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Drought monitoring, prediction and adaptation under climatic changes

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With four years¡¯ implement of Dragon II, some effective works have been carried out in our project 5341. The main achievements are: (1) improved understanding of land surface processes and land-atmosphere interactions over different underlying surfaces (e.g. agriculture land, desertification grassland, grassy marshland, river, lake), (2) algorithms for remote sensing of land surface parameters and heat fluxes, (3)drought monitoring for the Tibetan Plateau as a whole and the middle reaches of Yarlung Zangbo River (YR) and its two tributaries (4) training of young scientists in the area of water, climate and environment. Firstly, with the continuing of Chinese monitoring and observational networks, a large amount of observational data has been collected. It includes the data from 5 observation sites (networks). They are TORP/CAMP/Tibet Sites, Heihe Oasis-Desert Site, CAS Luancheng agro-ecological Observation Station (Hebei), CAS Xiaotangshan & Shunyi field experiment sites in Beijing, Maqu & the Yellow River Headwater Site. Secondly, combing AVHRR, MODIS and ASTER data, a set of algorithms for estimating land surface parameters and heat fluxes over the Tibetan Plateau has been achieved. As a major agricultural region in central Tibet Autonomous Region, the middle reaches of Yarlung Zangbo River (YR) and its two tributaries have been selected as a study area. On the basis of estimated bio-physical parameters from remote sensing data, together with the in-situ meteorological data and reanalysis data (ERA-40), SEBS (Surface Energy Balance System) has been applied to acquire the spatial-temporal characteristics of land surface parameters, surface heat fluxes, and DSI (Drought Severity Index) for the study area. Thus it provides scientific basis for crop growth monitoring, crop yield assessment and disaster monitoring. Thirdly, nearly 20 years¡¯ NOAA/NASA Pathfinder AVHRR Land (PAL) dataset and reanalysis data are used to derive land surface parameters for the Tibetan Plateau. Results show that from 1982 to 2000 both LST and surface air temperature increased on the TP. At the same time, both the near surface wind speed and surface sensible heat flux showed downward trends. These accelerated environmental changes inevitably have significant impacts on local energy and water cycle, the Asian monsoon and global changes. Furthermore, the land surface parameters for the northern Tibetan Plateau area have been simulated by the WRF (Weather Research Forecast) model. The simulated land surface heat fluxes, air temperature, wind field, etc. show good consistency with in-situ measurements.

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15 DROUGHT MONITORING (ID. 5341)

全球气候变化背景下的干旱监测、预测与适应对策

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摘要："龙计划"二期项目顺利实施4年来，5341课题组进行了卓有成效的工作，主要获得以下几个方面的研究成果：（1）增进了对不同下垫面类型区（如：农用地、荒漠化草地、草甸、河流、湖泊）陆面过程与地气相互作用的定量理解；（2）发展了地表特征参数和地表热通量的遥感反演算法；（3）利用实测、遥感、模型相结合的方法对青藏高原地区和西藏中部主要农业区--"一江两河"地区进行干旱监测；（4）在水资源、气候变化和环境领域培养了数名青年科学家。首先，随着TORP/CAMP/Tibet、黑河流域、栾城、小汤山、顺义、玛曲等观测站点（网络）的持续观测，获得了大量第一手观测数据；结合AVHRR、MODIS、ASTER等卫星遥感数据，建立了一套青藏高原地表特征参数和地表能量通量反演算法。其次，选取青藏高原和西藏主要农业区（一江两河地区）作为典型研究区，在遥感反演获得地表特征参数的基础上，结合气象观测数据和再分析资料（ERA-40），利用SEBS模式计算研究区地表热通量和干旱指数，为当地农作物生产、作物长势监测和防灾减灾提供科学依据。第三，利用20年的PAL时间序列资料，反演青藏高原长时间序列的地表特征参数，发现随着高原的增温，近地层风速和地表感热通量有逐渐下降的趋势。而青藏高原地表环境的改变势必将会对区域能量水循环、亚洲季风甚至全球气候变化带来重要影响。最后，利用WRF模式对藏北高原地区地表参数进行了数值模拟，结果表明，模型对地表热通量、气温和风场的模拟结果和实际观测具有较好的一致性。