VIRTUAL TRAINING LABORATORY (VTL) AT THE WMO RTC OF THE RUSSIAN FEDERATION

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Development and introduction in educational process of innovative educational programmes and technologies, wide use of world information resources are necessary and actual now. It is obviously, that existing forms and ways of information delivery to trainee will change a lot. First of all, traditional manuals and textbooks will be replaced by electronic analogues. Therefore, creation of educational web-portals becomes more and more important and popular among education and training community.

In the framework of the WMO Space programme, it is recommended that efforts of WMO RTCs should be aimed at improvement of space components of the global observation system and at facilitating of wide use of satellite data and products for different purposes including organization of specialized hydrometeorological education and training. Creation of virtual laboratories and centres of excellence network is one of the ways to achieve these purposes.

There are a lot of training hydrometeorological modules produced. An example of high qualitative distance learning tool is COMET modules (www.comet.ucar.edu) which were developed for training of experts in different fields for the USA NHMS. COMET gained the international recognition and their training modules are widely used. Some COMET modules are translated into Russian (www.meted.ucar.edu/resource-modlist.php). Under the aegis of the Network of the European NHMSs, EUMETCAL (http://eumetcal.meteo.fr) is successfully established. In the framework of WMO programme, training resources in the field of aviation meteorology (www.caem.wmo.int) is also available. However some of the web-sites available might be referred to information sites, instead of training sites.

From our point of view, it is rationally to follow three main principles while developing of training materials:

- Adequacy of the content,
- Efficiency of the form of information representation,
- Economic efficiency.

Adequacy means completeness and sufficiency of representation of teaching materials, use of various forms of learning and control. Efficiency of forms of information representation includes such requirements as simplicity and convenience of use, convenient navigation, ergonomics, possibility of the further perfection of materials, provision of communication between trainee and tutor. Economic efficiency depends on duration of operation and reasonable configuration hardware and software used. Wide resources and potential of computer and internet technologies should be used taking into account ergonomics requirements, psychophysiological features of human perception and didactic purpose of teaching materials to be developed. It is also necessary to keep in mind that the system of knowledge instead of their sum should be presented in composing of teaching material.

In general there are three types of VTLs, namely: procedural, declarative and hybrid. Let's consider the first type. Basis of procedural VTL as applied to meteorological education and training is training packages of application software for automation of meteorological calculations and forecasts. Usually mathematical modeling, methods of statistical analysis, optimization of studied objects or processes are the main component of such VTL. However automation of meteorological calculations and forecasts in training purposes not always leads to improvement of educational and training quality. The high training potential of VTL consisting in possibility to study properties of various objects and processes by means of mathematical modeling and computing experiments remains non-realized often since work with VTLs demands certain knowledge and considerable high qualification of trainee. In this case, to our mind, specially developed didactic interface can help which is based on the following principles:

- definition of interesting typical and instructive tasks,
- organisation of appropriate management and control of cognitive activity of trainee,
- obligatory heuristic solution of problems with subsequent comparison with computer variant of the solution,
- organization of competitive situations for promotion of trainee cognitive activity.

Experience of realization of these principles in educational and training process at the WMO RTC in Russia on programmes of improvement of professional skill of meteorologists and meteorological technicians has shown high didactic efficiency. Studying of hydrometeorological equipment and devices, including satellite meteorological systems have a great value. For this purpose further improvement of virtual training facilities are foreseen at Roshydromet IQI which can be classified as a systems of
declarative type. It is supposed to provide them with virtual analogues of hydrometeorological devices, systems, complexes and devices. It is necessary to note that now in Russia the first version of the satellite VTL integrated with existing technological structure of Roshydromet is produced and introduced in practice. The Russian language VTL site is: http://wmo.scanex.com/.

The site accumulates the lectures grouped in 13 various sections, namely:

- «WMO Space programme»,
- «Space hydrometeorological systems»,
- «From satellite images to information products»,
- «Spectral ranges and their application»,
- «Cloud systems»,
- «Atmosphere dynamic characteristics»,
- «The world ocean and climate»,
- «Ice cover»,
- «Water objects»,
- «Modelling of floodings»,
- «Vegetative cover»,
- «Hazardous phenomena»,
- «Environmental pollution».

The structure of VTL includes sections with description of technical objects including graphic illustrations (photos, schemes, pictures etc.) and hyperlinks to video-audio-materials and animations.

For raising efficiency of perception of teaching material, to our minds, use of such technical means as flash-animations is expedient. At the end of each section it is useful to ask questions for self-control with the short comments "hidden" under hyperlinks that allow to make training process interactive. Such electronic support of training process will allow:

- to raise activity of trainee by promoting their self-study process,
- to improve perception of teaching material through multimedia capability,
- to provide the full control of knowledge digestion by each trainee,
- to make easier the process of preparation for examinations and tests,
- to use out-of-class time for studying of devices, systems, complexes, etc.,
- to introduce and facilitate distance learning.

Besides of this, use of VTL resources will essentially make lower expenses for acquisition of the expensive equipment, devices etc. Further it is supposed also to introduce the hybrid approach to construction of VTL with use of imitating modeling. At that the control panel of meteorological device is displayed visually adequately to its real analogue, and various natural processes or phenomena might be investigated in their development by means of mathematical or imitating models. Consecutive realization of various approaches to creation of meteorological VTL at WMO RTC in Russia will allow to realise the most effective, in didactic terms, complex approach when support of training of all target groups is provided.

The most part of teaching materials of the VTL are prepared by leading experts of WMO RTC of Russia. Excepting lecture materials, reference materials, curricula and programmes on satellite
meteorology for high educational institutions and courses of qualification improvement are included in the Russian satellite VTL. Teaching materials of the Russian VTL have block hypertext structure. The block structure means that all teaching materials are divided by rather independent educational blocks, for each of which the list of purposes, tasks and control questions are formulated. The hypertext structure provides opportunity to move from block to block and studying it according to already available knowledge and in a requested sequence.

Computer testing has an essential value in system of distant learning since it is the universal tool for control of trainee’ level of knowledge gained. In framework of the Russian VTL it is supposed to carry out two kinds of testing: so called frontier and training testings. Frontier testing will be conducted after completion of studying each module. The purpose of frontier testing is definition of level of knowledge received by trainee. Training testing is intended for self-work of trainee and is used by tutor as training technology for explaining of certain theme or topic.

Use of satellite data and world information resources will essentially raise quality of hydrometeorological education, training and raising the level of professional skills and continuing education of hydrometeorological personnel. VTL should be considered as a part of hydrometeorological training portal which will be further developed for purposes of remote training. However, from our point of view, the best results might be only reached using combination of electronic and traditional training when the trainee study theoretical part of the programme distantly, but practical part is organized face to face.

Now WMO RTC of the Russian Federation is undertaking measures to get the status of the WMO Centre of Excellence for RA II and VI (Europe and Asia). The purpose is to establish the working group for gathering of the operative satellite information and its use in teaching process for hydrometeorological education, training and raising the level of professional skills and continuing education of the personnel of Roshydromet and NHMSs of other member countries.