Satellite Data and Hydrological Model to Asses Water Quantity and Quality in the Yangtze River Basin

European PI(s)
Prof. Marco MANCINI, marco.mancini@polimi.it

Chinese PI(s)
Prof. LI Jiren, lijiren@iwhr.com

The main objective of the project is to assess water quantity and quality under natural and human pressure on the Yangtze River basin (1'800'000 sq. km.) to support politics of sustainable development.

Two distributed hydrological models coupled with satellite and ground data will analyse the behaviour of the main components of water balance for the whole basin area considering also hydropower and agriculture water use. The proposal presents an innovative way to write the energy and water balance system as function of the land surface temperature (representative equilibrium temperature), so that remote sensing LST can be directly compared with modelled ones. This approach offers the possibility to control evapotranspiration fluxes at pixel scale, opening a new vision to control the mass balance not more based only on the discharge measures (generally few at the basin scale), but for any pixel in which the basin surface is discretized. A distributed hydrological model, FEST-EWB, will be used for these analyses. The conceptual hydrological model Xinanjiang will also be used and compared to the physically based FEST-EWB model according to remote sensing data input. In fact in this project several different sensors will be used spanning from the visible, thermal infrared to microwave wavelengths for the retrieval of vegetation parameters, snow coverage, land surface temperature and soil water content. The water quality analysis will be focused on the detection of suspended solid sediments in the three gorges dam reservoir and along the river network from satellite data and eventually ground data. An erosion distributed model for the Upper Yangtze River basin closed at the Dam. Detection from satellite of other quality parameters (e.g. chlorophyll and turbidity as well as surface water temperature, organic matter) will be used to test the satellite information capability to monitor water quality in a controlled environment such as the three gorges reservoirs.

Objectives:

1. Definition of a data base of European and Chinese remotely sensed products at different temporal and spatial resolutions;
2. Definition of a data base of ground data including meteorological and hydrological data and channel river geometry;
3. Calibration/validation of hydrological water balance model for water resources assessing using satellite data of land surface temperature and river height;
4. Comparison between conceptual and physically based hydrological models according to remote sensing data input;
5. Soil moisture monitoring through remote sensing data and hydrological models;
6. Retrieval of water quality parameters from satellite data;
7. Calibration/validation of erosion distributed model;
8. Small cases study: water resources analysis for Daning river basin or upper basin of the Huaihe River and Tibetan plateau;
9. Interaction with other Dragon3 projects in the framework of water resources.

Deliverables:

1. GIS database of satellite and ground data;
2. Flow duration curves for different river cross sections for hydropower and agricultural potential use;

3. Distributed maps of daily and monthly evapotranspiration from the hydrological model using ground and satellite data;
4. Distributed soil moisture maps for flood forecast and irrigation time management
5. Maps of flooded area
6. Distributed maps of soil erosion from distributed model
7. Maps of suspended solid sediments, chlorophyll and turbidity and surface water temperature

基于遥感和水文模型的长江流域水量和水质评价

欧方首席专家 : 马科.马西尼教授　Marco.mancini@polimi.it
中方首席专家:　李纪人教授　lijire.@iwhr.com

项目的主要目的是对在自然和人类活动作用下长江流域（1，800，000平方公里）水量和水质进行评价以支持流域的可持续性发展。
以遥感和地面资料为支持的二个分布式模型将在也考虑水能和农业等用水情况下分析整个流域水量平衡主要组成部分的情况。提出了一个富有创造性的途径，即把能量和水量平衡表达为陆面温度（代表性平衡温度）的函数，从而遥感得到的LST可以直接与模拟的进行比较。这一途径提供了控制像元蒸散发通量的可能性，为不仅仅依赖流域实测流量而是通过控制流域表面像元的质量平衡打开了一个新的视野。分布式模型FEST-EWB将用于这些分析。概念模型-新安江模型将与基于遥感输入具有物理基础的FEST-EWB模型比较。事实上，该项目将利用从可见光，热红外到微波的多种传感器的数据提取植被指数，雪盖，地表温度和土壤湿度。水质分析将根据遥感和地面资料集中于三峡水库及河网中悬移质泥沙含量。对接近坝址的上游流域将开发一个分布式土壤侵蚀模型。遥感资料将用于试验提取其它水质参数（如叶绿素，浑浊度及水面温度，有机质等）的能力以便在如三峡水库这种有控制环境下监测水质。

目标：

1. 确定中欧不同时空尺度的遥感产品；
2. 确定包括水文气象数据和河道几何形态的地面资料；
3. 率定利用地表温度和河道水位遥感资料的用于水资源的水文模型；
4. 比较概念性水文模型和以遥感数据为输入的有物理基础的水文模型；
5. 通过遥感资料和水文模型对土壤湿度的监测；
6. 水质参数的遥感反演；
7. 率定和验证分布式土壤侵蚀模型；
8. 示范研究：大宁河流域或淮河上游和青藏高原的水资源分析；
9. 与龙计划三期中其它与水资源有关的项目的互动。

预期成果：

1. 遥感和地面资料的GIS数据库；
2. 用于水力发电和农业等潜在应用的不同河道断面的流量历时曲线；
3. 利用遥感和地面资料的水文模型得出的日和月蒸散发量分布图；
4. 用于洪水预报和减灾调度管理的分布式土壤含水量分布图；
5. 受淹范围图；
6. 从分布式模型获取的土壤侵蚀分布图；
7. 悬移质泥沙含量，叶绿素，浑浊度及水面温度分布图。