

Faculty of Biological, Agronomic and Environmental Engineering

BIR1333

Bioclimatology

[15h+7.5h exercises] 2 credits

This course is taught in the 1st semester

Teacher(s): Thierry Fichet, Guy Schayes (supplée Jean-Pascal van Ypersele de Strihou), Jean-Pascal van Ypersele de Strihou

Language: French

Level: First cycle

Aims

This course has for main objective to initiate the student into the bioclimatology and associated meteorological aspects. It especially leads the student to:

- understand, leaning on basis in physics, the mechanisms leading to the climate formation at different scales (from the global one to that of the microclimatic station);
- understand the interactions between these mechanisms and the vegetation cover as well as the soil;
- be initiated into the instruments of measure of climatic factors and into the use of climatic data, obtained through meteorological networks, for agronomical and environmental applications.

These leading themes allow the student to catch the importance of the climatic factors for the biomass production, the species distribution on the Earth, the rural planning, and the impact of human-induced changes of the environment on the microclimate.

Main themes

1. Physical bases necessary to the understanding of the mass and heat exchanges in the low layers of the atmosphere, inside vegetation populations and in the upper soil layers: a) radiation: review of the laws, natural radiation, interaction between electromagnetic radiation and plants, use of the active photosynthetic radiation, radiative balance; b) heat and mass exchanges by conduction and convection; c) water: atmospheric moisture, precipitation, water path in the continuum soil-plant-atmosphere, potential and real evapotranspiration.
2. Mechanisms of climate formation, from the global scale to the microclimatic station one: a) atmosphere: structure, vertical profiles in the low layers, lateral movements, atmospheric circulation, clouds and precipitation, greenhouse effect; b) topoclimates and microclimates: effects of the elements of the landscape, dynamic and thermal action of the topography and the vegetation; c) influence of human activities on the climate and impacts of the global warming on the agronomic activities.
3. Agroclimatology: a) collection, organisation, treatment, and analysis of agroclimatic data (networks); b) measuring the climatic factors (temperature, moisture, precipitation, wind speed and direction, radiative balance components) and description of the main instruments used for the measuring of these factors; c) climatic indexes (temperature sum).

Content and teaching methods

The first part is essentially dedicated to bases necessary to understand the physical and dynamic meteorological phenomena. It includes the climate classification. The second part develops some aspects of the agrometeorology and the applied climatology. The exercise part illustrates the course and introduces the student to the practical meteorology. The course includes indispensable elements for the understanding of the bases of climatology without entering too complex details.

First part: Introduction to meteorology and climatology. 1. Important physical factors in meteorology: a) radiation: transfers in the atmosphere, energetic balances, b) physical properties of the air: moist air thermodynamics, adiabatic transformations and applications, air stability, c) wind dynamics: Coriolis acceleration, geostrophical wind, thermal and dynamic cell. 2.

Repartition of elements on the Earth: a) atmospheric general circulation, air masses, polar front and its perturbations, tropical meteorology, b) water cycle in the atmosphere: evaporation, precipitation. 3. Köppen's climate distribution on the Earth, influence of local factors on the global climate.

Second part: Agrometeorology and applied climatology. 1. Micro-meteorology: a) bases of atmospheric turbulence and energy exchanges near the ground, wind and temperature structure in the low atmosphere, nocturnal minimum temperature, b) evapotranspiration, local hydric balance. 2. Meso-meteorological phenomena: a) valley wind, thermal breeze, topographic effects, b) precipitation formation, thunderstorms, fronts, squall lines. 3. Meteorological aspects of the air pollution (for students CMAG 23, or. 4c only): a) diffusion, transport and fallouts, b) mathematical modelling. 4. Climatic system and human's action on climate: a) energy and radiatively active gases (CO₂, CH₄, etc#), b) deforestation, desertification, climatic variations.

Practical work: instruments, meteorological data, illustration of the aerological diagram, simple hydrological model, weather forecasting, and agronomical applications.

Other information (prerequisite, evaluation (assessment methods), course materials recommended readings, ...)

Precursory courses: all courses of BIR11 and BIR12

Material: recommended source: Gérard Guyot "Climatologie de l'environnement. De la plante aux écosystèmes", Masson, Paris, 1997.

Teaching staff: team of teachers

Other credits in programs

ARCH12BA	Deuxième année de bachelier en sciences de l'ingénieur, orientation ingénieur civil architecte	(2 credits)	
ARCH13BA	Troisième année de bachelier en sciences de l'ingénieur, orientation ingénieur civil architecte	(2 credits)	
BIR13BA/A	Troisième année de bachelier en sciences de l'ingénieur, orientation bioingénieur (option : agronomie)	(2 credits)	Mandatory
BIR13BA/E	Troisième année de bachelier en sciences de l'ingénieur, orientation bioingénieur (option : environnement)	(2 credits)	Mandatory
ENVI3DS/4	Diplôme d'études spécialisées en science et gestion de l'environnement (Administration publique, environnement)	(2 credits)	Mandatory
ENVI3DS/5	Diplôme d'études spécialisées en science et gestion de l'environnement (Santé et environnement)	(2 credits)	Mandatory
ENVI3DS/6	Diplôme d'études spécialisées en science et gestion de l'environnement (Science et environnement)	(2 credits)	Mandatory