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Monitor of Qinghai-Tibet Plateau Hydro-Thermal Circulation with Heat Pulse

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Global warming and the effect of human activity in recent years caused a series of problems including permafrost degradation and glacial ablation. These problems will have a negative effect on the Northwest China. It is a challenge about how to monitor the magnitude of the effect. Now in situ monitoring system of stratum water's hydro-thermal characters based heat pulse provides a very good technical means. Water ratio, temperature, thermal conductivity and velocity of permeability of stratum are the important characters in studying the Hydro-thermal Circulation between the ground water and surface water. We developed a new system that can measure these characters in situ. The system's hardware includes one heat pulse circuit and three temperature measure circuits. The heating power is 0.5W and the duty time of every heat pulse is 8s. Three temperature measure circuits can measure the change of stratum's temperature accurately after the heat pulse issued. The temperature resolution is 0.001℃, precision is 0.01℃ and sampling rate is 1 Hz. The instrument also can measure the stratum's temperature easily and reliably. It can fit the other hydrothermal characters through the soft.

The heat pulse has the connatural advantage on the study of the strata water and heat parameters because the process that heat moved in the stratum is closely related to the strata water and heat parameters. This essay focused on the system's massive structure and soft design flow. It also give some advice about how to designing the instrument that mainly using in the Frigid Zone. Qinghai-Tibet plateau is a typical high land and cold region. Permafrost, segregated frozen ground and glacier distribute widely. The instrument will be installed on the typical frozen soil section: Xidatan to Naqu section along Qinghai-Xizang railway, where the geological research level is higher than other section. The distance is 800 kilometers. Xidatan to Dangxiong section is the permafrost region. It is one of the coldest regions of China.

Key words: monitor, Heat pulse, Qinghai-tibet plateau, Hydro-thermal Circulation

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References

Deqiang Mao, Li Wan, and Tian-chyi J. , 2011. A revisit of drawdown behavior during pumping in unconfined acquirers. Water Resource Research, P.WO5501.1- P.WO5501.15.

T.Ren, G.J.Kluitenberg, R.Horton, 2000. Determining Soil Water Flux and Pore Water Velocity by a Heat Pulse Technique. Soil SCI SOC.Am.J.,41: 552-554.

Y.Mori, Hopmans J.W., 2005. A.P.Mortensen.Estimation of Dadoes Zone Water Flux from Multi-Functional Heat Pulse Probe measurements. Soil SCI SOC.Am.J., 40:600-602.

Quanjiu Wang, Tyson E.Ochsner, 2002.Mathematical analyses of heat signal for soil water flux determination [J]. Water Resources Research,37:342-344.

Xingxing Kuang, Jiu Jimmy Jiao, Li Wan,2011. Air and Water flow in a vertical sand column.Water resource research, P. WO4506.1- P.WO4506.15.

Abramowitz, M.and I. Stegun,1972. Handbook of mathematical function, New York:Dover Publications Inc., 35.

Bilskie T.R,R.Horton,and K.C.Bristou, 1998. Test of a dual-probe heat-pulse method for determining thermal properties of porous materials.Soil Sci,45:33-45.

Kluitenberg, G.J., K.L. Bristow and B.S. Das, 1995.Thermal gradients as a tool for content of unsaturated sandy soil using dual-probe heat-pulse. Soil Sci. 67:50-65.

Bristow, K.L, 2001. A small multi-sensor probe for measuring soil thermal properties. Water Resource,12:513–522.

Basinger, J.M.and G.J. Kluitenberg,2003.Laboratory evaluation of the dual-probe heat-pulse method for measuring soil water content.Vadose Zone,54:122-138.

JIN Sheng , ZHANG Let ian1and WEI Wenbo1(eds), 2001. Magnetotelluric Method for Deep Detection of Chinese Continent. acta geologica sinica, 84:808-816.

Wu Zhenhan, Jiang Wan and Zhou Jirong(eds), 2001. Thermao-chronological dating on the thermal history of plutonsn and Tectonic-landform evolution of the central Tibetan plateau. acta geologica sinica, 75:469-476

Zhong Dalai, Ding Lin. 1996. Rising proeess of the Q ing hai-

Xizang plateau and its meehanism. Science in China (Series D), 39 (4):369- 379.

Xiao Xuehang ,Wang Jun, 1998.a brief review of teetonie evolution and uplift of the Qinghai-Tibet Plateau , Geological Review , 44(4):372-381(in Chinese with English abstract).

YANG Meixue, YAO Tandong and He Yuanqing,2002. The Role of Soil Moisture-Energy Distribution and Melting-Freezing Processes on Seasonal Shift in Tibetan Plateau. Journal of mountain science, 20: 553- 558.

Luo Hao and Yanai Meng, 1984. The large scale circulation and heat sources over the Tibet an Plat eau and surrounding areas during the early summer of 1979. Part I : Heat and moisture budgets . 112: 966-989.

Shukla , J andMintz, Y , 1982. Influence of land-surface environment on the earth climate.Science,215:1498- 1501.

Zhang shiqiang, Ding Yongjian and Lu Jian,2004. Simulative Study of Water-Heat Process in the Tibetan Plateau (I) : Soil Moisture. Journal of glaciology and geocryology, 26:383-388.

Zhang Yu, Song minhong, Lu Shihua, 2003. Frozen soil parame-terizations scheme coupled with scale model. Journal of Glaciology and Geocryology, 25:541-546.

Yang Meixue, Yao Tiandong, Gou Xiaohua, 2000. The feature of soil melting freezing processes and water energy by Qinghai-Xizang road. Advance in Natural Science, 10:443-450.

Ma Yaoming, Osamu Tsukamoto, Wu Xiaoming, 2000. Characteristics of energy transfer and micro met erotology in the surface layer of the atmosphere above grassy marshland of the Tibetan Plateau Area. Chinese Journal of Atmospheric Sciences, 24:715-722.

Zhang Yu, Song Minhong, Lu Shihua, 2003. Frozen soil parameter rization scheme coupled with mesoscale model. Journal of Glaciology and Geocryology, 25:541-546.

Zhang Shiqiang, Ding Yongjian, Lu J ian, 2005. Simulative study of water- heat process in the Tibetan Plateau (Ⅱ) :Soil temperature. Journal of Glaciology and Geocryology, 27:95-99.

Yang Zhenniang and Liu Xinren ,2000. The Hydrology in Cold Regions of China . Beijing: Science Press.

Wu Qingbai, Shen Yongping, Shi Bin, 2003. Relationship between frozen soil together with its water-heat process and ecological environment in the Tibetan Plateau. Journal of Glaciology and Geocryology, 25:250-255.

Eastm J R, Fulk M, 1993. Long t ime series evaluation using standardized principal components. Photogrammetry Engineering and Remote Sensing, 59: 991- 996.

Dawa T sering,2010. Impacts ofGlobalWarming on theWater Resources of Tibetan Plateau. Tibetan Studies,4:90-99.

Zhao L, Cray D M, Male D H, 1997. Numerical analysis of simultaneous heat and water transfer during infiltration into frozen ground. Hydrology, 200: 345—363.

Li C F and Yanai M , 1996. The onset and interannual variability of the Asian summer monsoon in relation to land - sea thermal contrast. Climate: 9:358-375.

KesslerA and RubinH,1987.relationships between water in filtration and soil spill migration in sandy soil . Journal of Hydrology.91:253-256.