factors that get together in the study of the electric and electromagnetic fields bio-effects in living organism at multiple scales and places.

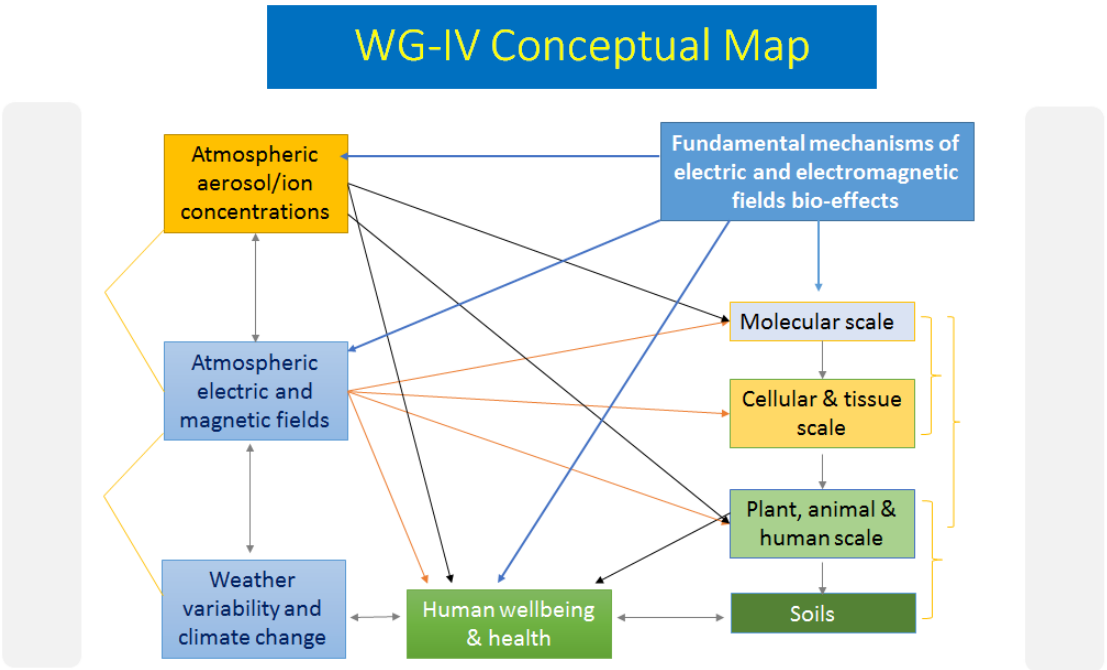

Figure 1. Basic conceptual frame for COST Action WG-IV

4. LIST OF MAP CODES

Map Codes have been defined in order to assign to each term one or several research lines. This list of Map Codes is still uncompleted and has to be improved considering that the scientific meaning of many terms can vary substantially depending on the academic discipline in which is scientifically used. This an open list to be use as a reference in the COST Action Working Group IV in particular with the possibility of expanding its use to other working groups in the Action.

CODE	CONCEPTUAL FRAME
0	GENERAL TERMS
1	ATMOSPHERIC AEROSOL/IONS CONCENTRATION AND SIZE
2	ATMOSPHERIC ELECTRIC AND MAGNETIC FIELDS
3	ELECTRIC AND ELECTROMAGNETIC FIELDS BIOEFFECTS AT MOLECULAR SCALE
4	ELECTRIC AND ELECTROMAGNETIC FIELDS BIOEFFECTS AT CELULAR AND TISUES SCALE
5	ELECTRIC AND ELECTROMAGNETIC FIELDS AND SOILS
6	ELECTRIC AND ELECTROMAGNETIC FIELDS BIOEFFECTS IN PLANTS
7	ELECTRIC AND ELECTROMAGNETIC FIELDS BIOEFFECTS IN ANIMALS
8	ELECTRIC AND ELECTROMAGNETIC FIELDS BIOEFFECTS IN HUMANS
9	SPACE WEATHER
10	BIOELECTRICAL INDEXES
11	RADIOACTIVITY
12	ATMOSPHERIC GLOBAL ELECTRIC CIRCUIT
13	ATMOSPHERIC ELECTRICITY - LIGHTNING
14	SOLAR, MAGNETOSPHERIC, AND IONOSPHERIC EFFECTS
15	ELECTRICAL PROPERTIES OF THE EARTH'S SURFACE
16	ELECTRICAL PROPERTIES OF THE EARTH'S ATMOSPHERE
17	GEOGRAPHIC SCIENCES
18	BIOMETEOROLOGY AND ELECTRIC AND ELECTROMAGNETIC FIELDS
19	ELECTRIC AND ELECTROMAGNETIC FIELDS AND PUBLIC HEALTH
20	OTHERS

COST Association
Avenue Louise 149 I 1050 Brussels, Belgium
t: +32 (0)2 533 3800 I f: +32 (0)2 533 3890
office@cost.eu I www.cost.eu

5. GLOSSARY

Absorption

Conceptual Map Code: 1,8

It is the movement of material into blood regardless of mechanism. Generally applies to dissociation of particles and the uptake into blood of soluble substances and materials dissociated from particles. Ii includes movement of ultrafine particulate material, e.g. nanometer-size-particles.

REF: Human Respiratory Tract Model for Radiological Protection, ICRP Publication 66. Ann. ICRP 24 (1-3), 1994.

Absorption

Conceptual Map Code:17

The process of taking up electromagnetic energy transmitted from other source.

AC Global Electric Circuit

Conceptual Map Code: 2,3,4,5,6,7,8,12,15

Alternating magnetic and electric currents (AC) produced naturally by lightning in the ELF frequency range that are observed globally, linked to the Schumann resonances.

Action potential

Conceptual Map Code: 4,5,6,7,8

The action potential is the rapid rise and fall of the membrane potential of a specific location along the cell membrane. This depolarisation is propagated in adjacent locations across the axon or muscle membrane.

REF: Hodgkin AL, Huxley AF (1952). "A quantitative description on of membrane current and its application on to conduction and excitation in nerves". The Journal of Physiology 117 (4): 500–544.

Acute effect

Conceptual Map Code: 1,8

A health or physiological effect that occurs suddenly over hours or days, for example lung inflammation resulting from inhalation exposure.

REF: WHO guidelines on protecting workers from potential risks of manufactured nanomaterials. ISBN 978-92-4-155004-8.

Adiabatic process

Conceptual Map Code: 0

The process in which a system does not transfer heat to its surrounding.

Advection

Conceptual Map Code: 0, 17

Transfer of fluids and their physical properties. In relation to meteorology a horizontal air motion.

Aerodynamic diameter

Conceptual Map Code: 1,8

Aerodynamic diameter is defined as the diameter of a sphere with standard density that settles at the same terminal velocity as the particle of interest.

REF: Human Respiratory Tract Model for Radiological Protection. ICRP Publication 66, Ann. ICRP 24 (1-3), 1994.

Aerosol

Conceptual Map Code: 1,5,6,7,8

A colloidal system of solid or liquid particles in a gas. Aerosols range in sizes from a few nm to about a mm and occur in the atmosphere both naturally but as a result of anthropogenic processes. Also can be seen as mixture of small particles (solid, liquid or a mixed variety) and a carrier gas (usually air).

REF: WHO guidelines on protecting workers from potential risks of manufactured nanomaterials. ISBN 978-92-4-155004-8.

Aerosol dynamics

Conceptual Map Code: 1

Dynamical processes modify the number size distributions of atmospheric aerosol particles. These processes mainly include nucleation, coagulation, condensation, wet and dry scavenging.

REF: Seinfeld, J. H., and Pandis, S. N.: Atmospheric chemistry and physics from air pollution to climate change, 2nd ed., John Wiley & Sons, Inc., Hoboken, New Jersey, United States, 2006.

Agglomerate

Conceptual Map Code: 1,5,6,7,8

A collection of weakly bound particles or aggregates where the resulting external surface area is similar to the sum of the surface areas of the individual components.

REF: European Commission, “Guidance on the protection of the health and safety of workers from the potential risks related nanomaterials at work. Guidance for employers and health and safety practitioners” Brussels, 2014.

Aggregate

Conceptual Map Code: 1,5,6,7,8

A particle comprising strongly bound or fused particles.

REF: European Commission, “Guidance on the protection of the health and safety of workers from the potential risks related nanomaterials at work. Guidance for employers and health and safety practitioners” Brussels, 2014.

Air Ion Spectrometer - AIS

Conceptual Map Code: 1

An apparatus capable of measuring the size distribution of air ions, consisting of two differential mobility analysers, one for measuring positive and the other for measuring negative ions.

REF: Laakso, L., Anttila, T., Lehtinen, K. E. J., Aalto, P. P., Kulmala, M., Hõrrak, U., Paatero, J., Hanke, M., and Arnold, F.: Kinetic nucleation and ions in boreal forest particle formation events, Atmos. Chem. Phys., 4, 2353-2366, https://doi.org/10.5194/a

Air-Earth current

Conceptual Map Code: 1, 2,11,12,15,16

Electric current that flows in the atmosphere, the current of the global atmospheric circuit that flows through the circuit's load.

REF: MacGorman, D. and Rust, W. D., The electrical nature of storms, Oxford University Press, New York, 1998, Chapter 1.

Alpha radiation (sub of ionizing radiation)

Conceptual Map Code: 1, 11

Radiation resulting from radioactive decay of an atom emitting an alpha particle (composed of two protons and two neutrons). The range of alpha particles is very small in air (a few cm), and they are therefore unable to penetrate directly the human body. However, if inhaled or ingested alpha particles can cause serious cellular damage.

REF: Alice Sollazzo, Beata Brzozowska, Lei Cheng, Lovisa Lundholm, Siamak Haghdoost, Harry Scherthan, and Andrzej Wojcik, 2017. Alpha Particles and X Rays Interact in Inducing DNA Damage in U2OS Cells. Radiation Research 188, 400-411.

Alveolar-Interstitial region - AI

Conceptual Map Code: 1,8

Consists of the respiratory bronchioles, alveolar ducts and sacs with their alveoli, and intertitial connective tissue; airway generations 16 and beyond.

Human Respiratory Tract Model for Radiological Protection ICRP Publication 66Ann. ICRP 24 (1-3), 1994.

Aragats Space Environment Center - ASEC

Conceptual Map Code: 20

Research station at an altitude of 3250 m

Atmospheric discharge

Conceptual Map Code: 13, 16

Lightning (intra-cloud, inter-cloud, cloud-to-cloud and cloud to ground discharge).

http://www.foudre-ineo.com/en/rep-la_foudre/rub-decharges_atmospheriques.html

Atmospheric turbidity

Conceptual Map Code: 0,1

A measure of the presence of aerosols that affects transparency of the atmosphere. The more aerosols present in the atmosphere, the higher the intensity of scattered light and the higher the turbidity. It expresses the attenuation of the solar radiation that reaches the Earth's surface under cloudless sky and describes the optical thickness of the atmosphere. Atmospheric turbidity is a convenient parameter frequently used to estimate the aerosol optical characteristics.

Djafera D, Irbah A. Estimation of atmospheric turbidity over Ghardaïa city. Atmos. Res 2013;128:76–84.;C. Gueymard, Turbidity determination from broadband irradiance measurements: A detailed multi-coefficient approach. J. Appl. Meteorol., vol. 37: 414-435

Atmospheric Electric Field – AEF

Conceptual Map Code: 0,2,3,4,5,6,7,8,12,16

A quantitative term denoting the electric field of the atmosphere (AEF) at any specified point in space and time. In areas of fair weather, the atmospheric electric field near the earth´s surface is normally about 100 V/m and this value decreases in magnitude with increasing altitude in the global electric circuit, falling for example, to about 5 V/m at an altitude of about 10 km. The study of many environmental processes can benefit substantially by the inclusion of atmospheric electricity as a complementary factor. Such processes include, but are not limited to, earthquakes, aerosols / clouds and climate, sun-earth interactions, air pollution, lightning etc. Further, there is emerging evidence that AEF variations may interfere with biological processes, including human health and brain function.

http://glossary.ametsoc.org/wiki/Atmospheric_electric_field

Atmospheric ions

Conceptual Map Code: 1

Atmospheric ions (also called air ions) are charged molecules and molecular clusters suspended in atmospheric air. If larger than 1.6 nm, they are defined as charged particles [1, 2]. Primary sources of air ions are gamma radiation, radon decay and cosmic radiation.

[1]Hirsikko A. et al., Atmospheric ions and nucleation: a review of observations, Atmos. Chem. Phys., 11, 767–798, 2011, doi:10.5194/acp-11-767-2011; [2]Junninen H.et al, A high-resolution mass spectrometer to measure atmospheric ion composition, Atmos. Meas. Techniques 1039–1053, doi:10.5194/amt-3-1039-2010, 2010.

Atmospheric New Particle Formation - NPF

Conceptual Map Code: 1

Refers to the production of aerosol particles in the ambient air from gaseous precursors, followed by subsequent growth of these newly formed particles. Photochemical reactions in the gas phase are believed to trigger the initial step of atmospheric NPF.

Dal Maso, M., Kulmala, M., Riipinen, I., Wagner, R., Hussein, T., Aalto, P. P., and Lehtinen, K. E. J.: Formation and growth of fresh atmospheric aerosols: eight years of aerosol size distribution data from SMEAR II, Hyytiälä, Finland, Boreal Env. Res., 1

Atmospheric Potential Gradient - APG or PG

Conceptual Map Code: 2, 12, 13, 14, 15, 16

Equal in magnitude, but opposite in polarity to atmospheric electric field (which is sometime ambiguous in terms of sign), will typically be positive in fair weather. Often used in atmospheric electricity literature instead of AEF due to lack of ambiguity of sign.

Aurora

Conceptual Map Code: 9, 14,16

A colorful, rapidly varying glow in the sky caused by the collision of charged particles in the magnetosphere with atoms in the Earth's upper atmosphere. Auroras are most often observed at high latitudes and are enhanced during geomagnetic storms.

Glossary for the Solar Flare Theory web site by Gordon Holman and Sarah Benedict.

Responsible NASA Official: Gordon D. Holman, Heliophysics Science Division, NASA/Goddard Space Flight Center, Solar Physics Laboratory / Code 671, Gordon.D.Holman@nasa.gov

Beta radiation (sub of ionising radiation)

Conceptual Map Code: 1, 11

Radiation resulting from radioactive decay of an atom emitting an electron or positron. The range of beta radiation in air is larger than for alpha particles (up to a few meters) and it is therefore able to penetrate skin. However the main risk is associated with internal emission from ingested material.

Binary homogeneous nucleation

Conceptual Map Code: 1

Homogeneous-heteromolecular nucleation with two substances. In the Earth's atmosphere a typical system is binary homogeneous nucleation of sulfuric acid and water.

Bioelectricity

Conceptual Map Code: 3,4,6,7,8, 10

Electric potentials and currents produced by or occurring within living organisms. Bioelectric potentials are generated by a variety of biological processes and generally range in strength from one to a few hundred millivolts.

Encyclopædia Britannica

Bioelectromagnetics

Conceptual Map Code: 3,4,6,7,8,10

Bioelectromagnetics is the field that studies interactions of electromagnetic fields with living tissues and organisms

Biometeorological Data Infrastructure – BDI

Conceptual Map Code: 8

A complex platform formed by a mainframe, a biometeorological model, a relational database management system, data procedures, communication protocols, different software packages, users, datasets and mobile applications in order to analyzed the impact of different atmospheric variables on living organism in order to define their specific vulnerability to their variability and change

https://www.ncbi.nlm.nih.gov/pubmed/28660342

Biometeorological profile

Conceptual Map Code: 8,15,17, 18

It refers to the biological answers in terms of wellbeing that a living organism (animal, plant or human being) experiences through time and space in relation to changes and variability of multiple atmospheric factors such as temperature, air humidity, sun radiation, atmospheric field.. A specific profile can be defined for each variable and living organism. It is a graphical characterizacion of the physical and psycological reactions of living organisms, including humans, to the variability and change of specific atmospheric factor through a period of time. The definition must be based on empirical measurements of the atmospheric determinants

https://www.ncbi.nlm.nih.gov/pubmed/28660342

Blood pressure

Conceptual Map Code: 7, 8

MV: The pressure in arteries of mammals, including humans. The bloodpressure has two main components: an upper value, and a lower background value. The background pressure is the pressure always present in the arterie. The upper value is the pressure caused by the actual heartbeat. KK: Some studies show that SR can influence blood pressure.

Mitsutake G., K. Otsuka, M. Hayakawa, M. Sekiguchi, G. Corndlissen, F. Halberg, Does Schumann resonance affect our blood pressure?, Biomedicine & Pharmacotherapy 59, S10-S14, 2005.

Blowing dust

Conceptual Map Code: 0

Dust picked up locally from the surface of the earth and blown about in clouds or sheets. It is classed as a lithometeor and is encoded BLDU as an obstruction to vision in an aviation weather observation (METAR). (Encoded as BD in SAO observation format.) Blowing dust may completely obscure the sky; in its extreme form it is called a duststorm. A layer of stable air aloft tends to stop the vertical transport of dust by eddies. There is then a sharply defined upper limit to the dust layer.

http://glossary.ametsoc.org/wiki/Blowing_dust

Blue/Gigantic Jet - BJ/GJ

Conceptual Map Code: 2,12,13,16

Blue jets, gigantic jets (GJ) and other jet-type TLE phenomena shoot up to different heights from the top of thunderclouds. These streamer-type discharges are driven by an imbalance of charges in the thundercloud. Their color is predominantly white and blue close to the thundercloud but it turns into red in higher air regions. The height a jet can reach depends on the rate the charge imbalance in the top of the the thundercloud is supported by charge separation and transport processes. Gigantic jets may reach up to 90-95 km, i.e., to the bottom of the ionospheric E-layer at night. Jets are the least frequently observed type of TLEs. See also TLE.

Soula et al., 2011, Gigantic jets produced by an isolated tropical thunderstorm near Réunion Island, J. Geophys. Res., 116, D19103, 14 pp, doi:10.1029/2010JD015581

Breakdown

Conceptual Map Code: 2,16

The process by which electrically stressed air is transformed from an insulator to a conductor. Breakdown involves the acceleration of electrons to ionization potential in the electric field imposed by the thundercloud, and the subsequent creation of new electrons that avalanche and expand the scale or enlarge the volume of enhanced conductivity. Breakdown precedes the development of lightning.

http://glossary.ametsoc.org/wiki/Breakdown

Breakdown field

Conceptual Map Code: 2,16

The electric field necessary to produce breakdown.

http://glossary.ametsoc.org/wiki/Breakdown_field

Bronchial region - BB

Conceptual Map Code: 1,7,8

Consists of the trachea and bronchi from which deposited material is cleared by ciliary action; airway generations 0 through 8.

Human Respiratory Tract Model for Radiological Protection ICRP Publication 66Ann. ICRP 24 (1-3), 1994.

Bronchiolar region - bb

Conceptual Map Code: 1,8,18

Consists of the bronchioles and terminal bronchioles; airway generations 9 through 15.

Human Respiratory Tract Model for Radiological Protection ICRP Publication 66Ann. ICRP 24 (1-3), 1994.

Bulk material -

Conceptual Map Code: 1,8,18

The larger counterpart of a nanomaterial not confined to the nanoscale in any dimension, e.g. gold as the bulk material and nano-gold as the nano-form material.

WHO guidelines on protecting workers from potential risks of manufactured nanomaterials ISBN 978-92-4-155004-8.

Carnegie curve

Conceptual Map Code: 2,12

Average diurnal variation of the atmospheric electric field at ground level obtained from measurements on sea from research vessel "Carnegie" of the Carnegie Institution of Washington in the first half of 20th century

Cellular respiration

Conceptual Map Code: 4,5,6,7,8

Cellular respiration is a process where energy from food is captured and stored into a molecule, namely adenosine triphosphate (ATP). Cellular respiration relies mainly on redox reactions that take place within cells and their membranes. The reactions involved in respiration are catabolic reactions, which break large molecules into smaller ones, releasing energy in the process. The final acceptor of electrons during aerobic respiration is molecular oxygen, and is used by animals, while various bacteria use a variety of acceptors other than oxygen, for instance nitrate and sulfate, and is often referred to as anaerobic respiration.

Rich, P. R. (2003). "The molecular machinery of Keilin's respiratory chain". Biochemical Society Transactions. 31 (Pt 6): 1095–1105. doi:10.1042/BST0311095

Charge distribution

Conceptual Map Code: 1

The probability that a charged aerosol (or large ion) of a given mobility has a given charge. For ambient aerosols this is typically skewed to slightly negative, as negative small ions are higher mobility and therefore more likely to attach. Sources of unipopolar space charge (eg High Voltage Power Lines) can affect the charge distribution on an aerosol population.

W. C. Hinds. Aerosol technology: properties, behavior and measurement of

airborne particles. John Wiley & Sons, New York, 1982. Wiedensohler A 1988 J. Aerosol Sci.19 387-9. Buckley A J, Wright M D and Henshaw D L 2008 Aerosol Sci. Technol.42 1042–51

Charged clouds

Conceptual Map Code: 1,2

When is a cloud charged, and when not? Somebody? AO: a cloud (or parts of the cloud?) with non-zero net total charge, some highly charged clouds such as Cumulonimbus create conditions for lightning discharges during a thunderstorm

Charged nanoparticles

Conceptual Map Code: 1

Charge carriers that are stable enough under the ambient atmospheric conditions and they can grow further in size, provided that the ambient conditions remain unchanged.

Kulmala, M., Petaja, T., Ehn, M., Thornton, J., Sipila, M., Worsnop, D. R., and Kerminen, V. M.: Chemistry of atmospheric nucleation: on the recent advances on precursor characterization and atmospheric cluster composition in connection with atmospheric nucleation: on the recent advances on precursor

Chronic effect

Conceptual Map Code: 1,8

An effect that occurs or builds up over a long period; for humans over years, for example cardiovascular disease.

WHO guidelines on protecting workers from potential risks of manufactured nanomaterials ISBN 978-92-4-155004-8.

Chronic exposure

Conceptual Map Code: 1,8

Exposure over a long period, for humans over years.

WHO guidelines on protecting workers from potential risks of manufactured nanomaterials ISBN 978-92-4-155004-8.

Circadian rhythm

Conceptual Map Code: 5,6,7,8

Circadian rhythm is any biological process that displays an endogenous oscillation of about 24 hours. These 24-hour rhythms are driven by a circadian clock, and they have been widely observed in various living organisms. Some studies show that they can be affected by natural weak electric fields.

Wever R., Human Circadian Rhythms under the Influence of Weak Electric Fields and the Different Aspects of These Studies, Int. J. Biometeor., 17, 3, 227-232, 1973.

Circular polarization

Conceptual Map Code: 5

A polarization state of an electromagnetic signal in which the electric field vector at a point in space describes a circle. Relative to an observer looking in the direction of signal propagation, the electric fields of right and left circularly polarized signals rotate clockwise and counterclockwise, respectively.

http://glossary.ametsoc.org/wiki/Circular_polarization

Circulation Weather Types – CWT

Conceptual Map Code: 1,2,4,9,12,13,15,16

A classification of the synoptic atmospheric situations in a specific region of the world attending to objective and/or subjective methods based on meteorological data. Types can be obtained from one specific variable such as atmospheric pressure attending to the main component of atmospheric circulation or can be also produced using complex analytical statistics methods based on the physical properties of the air masses that affects to a specific regionof the world.

https://www.frontiersin.org/research-topics/2450/circulation-weather-types-as-a-tool-in-atmospheric-climate-and-environmental-research

Clearance

Conceptual Map Code: 1,8

The removal of material from the respiratory tract by particle transport and by sbsorption into blood.

Human Respiratory Tract Model for Radiological Protection ICRP Publication 66Ann. ICRP 24 (1-3), 1994.

Climate

Conceptual Map Code: 0,12,18

Average weather conditions over some location for an extended period of time.

Climate Services - GFCS

Conceptual Map Code: 8,15, 17, 18

The development and incorporation of science-based climate information and prediction into planning, policy and practice on the global, regional and national scale. Climate services provide and use climate and metereological information in a way that assists decision making by individuals and organizations in different fields such as water, ffod, energy, risk and health. Such services require appropriate engagement along with an effective access mechanism and must respond to user needs

http://www.wmo.int/gfcs/about-gfcs

Climate, Air pollution and Health

Conceptual Map Code: 1, 4, 8

Climate, electric fields, nanoparticles and Human health

Cloud generator

Conceptual Map Code: 12, 15

A single electrically charged cloud or all such clouds which generate an electric current that adds to the current of the global atmopsheric electric circuit

Wilson, C. T. R., Investigation on lightning discharges and on the electric field of thunderstorms, Philosophical Transactions of the Royal Society of London. Series A, 211, 73-115, 1921

Cloud-to-ground flash/stroke - CG, -CG, +CG

Conceptual Map Code: 13

A lightning flash in which one or more cloud-to-ground return strokes are produced. A stroke is one impulsive event in which the polarity of the cloud charge transferred to ground determines the stroke (or flash) polarity.

Cluster ions

Conceptual Map Code: 1

Charge carriers composed of two or more monomers, e.g. HSO4-.H2SO4, HSO4-.(H2O)n

Harrison, R. G., and Tammet, H.: Ions in the Terrestrial Atmosphere and Other Solar System Atmospheres, Space Sci. Rev., 137, 107-118, 10.1007/s11214-008-9356-x, 2008.

Coagulation sink - CoagS

Conceptual Map Code: 1

Quantifies the loss rate of particles of a certain size via coagulation with other aerosol particles and via self-coagulation. It typically has a unit of cm-3s-1

Dal Maso, M., Kulmala, M., Lehtinen, K. E. J., Mäkelä, J. M., Aalto, P., and O'Dowd, C. D.: Condensation and coagulation sinks and formation of nucleation mode particles in coastal and boreal forest boundary layers, J. Geophys. Res., 107, 10.1029/2001jd00

Condensation sink - CS

Conceptual Map Code: 1

Is a quantity that measures the capability of aerosol particles in the atmosphere to accommodate condensable vapours, which is derivable from the number size distriutions of aerosol particles. It is usually expressed in unit of cm-3s-1.

Dal Maso, M., Kulmala, M., Lehtinen, K. E. J., Mäkelä, J. M., Aalto, P., and O'Dowd, C. D.: Condensation and coagulation sinks and formation of nucleation mode particles in coastal and boreal forest boundary layers, J. Geophys. Res., 107, 10.1029/2001jd00

Condensational Particle Counter - CPC

Conceptual Map Code: 1

A type of instrument which detects aerosol particles optically after growing them by vapour condensation.

Kulkarni, P., Baron, P. A., and Willeke, K.: Aerosol measurement: principles, techniques, and applications, 3 ed., John Wiley and Sons, Inc, New York, Chichester, Weinheim, Brisbane, Singapore, Toronto, 2011.

Conduction

Conceptual Map Code: 0

Form of electromagnetic energy transfer through solids from molecule to molecule without their.

Conduction current

Conceptual Map Code: 2, 11, 12

Electric current component determined by the conductivity of the air and the electric field according to the Ohm's law

Confounder

Conceptual Map Code: 1,8

A factor in an exposure study that is both related to the exposure and to the outcome. The uneven distribution of the confounder will lead to distorted or spurious results.

WHO guidelines on protecting workers from potential risks of manufactured nanomaterials ISBN 978-92-4-155004-8.

Control banding

Conceptual Map Code: 1,8

A risk management approach to identify and recommend exposure control measures for potentially hazardous substances for which toxicological information is limited.

WHO guidelines on protecting workers from potential risks of manufactured nanomaterials ISBN 978-92-4-155004-8.

Convection current

Conceptual Map Code: 2,12, 16

Electric current carried by ions moving due to thermal convection of air

Convergence

Conceptual Map Code: 0,19

Horizontal inflow of air into an area, leading to upward motion of air and clouds and precipitation.

Corona

Conceptual Map Code: 2,16

Persistent "cloud" of electron avalanches initiating at (or moving towards) an object immerged in an electric field.

Corona (SUN)

Conceptual Map Code: 9, 14,16

The outermost layer of the solar atmosphere. The corona consists of a highly rarefied gas with a temperature greater than one million kelvin. It is visible to the naked eye during a solar eclipse.

SOHO, the Solar & Heliospheric Observatory WEBSITE

Corona current

Conceptual Map Code: 2,12, 15

Electric current carried by corona discharge

Corona discharge

Conceptual Map Code: 16

(Also called brush discharge, corposant.) A luminous, and often audible, electric discharge that is intermediate in nature between a spark discharge (with, usually, its single discharge channel) and a point discharge (with its diffuse, quiescent, and nonluminous character). It occurs from objects, especially pointed ones, when the electric field strength near their surfaces attains a value near 1 × 105 V m-1. Aircraft flying through active electrical storms often develop corona discharge streamers from antennas and propellers, and even from the entire fuselage and wing structure. So-called precipitation static results. It is seen also during stormy weather, emanating from the yards and masts of ships at sea.

http://glossary.ametsoc.org/wiki/Corona_discharge

Coronal mass ejection - CME

Conceptual Map Code: 9, 14,16

A huge magnetic bubble of plasma that erupts from the Sun's corona and travels through space at high speed

SOHO, the Solar & Heliospheric Observatory WEBSITE

Cosmic rays

Conceptual Map Code: 1, 11

High-energy particles that reach the earth from the outer space, interact with the nuclei of atmospheric constituents and generate secondary reaction products in the lower atmosphere

United Nations Scientific Commitee on the Effects of Atomic Radiation (UNSCEAR), 2016. UNSCEAR 2016 Report, Report to the General Assembly, Annex B.

Cosmic-ray ionization

Conceptual Map Code: 1,16

The process of converting atoms or molecules into ions or a change of an ion to another ionic form. “Positive ions are commonly formed by impact of high energy photons or particles with neutral atoms or molecules.”

The Facts on File dictionary of astronomy / edited by John Daintith, William Gould New York, NY : Facts on File, c1994. Call # 520.3 FA. “Cosmic rays are a global source of ionization distributed through the Galaxy.” Source: Dalgarno, A. (2006), Interstel

Cosmogenic radionuclides

Conceptual Map Code: 1, 11

Radioactive nuclei produced by cosmic ray interactions with nuclei of atmospheric constituents

United Nations Scientific Commitee on the Effects of Atomic Radiation (UNSCEAR), 2016. UNSCEAR 2016 Report, Report to the General Assembly, Annex B.

Coulomb force

Conceptual Map Code: 6,7, 8

The electric force acting between two charged objects, in our case measured between biological organisms.

Stewart, Joseph (2001). Intermediate Electromagnetic Theory. World Scientific. p. 50

Critical frequency of the E layer - foE

Conceptual Map Code: 9, 14,16

The maximum frequency which can be reflected from this layer.

The DIAS Project (European Digital Upper Atmosphere Server)

http://dias.space.noa.gr:8080/LatestDias2/glossaryMin.jsp

Critical frequency of the F2 layer - foF2

Conceptual Map Code: 9, 14,16

The maximum ordinary mode radiowave frequency capable of vertical reflection from the F2 of the ionosphere.

The DIAS Project (European Digital Upper Atmosphere Server)

http://dias.space.noa.gr:8080/LatestDias2/glossaryMin.jsp

Crust

Conceptual Map Code: 9, 14,16

The crust is the outermost major layer of the earth, ranging from about 10 to 65 km in thickness worldwide. The uppermost 15-35 km of crust is brittle enough to produce earthquakes.

U.S. Geological Survey Earthquake Hazards Program https://earthquake.usgs.gov/

D REGION

Conceptual Map Code: 9, 14,16

The lowest layer of the Earth's ionosphere. It is between about 50 and 95 kilometers above Earth's surface. This is the layer which reflects radio waves. Also called the D Layer

SOHO, the Solar & Heliospheric Observatory WEBSITE

DC Global Electric Circuit

Conceptual Map Code: 2,5

Direct currents (DC) and fields that are quasi-static in time produced by global thunderstorm activity.

Denitrification

Conceptual Map Code: 5,6,15

Denitrification is the unique pathway whereby N in the terrestrial biosphere is transformed by denitrifying bacteria into atmospheric N_2. Denitrification is also significant as the major source of atmospheric N2O, an important green-house gas that also consumes stratospheric ozone.

Per Ambus, Sophie Zechmeister-Boltenstern, in Biology of the Nitrogen Cycle, 2007.G.P. Robertson1, P.M. Groffman2, in Soil Microbiology, Ecology and Biochemistry (Fourth Edition), 2015

Deposition

Conceptual Map Code: 1,8

Refers to the initial processess determining how much of the material in the inspired air remains behind after expiration. Deposition of material may occur duraint both inspiration and expiration.

Human Respiratory Tract Model for Radiological Protection ICRP Publication 66Ann. ICRP 24 (1-3), 1994.

Deposition efficiency of region - ni

Conceptual Map Code: 1,7,8

Deposition efficiency of region, i, of the respiratory tract.

Human Respiratory Tract Model for Radiological Protection ICRP Publication 66Ann. ICRP 24 (1-3), 1994.

Deposition in region

Conceptual Map Code: 1,7,8

Expressed as a fraction of the number or activity of particles of a given size that are present in a volume of ambient air before insipiration.

Human Respiratory Tract Model for Radiological Protection ICRP Publication 66Ann. ICRP 24 (1-3), 1994.

Depression

Conceptual Map Code: 19

Common and serious medical illness that negatively affects how you feel, the way you think and how you act. It causes feelings of sadness and/or a loss of interest in activities once enjoyed and leads to a diversity of emotional and physical problems and can decrease a person's ability to function at work and at home

Differential Mobility Analyzer - DMA

Conceptual Map Code: 1

A type of instrument to classify aerosol particles according to their electric mobility.

Kulkarni, P., Baron, P. A., and Willeke, K.: Aerosol measurement: principles, techniques, and applications, 3 ed., John Wiley and Sons, Inc, New York, Chichester, Weinheim, Brisbane, Singapore, Toronto, 2011.

Differential/Scanning Mobility Particle Sizer - DMPS/SMPS Conceptual Map Code: 1

A type of setup to measure the number size distributions of aerosol particles. Aerosol particles are initially brought to an equilibrium charging state prior to size segregation in a Differential Mobility Analyser (DMA). Aerosol particles of a certain size selected by the DMA are then grown and counted by a Condensational Particle Counter.

Wiedensohler, A., Birmili, W., Nowak, A., Sonntag, A., Weinhold, K., Merkel, M., Wehner, B., Tuch, T., Pfeifer, S., Fiebig, M., Fjäraa, A. M., Asmi, E., Sellegri, K., Depuy, R., Venzac, H., Villani, P., Laj, P., Aalto, P., Ogren, J. A., Swietlicki, E., Wi

Direct solar radiation - Conceptual Map Code: 6,14

Electromagnetic radiation from the Sun which reaches the earth's surface without being diffused, absorbed, scattered or reflected by aerosols.

Divergence Conceptual Map Code: 0

Horizontal outflow of air from an area, leading to downward motion of air and fine weather.

Dosimetry and microdosimetry Conceptual Map Code: 4, 7 and 8

Numerical evaluation of the electromagnetic field induced in animals, tissues, cells

Earth-ionosphere cavity Conceptual Map Code: 2,12,15,17

See 'Earth-ionosphere waveguide'.

A.P. Nickolaenko and M. Hayakawa, Resonances in the Earth–Ionosphere Cavity, Kluwer Academic Publishers, Dordrecht–Boston–London (2002)

Earth-ionosphere waveguide - EIWG Conceptual Map Code: 2,12,13,15,16

The surface of the Earth and the lower ionosphere are relatively good conductors while the air between them can be considered as a dielectric layer. This system forms a waveguide for electromagnetic waves which, depending on their frequency, get reflected from the conductive boundary regions and propagate laterally from their source (e.g., lightning).

The complete Earth-ionosphere waveguide is spatially finite. This system forms the closed Earth-ionosphere cavity for low frequency electromagnetic waves (e.g., VLF and ELF band radio waves), which, in principle, cannot propagate through the conducting boundaries. The quasi-spherical shell geometry of the cavity makes it possible for electromagnetic resonance to develop inside it. This happens when radio waves propagate all around the Earth (this is possible only for ELF waves which are not damped severily during their propagation) and when the wavelength of the waves is an integer multiple of the circumference of the Earth so that constructive interference can occur (Schumann resonances).

A.P. Nickolaenko and M. Hayakawa, Resonances in the Earth–Ionosphere Cavity, Kluwer Academic Publishers, Dordrecht–Boston–London (2002)

Earthquake

Conceptual Map Code: 9, 14,16

Earthquake is a term used to describe both sudden slip on a fault, and the resulting ground shaking and radiated seismic energy caused by the slip, or by volcanic or magmatic activity, or other sudden stress changes in the earth.

U.S. Geological Survey Earthquake Hazards Program https://earthquake.usgs.gov/

Earthquake hazard

Conceptual Map Code: 9, 14,16, 17

Earthquake hazard is anything associated with an earthquake that may affect the normal activities of people. This includes surface faulting, ground shaking, landslide, liquefaction, tectonic deformation, tsunamis, and seiches.

U.S. Geological Survey Earthquake Hazards Program https://earthquake.usgs.gov/

Earthquake risk

Conceptual Map Code: 9, 14,16,17

Earthquake risk is the probable building damage, and number of people that are expected to be hurt or killed if a likely earthquake on a particular fault occurs. Earthquake risk and earthquake hazard are occasionally incorrectly used interchangeably.

U.S. Geological Survey Earthquake Hazards Program https://earthquake.usgs.gov/

Ecology

Conceptual Map Code: 6, 7 and 8

The study of how organisms interact with each other and with their physical and chemical environment. S. Freeman, K Quilin, L Allison. Biological Science 5th edition. Pearson Publishing. p.1059.

Electric charge

Conceptual Map Code: 2-8, 12-16

Electric charge is the physical property of matter that causes it to experience a force when placed in an electromagnetic field. There are two types of electric charges: positive and negative (commonly carried by protons and electrons respectively). The electric charge of an electron is -1e, while that of a proton is +1e. Like charges repel and unlike attract. An absence of net charge is referred to as neutral. An object can be negatively charged if it has an excess of electrons, positively charged if it has a deficiency of electrons, or uncharged.

Electric charge of biomolecule

Conceptual Map Code: 1,3

Electric charge is the physical property of a matter (here: biomolecule) that causes it to experience a force when placed in an electromagnetic field. The higher the charge the higher the force on the biomolecule due to electric field. The amount of charge on the biomolecule and its parts determines the magnitude of its interaction ("sensitivity") to the electric fields, including AEF.

http://onlinelibrary.wiley.com/doi/10.1002/0471140864.ps0210s41/full
http://www.nature.com/doifinder/10.1038/nnano.2017.26

Electric discharge

Conceptual Map Code: 0,1

The atmospheric electric discharge is a fundamental process of nature that converts electric energy into ionization, radiation, chemical products and heat.

Source: http://www.saint-h2020.eu/about-saint

Electric field - EF

Conceptual Map Code: 2-8, 12-16

An electric field is the force field that is created by electric charges. The electric field will affect a charge placed within the field by repelling or attracting it. [1, 2]. Electric fields are created by electric charges and are also induced by time-varying magnetic fields.

[1] Purcell and Morin, Harvard University. (2013). Electricity and Magnetism, 820pages (3rd ed.). Cambridge University Press, New York. ISBN 978-1-107-01402-2. [2] Richard Feynman (1970). The Feynman Lectures on Physics Vol II. Addison Wesley Longman. ISB

Electric mobility

Conceptual Map Code: 1

Classification used for determining size of an ion. In general a more commonly measured property than size of an ion. Defined as the drift velocity of an ion in a given electric field, and dependent on temperature and pressure.

W. C. Hinds. Aerosol technology: properties, behavior and measurement of airborne particles. John Wiley & Sons, New York, 1982.

Electric potential

Conceptual Map Code: 1,5,6,7,8,15,16

An electric potential (also called the electric field potential or the electrostatic potential) is the amount of work needed to move a unit positive charge from a reference point to a specific point inside the field without producing any acceleration. Typically, the reference point is Earth or a point at Infinity, although any point beyond the influence of the electric field charge can be used.

https://en.wikipedia.org/wiki/Electric_potential

Electrical conductivity - σ

Conceptual Map Code: 1,5,6,7,8,15,16

The ability to transmit electricity.

Electrical Low Pressure Impactor - ELPI

Conceptual Map Code: 1,8

ELPI®+ (Electrical Low Pressure Impactor) is an improved version of the widely used and well characterized ELPI® -system. ELPI®+ enables measurement of real-time particle size distribution and concentration in the size range of 6 nm – 10 µm with 10 Hz sampling rate.

https://www.dekati.com/products/Fine%20Particle%20Measurement/ELPI%C2%AE%2B

Electrical storm

Conceptual Map Code: 0,13,16

1. Popular term for thunderstorm.

2. Sometimes applied to a relatively rare condition of disturbed atmospheric electric field in the lower atmosphere that arises when strong winds are blowing and much dust is in the air, but there is no thunderstorm activity. Triboelectrification due to the blowing dust may charge fences and other metallic objects to such an extent that slight shocks are felt upon touch.

3. Same as earth-current storm.

http://glossary.ametsoc.org/wiki/Electric_storm

Electrojets

Conceptual Map Code: 16

Strong concentrated electric currents flowing in the lower ionosphere. The equatorial electrojet flows along the earth's magnetic dip equator and is present at all times, while the auroral electrojet is a more sporadic phenomenon occurring in association with auroral displays at high magnetic latitudes.

http://glossary.ametsoc.org/wiki/Electrojets

Electromagnetic field - EMF

Conceptual Map Code: 2,3,4,5,6,7,8,15,16

The combination of electric and magnetic fields as the result of the motion of an electric charge.

Electromagnetic radiation

Conceptual Map Code: 2,3,4,5,6,7,8,15,16

Energy propagated in the form of and advancing interaction between electric and magnetic fields. All electromagnetic radiation moves at the speed of light.

Electromagnetic spectrum

Conceptual Map Code: 2,3,4,5,6,7,8,15,16

A continuous range of wavelengths: all the types of light, radio waves, microwaves, IR, visible, UV, X-rays, and gamma rays.

Electrometeor

Conceptual Map Code: 2,13,16

A visible or audible manifestation of atmospheric electricity. This includes, therefore, not only igneous meteors, but also the sounds produced by them, principally thunder.

http://glossary.ametsoc.org/wiki/Electrometeor

Electromigration

Conceptual Map Code: 5

Electromigration is the movement of charged particles in the form of ions in the media due to the presence of an electric or magnetic field. Electrokinetic flows can occur at low current densities, ranging from 0.025–5 A m-2. These electric fields occur in soils and sediments due to natural potential gradients, but are also increasingly applied to remove contaminants from soils and sediments in a process called electro-remediation. The effective ionic mobility by electromigration of a specific ion in a soil is a function of its molecular diffusion coefficient, soil porosity, tortuosity factor and charge.

Probstein, R. F., & Hicks, R. (1993). Removal of contaminants from soils by electric fields. Science (Washington), 260(5107), 498-503.

Electron Density

Conceptual Map Code: 9, 14,16

Electron Density in a unit volume recorded in the ionosphere.

The DIAS Project (European Digital Upper Atmosphere Server)

http://dias.space.noa.gr:8080/LatestDias2/glossaryMin.jsp

Electron Transport Chain/System - ETC (S)

Conceptual Map Code: 4,5,6,7,8

An electron transport chain (ETC) is a series of molecules within cells, their membranes, or in the extracellular matrix, that transfer electrons from electron donors to electron acceptors via redox (both reduction and oxidation occurring simultaneously) reactions. This electron transfer results in the transfer of protons (H+ ions) across a membrane, which creates an electrochemical proton gradient that drives the synthesis of adenosine triphosphate (ATP), a molecule used to store energy. Electron transport chains are used for extracting energy via

redox reactions from sunlight in photosynthesis or, such as in the case of the oxidation of sugars, cellular respiration.

White D. (September 1999). The Physiology and Biochemistry of Prokaryotes (2nd ed.). Oxford University Press. ISBN 978-0-19-512579-5.

Electropermeabilisation

Conceptual Map Code: 4, 7 and 8

Changes in cell membrane permeability caused by electric fields

Electroporation

Conceptual Map Code: 4, 7 and 8

Generation of hydrophilic pores at the level of the membranes of the cells

Electrostatics

Conceptual Map Code: 2, 15

Electrostatics is a branch of physics that deals with study of the electric charges at rest.

Emission

Conceptual Map Code: 2

A flow of electromagnetic energy from an object with a temperature above absolute zero (0 K or –273 degrees Celsius).

Emissions of Light and Very Low Frequency Perturbations from Electromagnetic Pulse Sources - ELVES, elve

Conceptual Map Code: 2,12,13,16

The elve is usually a ring-shaped emission at around 100 km height produced by molecules excited by the electromagnetic shock wave of strong lightning strokes. The ring if reddish color and extends to sveral hundred km in diameter during its optical lifetime of about 1 millisecond. See also TLE.

Blaes et al., 2016, Global occurrence rate of elves and ionospheric heating due to cloud-to-ground lightning, J. Geophys. Res. Space Physics, 121, 699–712, doi:10.1002/2015JA021916

Van der Velde, O. A., and J. Montanya (2016), Statistics and variability

Endogenous biological chemiluminescence – UPE

Conceptual Map Code: 3,4,5,6,7,8

Emission of light from biological systems due to oxidative chemical reactions taking place within them. This luminescence is also called ultra-weak photon emission - UPE. Since electric fields applied to biosystems can induce oxidative and hence biological effects, monitoring oxidation due to electric field or electrode potential is important and can be achieved via monitoring UPE.

https://doi.org/10.1016/j.jphotobiol.2014.02.009, https://doi.org/10.1016/S0005-2736(99)00154-6, https://doi.org/10.1016/S0005-2736(98)00150-3

Epicenter

Conceptual Map Code: 9, 14,16

The epicenter is the point on the earth's surface vertically above the hypocenter (or focus), point in the crust where a seismic rupture begins.

U.S. Geological Survey Earthquake Hazards Program https://earthquake.usgs.gov/

Exposure systems

Conceptual Map Code: 4,6,7

Laboratory systems for the exposure of 'in vitro' and 'in vivo' to electromagnetic fields

Extensive Air Showers - EAS

Conceptual Map Code: 1,2

Cascade of ionized particles and electromagnetic radiation produced in the atmosphere when a primary cosmic ray enters the atmosphere.

Extraterrestrial radiation

Conceptual Map Code: 9,11,16

Electromagnetic energy from beyond the Earth, generally from the Sun. It is partly depleted by earth’s atmosphere.

Extrathoracic region - ET

Conceptual Map Code: 1,8

Consists of anterior nose (ET1) and the posterior nasal passages, laryns, pharynx, and mouth (ET2).

Human Respiratory Tract Model for Radiological Protection ICRP Publication 66Ann. ICRP 24 (1-3), 1994.

Extremely Low Frequency - ELF

Conceptual Map Code: 2

ELF electromagnetic waves in the 3-3000 Hz range produced naturally by lightning

F Region

Conceptual Map Code: 9, 14,16

The lowest layer of the Earth's ionosphere. It is between about 160 and 400 kilometers above Earth's surface. Also called the F Layer

SOHO, the Solar & Heliospheric Observatory WEBSITE

Fair weather - FW

Conceptual Map Code: 1,12,14

Weather conditions of low cloudiness, low wind speed, lack of fog and precipitation, which allow to study the global signal of the global atmospheric electric circuit at a location.

Field mill

Conceptual Map Code: 2,12,13

A device measuring the electric field based on electrostatic induction, consisting of electrodes periodically exposed to the electric field

Wahlin L., Atmospheric Electrostatics, Research Studies Press, 1986

Floral electric field

Conceptual Map Code: 6, 7, 8

The electric field arising from the proximity between a charged organism and a flower.

D Clarke, H Whitney, G Sutton, D Robert (2013) Detection and learning of floral electric fields by bumblebees. Science 340:66-69

Forecast

Conceptual Map Code: 0

A prediction of future events, conditions and occurrences based on available information from past experiences and a present situation.

Formation rate - J

Conceptual Map Code: 1

The rate at which aerosol particles/clusters of a given size are formed and it has a unit of cm-3s-1. The determination of this quantity requires a detailed analysis of the aerosol dynamic processes.

Kulmala, M., Petaja, T., Nieminen, T., Sipila, M., Manninen, H. E., Lehtipalo, K., Maso, M. D., Aalto, P. P., Junninen, H., Paasonen, P., Riipinen, I., Lehtinen, K. E., Laaksonen, A., and Kerminen, V.-M.: Measurement of the nucleation of atmospheric aeros

Galactic cosmic radiation - GCR

Conceptual Map Code: 1, 11

Cosmic rays arisen from sources outside the solar system, i.e. from deep space. The nucleonic component is primarily protons and alpha particles with energy from 1E+08 eV to more than 1E+20 eV.

United Nations Scientific Commitee on the Effects of Atomic Radiation (UNSCEAR), 2016. UNSCEAR 2016 Report, Report to the General Assembly, Annex B.

Gamma radiation (sub of ionizing radiation) -

Conceptual Map Code: 1, 11

Radiation resulting from radioactive decay of an atom emitting a high-energy photon (typically with energy above 100 keV). Since gamma radiation has no mass or charge, gamma rays have a much larger range than alpha or beta radiation and can be stopped by a dense enough material such as lead.

Geomagnetic equator

Conceptual Map Code: 0, 2, 14

The imaginary great circle exactly between the geomagnetic poles.

Geomagnetic field

Conceptual Map Code: 2,9,12,14

Geomagnetic field is the magnetic field that originates from the earth's interior and extends to space where its pattern can be modulated by the solar wind. The magnitude of the geomagnetic field at the Earth's surface is 25 to 65 microteslas (0.25 to 0.65 gauss).

Finlay C.C. et al., International Geomagnetic Reference Field: the eleventh generation, Geophysical Journal International. 183 (3): 1216–1230, 2010.

Geomagnetic pole

Conceptual Map Code: 0,2,14

"Positions on the Earth's surface where the geomagnetic field is vertical (i.e., perpendicular) to the ellipsoid." Source: https://www.ngdc.noaa.gov/geomag/GeomagneticPoles.shtml Those two points are the north and south ends of the earth's magnetic field.

Geomagnetic storm

Conceptual Map Code: 14

A geomagnetic storm is a temporary disturbance of the Earth's magnetosphere caused by intense solar wind.

Geophysics

Conceptual Map Code: 5

Geophysics is natural science concerned with the physical processes and physical properties of the Earth, and how it is influenced by its surrounding space environment. Biogeophysics is a sub-discipline concerned with the geophysical signatures of biotic interactions with geologic media, and spans disciplines such as geomicrobiology, biogeoscience, biogeochemistry and geophysics.

Gerdien cylinder/condenser

Conceptual Map Code: 1, 16

A device measuring the atmospheric ion concentration or air conductivity, consisting of two coaxial cylinder electrodes, the centre one connected to an electrometer

Wahlin L., Atmospheric Electrostatics, Research Studies Press, 1986

Global Electric Circuit - GEC

Conceptual Map Code: 1,2

The totality of electric currents flowing in the planet's atmosphere which form a closed electrical circuit

Global radiation

Conceptual Map Code: 2,11

The total short-wave radiation from the sky falling onto a horizontal surface on the ground. It includes both the direct solar radiation and the diffuse radiation resulting from reflected or scattered sunlight

https://www.pik-potsdam.de/services/climate-weather-potsdam/climate-diagrams/global-radiation

Granular biopersistent particles

Conceptual Map Code: 1,8

Particles that are characterized as respirable granular and biopersistent but not fibrous. Also known as “poorly soluble particles” or as “poorly soluble, low-toxicity particles”.

WHO guidelines on protecting workers from potential risks of manufactured nanomaterials ISBN 978-92-4-155004-8.

Growth rate - GR

Conceptual Map Code: 1

Describes how fast aerosol particles/clusters grow in size, typically given in nm/h. Aerosol particles in the atmopshere enlarge in size via condensation and coagulation. It is usually difficult to distinguish between the contributions of these two processes to the particle growth based on abiment observations. Therefore, the grwoth rate obtained from ambinet measurements often represents the overall growth rate.

Kulmala, M., Petaja, T., Nieminen, T., Sipila, M., Manninen, H. E., Lehtipalo, K., Maso, M. D., Aalto, P. P., Junninen, H., Paasonen, P., Riipinen, I., Lehtinen, K. E., Laaksonen, A., and Kerminen, V.-M.: Measurement of the nucleation of atmospheric aeros

Hazard

Conceptual Map Code: 1,8

The inherent potential to cause physical or psychological harm to the health of people.

WHO guidelines on protecting workers from potential risks of manufactured nanomaterials ISBN 978-92-4-155004-8.

Heat lightning

Conceptual Map Code: 12

Nontechnical, the luminosity observed from ordinary lightning too far away for its thunder to be heard. Since such observations have often been made with clear skies overhead, and since hot summer evenings particularly favor this type of observation, there has arisen a popular misconception that the presence of diffuse flashes in the apparent absence of thunderclouds implies that lightning is somehow occurring in the atmosphere merely as a result of excessive heat.

http://glossary.ametsoc.org/wiki/Heat_lightning

Heterogeneous nucleation

Conceptual Map Code: 1

Nucleation from the gas phase on a foreign surface or substanc. The nucleation can be from a single species on a foreign substance (heterogeneous-homomolecular) or nucleation of two or more species on a foreign substance (heterogeneous-heteromolecular).

High Aspect Ratio Nanoparticles - HARNs

Conceptual Map Code: 1,8

Are particles with one or two dimensions in the nanoscale that are much smaller than the others (HSE, 2013). Besides nanofibres, nanoplatelets (that present only one dimension in the nanoscale) are considered HARNs.

European Commission, "Guidance on the protection of the health and safety of workers from the potential risks related nanomaterials at work. Guidance for employers and health and safety practitioners" Brussels, 2014.

Homogeneous nucleation

Conceptual Map Code: 1

Nucleation from the gas phase without a surface or a pre-existing foreign nuclei. The nucleation can be from a single species (homogeneous-homomolecular) or nucleation of two or more species (homogeneous-heteromolecular).

Human bioclimatology

Conceptual Map Code: 9,17,18

The scientific discipline which seeks to understand the influence of climate and weather upon man.

http://biometeorology.org/

Human Respiratory Tract Model - HRTM

Conceptual Map Code: 1,8

Is the model to estimate pulmonary deposition, retention and biokinetic clearance to blood.

Human Respiratory Tract Model for Radiological Protection ICRP Publication 66Ann. ICRP 24 (1-3), 1994.

Hydrodynamic diameter

Conceptual Map Code: 1,8

The hydrodynamic size measured by Dynamic Light Scattering (DLS) is defined as “the size of a hypothetical hard sphere that diffuses in the same fashion as that of the particle being measured”. In practice though, particles or macromolecules in solution are non-spherical, dynamic (tumbling), and solvated. Because of this, the diameter calculated from the diffusional properties of the particle will be indicative of the apparent size of the dynamic hydrated/solvated particle. Hence the terminology, Hydrodynamic diameter. The hydrodynamic diameter, or Stokes diameter, therefore is that of a sphere that has the same translational diffusion coefficient as the particle being measured, assuming a hydration layer surrounding the particle or molecule.

International Standard ISO22412 Particle Size Analysis – Dynamic Light Scattering, International Organisation for Standardisation (ISO) 2008.

Hyperspectral remote sensing

Conceptual Map Code: 0,2

Remote sensing observation using electromagnetic energy from a large number of contiguous spectral bands.

Igneous meteor

Conceptual Map Code: 9

In U.S. weather observing practice, a visible electrical discharge in the atmosphere. Lightning is the most common and important type, but types of corona discharge are also included.

http://glossary.ametsoc.org/wiki/Igneous_meteors

Inhalabity of particles - nI

Conceptual Map Code: 1,8

Fraction of particles than enters the nose or mouth of those present in the volume al ambien air ths is inspired.

Human Respiratory Tract Model for Radiological Protection ICRP Publication 66Ann. ICRP 24 (1-3), 1994.

Insomnia

Conceptual Map Code: 8,19

Difficulty falling asleep or staying asleep, even when a person has the chance to do so. It is usually associated to daytime sleepiness, low energy, difficulty concentrating, and decreased

performance in work or at school. Mood swings, irritability, and anxiety are common associated symptoms.

Intermediate ion (sub of atmospheric ion)

Conceptual Map Code: 1

Atmospheric ion between the sizes of small and large ions. Mobility between 0.034 and 0.5 cm2 V-1 s-1 (typically size 1.6 to 7.4 nm)

U. H˜orrak, J. Salm, and H. Tammet. Sta s cal characterization of air ion m obility spectra at Tahkuse Observatory: Classification of air ions. Journal of Geophysical Research, 105(D7):9291–9302, 2000.

Intracloud flash - IC

Conceptual Map Code: 13, 14

A lightning flash without cloud-to-ground strikes, involving usually two oppositely charged cloud charge regions.

Ion

Conceptual Map Code: 1

An atom or molecule with a net electric charge due to the loss or gain of one or more electrons.

Ion balance equation

Conceptual Map Code: 1

An equation describing the processes of ion production rate, ion-ion recombination, ion-aerosol attachment and ion induced nucleation rates, thereby describing the number of atmospheric ions present in a system.

R. G. Harrison. Cloud formation and the possible significance of charge for atmospheric condensation and ice nuclei. Space Science Reviews, 94(1):381– 396, 2000.

Ion recombination

Conceptual Map Code: 1

The process by which ions of opposite polarities recombine and neutralise, thereby destroying both ions. It is proportional to a constant (alpha, the ion recombination coefficient)

W. A. Hoppel. Application of three-body recombination and attachment coefficients to tropospheric ions. Pure Applied Geophysics, 75:158–166, 1969

Ion-Aerosol attachment

Conceptual Map Code: 1

The process by which aerosols gain charge from ions. The rate at which ions attach to aerosol is dependent on the size of the aerosol present, the charges present on the aerosol, and the number of ions and aerosol present.

R. Gunn. Diffusion charging of atmospheric droplets by ions, and the resulting combination coefficients. Journal of the Atmospheric Sciences, 11(5):339–347, 1954.

Ion-induced nucleation

Conceptual Map Code: 1

Nucleation involving an ion. The presence of an ion often lowers the nucleation barrier

Ionizing radiation

Conceptual Map Code: 1, 11

Radiation (in the form of waves or particles) which is energetic enough to remove electrons from the orbit of an atom causing the atom to become charged (ionised).

Ionization

Conceptual Map Code: 9, 14,16

The process by which ions are produced, typically occurring by collisions with atoms or electrons ("collisional ionization"), or by interaction with electromagnetic radiation ("photoionization").

SOHO, the Solar & Heliospheric Observatory WEBSITE

Ionization energy -

Conceptual Map Code: 1

Minimum amount of energy required to remove an electron from a neutral atom to form a positively charged ion.

Ionization potential -

Conceptual Map Code: 1

An obsolete term for ionization energy.

Ionogram

Conceptual Map Code: 9, 14,16

Diagram of the time delay of HF echoes, in term of the virtual height of the ionospheric layers, recorded by an ionosonde over a range of different frequencies (typically between 1 and 20 MHz).

The DIAS Project (European Digital Upper Atmosphere Server)
http://dias.space.noa.gr:8080/LatestDias2/glossaryMin.jsp

Ionosphere

Conceptual Map Code: 9,12,13,14,16

A region in the atmosphere characterized by high concentration of free electrons and ions. Around the Earth, the ionosphere occupies roughly the 50 - 1000 km height range where ionizing radiation from the Sun (and, to less extent, galactic cosmic rays) produce free electrons and ions in a significant concentration. Generally, the ionosphere is thicker and its lower boundary is closer to the Earth during the day while it is thinner and its lower boundary is higher at night. The ionosphere is electrically conductive and has layers (D,E,F) in which the electron density has a local maximum. The layering of the ionosphere is varying, characteristically different during daytime and nighttime, and can be significantly affected by space weather events. According to a practical definition, the ionosphere is that part of the atmosphere in which the density of ionization is sufficient to deflect radio waves in the 2–30 MHz range. See also: 'lower ionosphere'.

B. Zolesi and L. R. Cander, Ionospheric Prediction and Forecasting, Springer Geophysics, DOI: 10.1007/978-3-642-38430-1_2, © Springer-Verlag Berlin Heidelberg 2014, Chapter 2.3.2

https://www.google.hu/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&cad=rja&uact=

Ionospheric Potential -

Conceptual Map Code: 2,12

This is a magnitude considered when hunderstorms and electrified clouds act as a meteorological generator and create a potential drop slow and non permanent in time (due to the spatiotemporal irregularity in thunderstorm activity) of Uint ≈ 240 kV between the ionosphere and the Earth's surface

SSN 0016 7932, Geomagnetism and Aeronomy, 2011, Vol. 51, No. 3, pp. 383–393. © Pleiades Publishing, Ltd., 2011.Original Russian Text © R.Yu. Lukianova, A.A. Kruglov, A.V. Frank Kamenetskii, A.L. Kotikov, G.B. Berns, V.D.R. French, 2011, Vol. 51, No. 3, pp

Ionospheric storm

Conceptual Map Code: 9, 14,16

A disturbance in the F region of the ionosphere, which occurs in connection with geomagnetic storms.

The DIAS Project (European Digital Upper Atmosphere Server)
http://dias.space.noa.gr:8080/LatestDias2/glossaryMin.jsp

Isobront

Conceptual Map Code: 2,9

A line on a map connecting points at which a given phase of thunderstorm activity occurred.

Isoceraunic

Conceptual Map Code: 2,9

A line on a map connecting points of equal frequency or intensity or simultaneous occurrence of thunderstorms (lightning discharges)

Isochasm

Conceptual Map Code: 2,9,12,14,16

A line on a map connecting points of equal frequency of aurora occurrence.

Isoclinic

Conceptual Map Code: 2,14

A line on a map connecting points of equal magnetic inclination.

Large ion (sub of atmospheric ion or Charged Aerosols -

Conceptual Map Code: 1

Some times referred to as Langevin ions (as discovered in 1905 by Langevin). These are atmospheric aerosols that have gained charge, typically by ion-aerosol attachment. Mobility of 0.00041 to 0.034 cm2 V-1 s-1 (size 4.8 - 79 nm).

U. H˜orrak, J. Salm, and H. Tammet. Sta s cal characterizaon of air ion mobility spectra at Tahkuse Observatory: Classification of air ions. Journal of Geophysical Research, 105(D7):9291–9302, 2000.

Leader

Conceptual Map Code: 9,14

A hot, conducting plasma channel in a lightning flash which is polarized into oppositely charged ends. The negative leader end propagates into the direction of positive cloud charge, and vice versa. The bidirectional leader tree maintains a zero net charge.

Lightning current

Conceptual Map Code: 2,12, 15

Electric current carried by lightning discharge

Lightning flash

Conceptual Map Code: 12,13

An electric discharge event, separable from other flashes by space and time criteria. In a flash, all processes from initial breakdown to leader growth and any strikes to ground are included.

Longwave radiation -LW

Conceptual Map Code: 2

Radiative energy in the infrared part of the spectrum, in the wavelength interval [4 – 100 µm]. Usually it is a terrestrial radiation.

Lower atmosphere

Conceptual Map Code: 17

Generally the troposphere, the lowest atmospheric layer.

Lower ionosphere

Conceptual Map Code: 9,12,13,14,17

The lower ionosphere is that region of the ionosphere where the level of ionization is primarily driven by photochemical processes as opposed to other regions where thermal and dynamic processes have equal or dominant role. This condition generally holds in the E layer and below. Usually, the part of the ionosphere below 100 km is considered as the lower ionosphere.

B. Zolesi and L. R. Cander, Ionospheric Prediction and Forecasting, Springer Geophysics, DOI: 10.1007/978-3-642-38430-1_2, © Springer-Verlag Berlin Heidelberg 2014, Chapter 2.4.1

https://www.google.hu/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&cad=rja&uact=

Lower positive charge region - LPCR

Conceptual Map Code: 9,12,14

Short living positive charge region just below the main negative layer in the model of tripole structure of the thundercloud.

Luminescence

Conceptual Map Code: 14

Emission of electromagnetic radiation not caused by the heat.

Magnetosphere

Conceptual Map Code: 9, 14

The region surrounding the earth or another astronomical body in which its magnetic field is the predominant effective magnetic field.

https://en.wikipedia.org/wiki/Earth%27s_magnetic_field#Magnetosphere

Mechanoreceptor hairs

Conceptual Map Code: 6, 7, 8

Hairs on the surface of most terrestrial arthropods (such as insects and spiders) that are sensitive to small, sometimes nanoscale, mechanical forces.

McIver SB 1985 Mechanoreception. in Kerkut GA, Gilbert LI, eds. Comprehensive Insect Physiol, Biochem and Pharma, Vol 6. Pergamon Press Oxford

Membrane potential

Conceptual Map Code: 6, 7

Membrane potential is the difference in electric potential between the interior and the exterior of a biological cell. With respect to the exterior of the cell, typical values of membrane potential range from –40 mV to –80 mV. https://en.wikipedia.org/wiki/Membrane_potential

Mental distress or psychological distress

Conceptual Map Code: 8, 12

A range of undifferentiated combinations of depression and general anxiety symptoms and experiences of a person's internal life that are commonly held to be troubling, confusing or out of the ordinary

Middle atmosphere

Conceptual Map Code: 17

"The region from the tropopause to the turbopause and even to the lower thermosphere." Source: Coupling from below as a source of ionospheric variability: a review Edward S. Kazimirovsky 2002.

Mobility distribution

Conceptual Map Code: 1

The amount of ions of a given mobility in an sample of ions, as measured by an air-ion spectrometer.

W. C. Hinds. Aerosol technology: properties, behavior and measurement of airborne particles. John Wiley & Sons, New York, 1982.

Modification of the energy Spectra - MOS

Conceptual Map Code: 2,12,14

Peaks and dips, arised in time series of count rates of surface particle detectors due to asymmetry of positive-to-negative flux of secondary cosmic rays in the terrestrial atmosphere.

Molecular ions

Conceptual Map Code: 1

Charge carriers in the form of monomers, e.g. HSO4-, NO3-, H3O+

Shuman, N. S., Hunton, D. E., and Viggiano, A. A.: Ambient and modified atmospheric ion chemistry: from top to bottom, Chem Rev, 115, 4542-4570, 10.1021/cr5003479, 2015.

Molecular modelling -

Conceptual Map Code: 3

Computational models for biomolecules as proteins, enzymes, membrane receptors

Mood

Conceptual Map Code: 8, 19

Person's everyday emotional state.

Nano-object

Conceptual Map Code: 1,8

Is a discrete piece of material with one or more external dimensions in the nanoscale (NOTE: This is a generic term for all nanoscale objects)

European Commission, “Guidance on the protection of the health and safety of workers from the potential risks related nanomaterials at work. Guidance for employers and health and safety practitioners” Brussels, 2014.

Nanofiber

Conceptual Map Code: 1,8

Is a nano-object with two similar external dimensions in the nanoscale and the third dimension significantly larger. A nanofibre can be flexible or rigid. The two similar external dimensions are considered to differ in size by less than three times and the significantly larger external dimension is considered to differ from the other two by more than three times. The largest external dimension is not necessarily in the nanoscale (ISO/TS 27687:2008). If the nanofibre has a length greater than 5 µm, a width less than 3 µm and a length to width ratio (aspect ratio) greater than 3:1, it meets the WHO criteria

European Commission, “Guidance on the protection of the health and safety of workers from the potential risks related nanomaterials at work. Guidance for employers and health and safety practitioners” Brussels, 2014.

Nanomaterial - NM

Conceptual Map Code: 1,8

A natural, incidental o manufactured material containing particles, in an unbound state or as an aggregate or as an angglomerate and wher, for 50% or mor of the particles in the number size distribution, one or more external dimensions is in the size range 1 nm - 100 nm. In specific cases and wher warranted by concerns for the environment, health, safety and competitiveness the number size distribution threshold of 50% may be replaced by a threshold between 1 and 50%. By derogation [from the above], fullerenes, graphene flakes, and single wall carbon nanotubes with one or more external dimensions below 1 nm should be considered as nanomaterials. Within this definition of nanomaterials, the terms "particle", "agglomerate" and "aggregate" are defined. Wher technically feasible and requested in specific legislation, compliance with the definition [of a nanomaterial] may be determined on the basis of the specific surface area by volume. A material should be considered as falling under the definition where the specific surface area by volume of the material is greater than 60 m2/cm3. However, a material which, based on its number size distribution, is a nanomaterial should be considered as complying with the definition even if the material has a specific surface area lower than 60 m2/cm3.

European Commission, “Guidance on the protection of the health and safety of workers from the potential risks related nanomaterials at work. Guidance for employers and health and safety practitioners” Brussels, 2014.

Nanoparticle

Conceptual Map Code: 1,8

Is a nano-object with all three external dimensions in the nanoscale (NOTE: If the length of the longest and the shortest axes of the nano-object differ significantly (typically by more than three times) the terms nanorod or nanoplate are intended to be used instead of the term nanoparticle).

European Commission, “Guidance on the protection of the health and safety of workers from the potential risks related nanomaterials at work. Guidance for employers and health and safety practitioners” Brussels, 2014.

Nanoscale

Conceptual Map Code: 1,8

Is the size range from approximately 1 nm to 100 nm (NOTE 1: Properties that are not extrapolations from a larger size will typically, but not exclusively, be exhibited in this size range. NOTE 2: The lower limit in this definition (approximately 1 nm) has no physical significance but is introduced to avoid single and small groups of atoms from being designated as nano-objects or elements of nanostructures, which might be implied by the absence of a lower limit).

European Commission, “Guidance on the protection of the health and safety of workers from the potential risks related nanomaterials at work. Guidance for employers and health and safety practitioners” Brussels, 2014.

Nanosecond pulsed electric fields - nsPEF

Conceptual Map Code: 4,8

Ultrashort electric pulses of a duration similar to streamer propagating in lightnings, used in some laboratories to analyze electric fields interactions with biological objects (cells, tissues, ...)

Natural radioactivity

Conceptual Map Code: 1, 11

Radioactivity arising from natural sources including both primordial radionuclides in the Earth's crust, and radionuclides being formed from the interaction of cosmic rays with the atmosphere and during thunderstorms and lightning conditions.

Negative cloud-to-ground lightning – CG-

Conceptual Map Code: 13

A discharge which transfers the negative charge from cloud to the ground, forming the downward branching pattern. It represents the most common type of lightning.

Neutral and Air Ion Spectrometer - NAIS

Conceptual Map Code: 1

An upgraded version of Air Ion Spectrometer. In addition to air ions, the NAIS can also measure uncharged aerosol particles in the electric mobility range of 3.2 – 0.0013 cm2V-1s-1.

Mirme, S., and Mirme, A.: The mathematical principles and design of the NAIS – a spectrometer for the measurement of cluster ion and nanometer aerosol size distributions, Atmos Meas Tech., 6, 1061-1071, 10.5194/amt-6-1061-2013, 2013.

Neutral atmosphere

Conceptual Map Code: 9

The term is used on the contrary of ionised part of the atmosphere.

Nucleation

Conceptual Map Code: 1

The formation of new aerosol particles from gaseous precursors.

Nucleation barrier

Conceptual Map Code: 1

An effective energy barrier that prevents the gas from nucleation although it is supersaturated in the gas phase

Optical remote sensing

Conceptual Map Code: 13,14

Remote sensing observation using electromagnetic energy from narrow spectral region.

Oxidation Reduction Potential - ORP

Conceptual Map Code: 11,14

Similar to redox potential; term used for measurements of redox potential in water. Unit: mV

Lee, J.-H., Jang, A., Bhadri, P. R., Myers, R. R., Timmons, W., Beyette, F. R., … Papautsky, I. (2006). Fabrication of microelectrode arrays for in situ sensing of oxidation reduction potentials. Sensors and Actuators B: Chemical, 115(1), 220–226. https:/

Particle

Conceptual Map Code: 1,8

A minute piece of matter with defined physical boundaries.

European Commission, "Guidance on the protection of the health and safety of workers from the potential risks related nanomaterials at work. Guidance for employers and health and safety practitioners" Brussels, 2014.

Particulate matter - PM

Conceptual Map Code: 1,8

A mixture of solid particles and liquid droplets suspended in the air. WHO guidelines on protecting workers from potential risks of manufactured nanomaterials ISBN 978-92-4-155004-8.

Particle transport

Conceptual Map Code: 1,8

Processess tha clear material from the respiratory tract to the grastrointestinal tract and to the lymph nodes, and move material from one part of the respiratory tract to another.

Human Respiratory Tract Model for Radiological Protection ICRP Publication 66Ann. ICRP 24 (1-3), 1994.

Peak current

Conceptual Map Code: 13

The maximum amount of current which a return stroke could have.

Peak discharge

Conceptual Map Code: 13

The maximum rate of discharge.

Photoionization

Conceptual Map Code: 13

The process by which is an ion made by electromagnetic radiation when an atom or a molecule loses one or more of its electrons.

Physical Ecology

Conceptual Map Code: 6, 7, 8

The study of the physical properties of an organism's environment and how organism interact with these physical properties.

Ref. David B. Dusenbery. Sensory Ecology.1992 Freeman and Co. NY

Positive cloud-to-ground lightning – CG+

Conceptual Map Code: 13

A discharge which transfers the positive charge from cloud to the ground.

Positive discharge

Conceptual Map Code: 13

Transfer of the positive charge from cloud to the ground.

Potential gradient - PG

Conceptual Map Code: 4, 12, 15, 16

A continuous increase or decrease in electric potential along a line between two points. The rate of change of electrical potential with distance. The rate of change of electric potential with respect to distance in the direction of greatest change across a cell membrane

https://en.oxforddictionaries.com/definition/potential_gradient

Precautionary principle

Conceptual Map Code: 1,8

Recourse to the precautionary principle presupposes: * Identification of potentially negative effects resulting from a phenomenon, product o procedure. * A scientific evaluation of the risk which because of the insufficiency of the data, their inconclusive or imprecise nature, makes is impossible to determine with sufficient certainty the risk in question.

European Commission, “Guidance on the protection of the health and safety of workers from the potential risks related nanomaterials at work. Guidance for employers and health and safety practitioners” Brussels, 2014.

Precipitation current

Conceptual Map Code: 1,2, 12

Electric current carried by precipitation particles

Primary ions

Conceptual Map Code: 1

The initial charge carriers resulting from ionization, e.g. N+, N2+, O+, O2+, e-, etc. These ions may include a fraction of simple molecular ions.

Shuman, N. S., Hunton, D. E., and Viggiano, A. A.: Ambient and modified atmospheric ion chemistry: from top to bottom, Chem Rev, 115, 4542-4570, 10.1021/cr5003479, 2015.

Protein

Conceptual Map Code: 3

Proteins are large biomolecules consisting of one or more long chains of amino acids. Proteins have a spatially complex distribution of electric charges in their structure. The charge distribution of proteins determines the nature and magnitude of the protein sensitivity to electric fiel. Since proteins are fundamental molecular machines which carry out the life processes, one of mechanisms of how electric field can act on a molecular scale is through influencing the protein dynamics and structure.

http://www.nature.com/doifinder/10.1038/nature20571,
https://doi.org/10.1016/j.bioelechem.2014.08.014

Q-burst

Conceptual Map Code: 2,13,16

Exceptionally powerful lightning discharges produce ELF band radio waves the amplitude of which can exceed that of the natural ELF background noise several times. These waves cause characteristic transient signals in the recorded time series as they reach ELF monitoring stations. These transient signatures are called Q-bursts. The most powerful waves can travel multiple times around the Earth and may temporarily excite the lowest Schumann resonance modes for a few hundred milliseconds.

Nickolaenko, A. P.; Hayakawa, M.; Hobara, Y., Q-Bursts: Natural ELF Radio Transients, Surveys in Geophysics, Volume 31, Issue 4, pp.409-425, 2010, DOI:10.1007/s10712-010-9096-9

Radioactive collector

Conceptual Map Code: 2, 12

A device measuring the potential gradient, consisting of an electrometer connected to a conducting antenna and an alpha radiation source in the vicinity of the antenna speeding up the equalisation of the potential of the antenna and the surrounding air

Wahlin L., Atmospheric Electrostatics, Research Studies Press, 1986

Radon - ^{222}Rn

Conceptual Map Code: 10,11

Radon is a chemical element with symbol Rn. It is a radioactive gas. It occurs naturally as an intermediate step in the normal radioactive decay chains through which thorium and uranium slowly decay into lead; radon itself is a decay product of radium. Its most stable isotope, 222Rn, has a half-life of 3.8 days.Unlike all the other intermediate elements in the aforementioned decay chains, radon is gaseous and easily inhaled. Radon gas is a health hazard. It is often the single largest contributor to an individual's background radiation dose, but due to local differences in geology, the level of the radon-gas hazard differs from location to location. Despite its short lifetime, radon gas from natural sources can accumulate in buildings, especially, due to its high density, in low areas such as basements and crawl spaces. Radon can also occur in ground water in some spring waters and hot springs.

Radon progeny

Conceptual Map Code: 1,11

Short-lived radioactive elements Po-218, Pb-214, Bi-214 and Po-214 which result from the radioactive decay of Radon (Rn-222).

Read across

Conceptual Map Code: 1,8

Transfer of hazard information from one material to another based on similarities between the materials.

WHO guidelines on protecting workers from potential risks of manufactured nanomaterials ISBN 978-92-4-155004-8.

Red Sprite

Conceptual Map Code: 2,12,13,16

Red sprites are optical flashes produced by streamer type electric discharges in the mesosphere. These discharges occur in a quasi-static electric field which can build up in the mesosphere after extremely powerful lightning discharges for a few milliseconds. Most often, several sprite entities show up quasi-simultaneously, sometimes in a rapid sequence (so-called 'dancing sprites'). There is a great variety of shapes of red sprites depending on the paths the heads of streamer discharges explore during the development of the event. Sprite entities are mostly vertical structures of length 20-50 km, while entities in a sprite cluster may be scatterd over an area of up to several hudred square km. The color of the emission is predominantly red at high altitudes while it contains more blue when produced in lower air regions. See also TLE.

Bór, 2013, Optically perceptible characteristics of sprites observed in Central Europe in 2007-2009, Journal of Atmospheric and Solar-Terrestrial Physics, 92: pp. 151-177, doi: 10.1016/j.jastp.2012.10.008

Reduction Oxidation Potential - Redox

Conceptual Map Code: 5

Measure of the tendency of a medium such as soil or water to acquire or release electrons. Quantity of redox potential is labeled as Eh and has a unit of mV.

Vorenhout, M., van der Geest, H. G., van Marum, D., Wattel, K., & Eijsackers, H. J. P. (2004). Automated and Continuous Redox Potential Measurements in Soil. Journal of Environment Quality, 33(4), 1562– 1567. https://doi.org/10.2134/jeq2004.1562; Fiedler,

Remote sensing

Conceptual Map Code: 0

Gathering information about an object or area from a distance without making physical contact with the examined phenomenon. The term is mostly used for Earth observation by satellites, airplanes or drones by electromagnetic sensors.

Richter scale

Conceptual Map Code: 9, 14,16

The Richter magnitude scale was developed in 1935 by Charles F. Richter of the California Institute of Technology as a mathematical device to compare the size of earthquakes. The magnitude of an earthquake is determined from the logarithm of the amplitude of waves recorded by seismographs. Adjustments are included for the variation in the distance between the various seismographs and the epicenter of the earthquakes. On the Richter Scale,

magnitude is expressed in whole numbers and decimal fractions. For example, a magnitude 5.3 might be computed for a moderate earthquake, and a strong earthquake might be rated as magnitude 6.3. Because of the logarithmic basis of the scale, each whole number increase in magnitude represents a tenfold increase in measured amplitude; as an estimate of energy, each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value.

U.S. Geological Survey Earthquake Hazards Program https://earthquake.usgs.gov/

Risk of bias

Conceptual Map Code: 1,8

The risk that the results of a study can be distorted due to methodological limitations such as the presence of confounders.

WHO guidelines on protecting workers from potential risks of manufactured nanomaterials ISBN 978-92-4-155004-8.

Runaway Breakdown/Relativistic Runaway Electron avalanches - RB/RREA

Conceptual Map Code: 14

A relativistic runaway electron avalanche (RREA) is an avalanche growth of a population of relativistic electrons driven through a material (typically air) by an electric field.

Schumann resonance transient

Conceptual Map Code: 2,13,17

See Q-burst

Schumann resonances - SR

Conceptual Map Code: 2

The Schumann resonances are a set of spectrum peaks in the extremely low frequency (ELF) portion of the Earth's electromagnetic field spectrum. Schumann resonances are global electromagnetic resonances, generated and excited by lightning discharges in the cavity formed by the Earth's surface and the ionosphere. Schumann resonances are the principal background in the part of the electromagnetic spectrum (Sentman, 1995) and appear as distinct peaks at ELF around 7.8 Hz (fundamental), 14.3, 20.8, 27.3 and 33.8 Hz.

Sentman D.D., Schumann resonances, In: Hans Volland (ed.), Handbook of atmospheric electrodynamics, Volume 1, pp. 267-296, CRC Press, London, 1995.

Self-potential - SP

Conceptual Map Code: 5

Self potential, or spontaneous potential, is a naturally occurring electric potential difference in the Earth, measured by an electrode relative to a fixed reference electrode. SPs are usually caused by charge separation in clay or other minerals, due to presence of semi-permeable interface impeding the diffusion of ions through the pore space of rocks, or by natural flow of a conducting fluid, e.g. (contaminated) ground water flows.

Revil, A., Naudet, V., Nouzaret, J., & Pessel, M. (2003). Principles of electrography applied to self-potential electrokinetic sources and hydrogeological applications. Water Resources Research, 39(5).

Sensory Ecology

Conceptual Map Code: 6,7,8

The study of how and why organisms acquire information from their environment.

Ref. David B. Dusenbery. Sensory Ecology.1992 Freeman and Co. NY

Shortwave radiation - SW

Conceptual Map Code: 2

Radiative energy in the visible, near-ultraviolet and near-infrared spectra, in the wavelength interval [0.4 – 1.0 µm]. Usually it is a solar radiation.

Small ion (sub of atmospheric ion)

Conceptual Map Code: 1

Atmospheric ions created by natural or anthrogenic means. They rapidly undergo clustering to form hydrates and would break apart if it did not have charge. Mobility from 0.5 - 3.2 cm^2 V^-1 s^-1 (diameter 0.36 - 1.6 mm)

U. H˜orrak, J. Salm, and H. Tammet. Sta s cal characterizaon of air ion mobility spectra at Tahkuse Observatory: Classification of air ions. Journal of Geophysical Research, 105(D7):9291–9302, 2000.

Solar cosmic radiation

Conceptual Map Code: 1, 11

Cosmic rays generated near the surface of the sun by magnetic disturbances. These solar particles are comprised mostly of protons with energies generally below 100 MeV and only rarely above 10 GeV.

United Nations Scientific Commitee on the Effects of Atomic Radiation (UNSCEAR), 2016. UNSCEAR 2016 Report, Report to the General Assembly, Annex B.

Solar Flare

Conceptual Map Code: 9, 14,16

Rapid release of energy from a localized region on the Sun in the form of electromagnetic radiation, energetic particles, and mass motions.

glossary for the Solar Flare Theory web site by Gordon Holman and Sarah Benedict.

Responsible NASA Official: Gordon D. Holman, Heliophysics Science Division, NASA/Goddard Space Flight Center, Solar Physics Laboratory / Code 671, Gordon.D.Holman@nasa.gov

Solar storm

Conceptual Map Code: 9,14

A major disturbance in the planet's magnetosphere resulting from the arrival of very disturbed solar wind and propagating down through the planet's atmosphere. The effects cause the disturbance of the magnetic field, electric field and currents, aurora, particle precipitation, and it can also be measured at low latitudes

Solar wind

Conceptual Map Code: 9, 14

The solar wind is a stream of charged particles released from the upper atmosphere of the Sun (the corona). This plasma consists of mostly electrons, protons and alpha particles.

https://en.wikipedia.org/wiki/Solar_wind

Solubility

Conceptual Map Code: 1,8

The ability of a material to release ions in water or in another liquid. Solubility may be expressed by the dissolution rate of the material and may also be described using words such as insoluble, very soluble or poorly soluble.

WHO guidelines on protecting workers from potential risks of manufactured nanomaterials ISBN 978-92-4-155004-8.

Space Environmental Viewing and Analysis Network - SEVAN

Conceptual Map Code: 1

Particle detector

Space Weather

Conceptual Map Code: 9

Changes in the space environment of the Earth can affect human tecnologies and life. Compared to the quasi-stable average radiation output of the Sun which characterises space climate, significant variaions can occur on shorter time-scales (e.g., eruptions of the Sun) which cause geomagnetic storms and signifikan change in cosmic particle fluxes. Space weather refers to such relatively short time-scale but significan varitions in the space environment of the Earth.

Messerotti M. (2004) Space Weather and Space Climate. In: Seckbach J., Chela-Flores J., Owen T., Raulin F. (eds) Life in the Universe. Cellular Origin and Life in Extreme Habitats and Astrobiology, vol 7. Springer, Dordrecht Space weather; Canadian Space

Sporadic E layer - Es

Conceptual Map Code: 14,16

A relatively thin ionospheric layer which appears between 90 and 140 km heights independently from the regular E layer. The attribute 'sporadic' refers to the variability of the layer in terms of its altitude, duration, and lateral extension. Es layers can have different patterns at high, middle, and low latitudes caused by different production mechanisms. The most widely accepted production mechanism is based on wind shear, where heavy ions dragged by high altitude winds of opposite directions are forced by the geomagnetic field of the Earth to concentrate in the layer of wind reversal.

B. Zolesi and L. R. Cander, Ionospheric Prediction and Forecasting, Springer Geophysics, DOI: 10.1007/978-3-642-38430-1_2, © Springer-Verlag Berlin Heidelberg 2014, Chapter 2.4.2

https://www.google.hu/url?sa=t&rct=j&q=&esrc=s&source=web&cd=3&cad=rja&uact=

Sprite Halo

Conceptual Map Code: 2,12,13,16

Sprite halos are diffuse glow discharges extending to a circular area with a diameter of few tens of km. These red emissions occur when the background electric field in the mesosphere

becomes very strong in a very short time, usually after powerful lightning strokes having very strong lightning current. Their optical lifetime is only a few milliseconds. See also TLE.

Williams et al., 2012, Resolution of the sprite polarity paradox: The role of halos, Radio Science, 47, RS2002, doi: 10.1029/2011RS004794,

St. Elmo's fire

Conceptual Map Code: 6, 7, 16

(Also called Elmo's fire, corposant.) Corona or point discharges that occur when the environmental electric field is high, typically at the tips of sharp conductors that enhance the electric field. This name was given the phenomenon by Mediterranean sailors who regarded it as a visitation of their patron saint, Elmo (Erasmus). Their superstition also led to the equivalent term corposant. An appearance of St. Elmo's fire was regarded as a good omen, for it tends to occur in those latter phases of a violent thunderstorm when most of the surface wind and wave disturbance is over

Schonland, B. F. J. 1950. The Flight of Thunderbolts. 44–47.
http://glossary.ametsoc.org/wiki/St._elmo%27s_fire

Streak lightning

Conceptual Map Code: 13

A single lightning channel in an electric cloud to ground discharge.

Streamer

Conceptual Map Code: 1,16

A cool, quasi-neutral plasma channel with a moving tip formed by electron avalanches

Sunspot

Conceptual Map Code: 9, 14,16

A temporary disturbed area in the solar photosphere that appears dark because it is cooler than the surrounding areas. Sunspots consist of concentrations of strong magnetic flux. They usually occur in pairs or groups of opposite polarity that move in unison across the face of the Sun as it rotates.

glossary for the Solar Flare Theory web site by Gordon Holman and Sarah Benedict.

Responsible NASA Official: Gordon D. Holman, Heliophysics Science Division, NASA/Goddard Space Flight Center, Solar Physics Laboratory / Code 671 Gordon.D.Holman@nasa.gov

Tectonic plates

Conceptual Map Code: 9, 14,16

The tectonic plates are the large, thin, relatively rigid plates that move relative to one another on the outer surface of the Earth.

U.S. Geological Survey Earthquake Hazards Program https://earthquake.usgs.gov/

Ternary homogeneous nucleation

Conceptual Map Code: 1

Homogeneous-heteromolecular nucleation with three substances. In the Earth's atmosphere a typical system is homogeneous nucleation of sulfuric acid, water and ammonia.

Terrestrial Gamma Flashes - TGF

Conceptual Map Code: 14

A terrestrial gamma-ray flash (TGF) is a burst of gamma rays produced in Earth's atmosphere. TGFs have been recorded to last 0.2 to 3.5 milliseconds, and have energies of up to 20 million electronvolts. It is speculated that TGFs are caused by intense electric fields produced above or inside thunderstorms.

The Carnegie Curve

Conceptual Map Code: 2,12

This is a single diurnal cycle variation in the atmospheric electric field (maximum around 19UT and minimum around 03UT). It is globally independent of the measurement position and known as the Carnegie curve. This name was received after the geophysical survey vessel of the Carnegie Institution of Washington on which the original measurement campaigns demonstratied the universal time variation.

Harrison, R.G. Surv Geophys (2013) 34: 209. https://doi.org/10.1007/s10712-012-9210-2

Thunderstorm -

Conceptual Map Code: 12,13

An electrified cloud, of cumulonimbus type, in which at least one lightning discharge is produced. A rain-bearing cloud that also produces lightning.

https://www.weather.gov/phi/ThunderstormDefinition

Thunderstorm cell

Conceptual Map Code: 12,13

The convective cell of a cumulonimbus cloud having lightning and thunder.

http://glossary.ametsoc.org/wiki/Heat_lightning

Thunderstorm Ground Enhancement - TGE

Conceptual Map Code: 12,13

Enhanced fluxes of high-energy electrons, gamma rays and neutrons

Total Electron Content - TEC

Conceptual Map Code: 9, 14,16

The Total Electron Content (TEC) is the total number of electrons present along a path between a radio transmitter and receiver. Radio waves are affected by the presence of electrons. The more electrons in the path of the radio wave, the more the radio signal will be affected. For ground to satellite communication and satellite navigation, TEC is a good parameter to monitor for possible space weather impacts. TEC is measured in electrons per square meter. By convention, 1 TEC Unit TECU = 10^16 electrons/m^2. Vertical TEC values in Earth's ionosphere can range from a few to several hundred TECU.

The DIAS Project (European Digital Upper Atmosphere Server)

http://dias.space.noa.gr:8080/LatestDias2/glossaryMin.jsp

Transient Luminous Event - TLE

Conceptual Map Code: 2,12,13,16

Transient luminous event is a collective name for various optical phenomena which occur within the altitude range of 15-110 km as a consequence of rapid re-distribution of electric charge in an underlaying active thundestorm. These brief flashes with optical duration less than can 1 second occur in many forms and have different production mechanisms. TLEs in the mesosphere (sprites, sprite halos, and gigantic jets) can perturb the propagation of VLF waves while TLEs at high altitudes (sprites, gigantic jets, ELVES) perturb (i.e., heat, influence) the lower ionosphere and can cause secondary effects in the Earth-ionosphere waveguide.

Pasko, V. P., Y. Yair, and C.-L. Kuo (2012), Lightning related transient luminous events at high altitude in the Earth's atmosphere: Phenomenology, mechanisms, and effects, Space Sci. Rev., 168, 475–516, doi:10.1007/s11214-011-9813-9

Translocation

Conceptual Map Code: 1,8

The transfer of material absorbed from the respiratory tract to other tissues in the body.

Human Respiratory Tract Model for Radiological Protection ICRP Publication 66Ann. ICRP 24 (1-3), 1994.

Triboelectrification

Conceptual Map Code: 2,3

A process of charge separation that involves the rubbing together of material surfaces. The triboelectric series is a classification scheme for the ordering of the tendency for positive charge acquisition in rubbing. The detailed physical mechanism in triboelectrification is a long unsolved problem.

http://glossary.ametsoc.org/wiki/Triboelectrification

Tribolectricity

Conceptual Map Code: 6, 7,8

Static electricity is generated during the contact or friction between the surfaces of dissimilar materials. When separated, each material acquires a charge of opposite polarity, hence undergoing triboelectric charging. This is synonym to contact electrification.

Ref: AF Diaz, RM Felix-Navarro (2004) A semi-quantitative tribo-electric series for polymeric materials: the influence of chemical structure and properties. Journal of Electrostatics 62:277-290

Ultrafine particles - UFPs

Conceptual Map Code: 1,8

The smallest fraction of ambient particulate matter and are defined as airborne particles with a diameter in the nanoscale. It is used when referring to naturally-ocurring nanomaterials.

European Commission, “Guidance on the protection of the health and safety of workers from the potential risks related nanomaterials at work. Guidance for employers and health and safety practitioners” Brussels, 2014.

Upper atmosphere

Conceptual Map Code: 17

Generally the thermosphere, the uppermost layer of the atmosphere.

Van Allen radiation belts

Conceptual Map Code: 1, 11

Cosmic rays formed through the capture of protons and electrons by the earth's magnetic field. Energies of protons are several hundred megaelectronvolts and those of electrons a few megaelectronvolts.

United Nations Scientific Commitee on the Effects of Atomic Radiation (UNSCEAR), 2016. UNSCEAR 2016 Report, Report to the General Assembly, Annex B.

Very Low Frequency - VLF

Conceptual Map Code: 2,13

VLF electromagnetic waves in the 2-30 kHz range produced naturally by lightning

Wilson antenna

Conceptual Map Code: 2, 12

A device measuring the atmospheric electric current density

Wahlin L., Atmospheric Electrostatics, Research Studies Press, 1986

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COST Association
Avenue Louise 149 I 1050 Brussels, Belgium
t: +32 (0)2 533 3800 I f: +32 (0)2 533 3890
office@cost.eu I www.cost.eu