

**DIPARTIMENTO DI INGEGNERIA
CORSO DI DOTTORATO IN INGEGNERIA INDUSTRIALE E
DELL'INFORMAZIONE -
PHD COURSE IN INDUSTRIAL AND INFORMATION ENGINEERING -
36TH CYCLE**

Title of the research activity:	Satellite Remote Sensing for hydrological applications
State of the Art:	Remote sensing has the capability of observing several variables for hydrological applications over large areas on a repetitive basis, allowing the modelling of hydrological phenomena. These variables include surface soil moisture, rainfall, surface temperature, water depth, flow velocity, and river discharge. In particular, river discharge is fundamental to the hydrologic cycle, flood forecasting, hydraulic risk mitigation, and water resources management. Improving discharge monitoring for various flow conditions at river sites can be accomplished by leveraging new technologies developed for ground measurements and remote sensing, thus enhancing the understanding of the surface hydrologic processes. Satellite platforms have paved the way for the development of new approaches for discharge monitoring from space at ungauged river sites. In this context, research efforts have focused on multiple remote sensing platforms thanks to the growing data availability for Earth Observation and the advanced processing techniques. The extensive availability of the different satellite missions represents a huge enhancement in the hydrology field, allowing their temporally continuative use on a global scale.
Short description and objectives of the research activity:	<p>The research activity will be based on the following tasks, aimed to assess the effective support of satellite data to hydrological studies and their benefit with respect to ground measurements:</p> <ul style="list-style-type: none"> - Definition of the sites of interests - Choice of the satellite platforms and sensors (e.g. multispectral radiometers) at different spatial resolution (MODIS, Landsat, Sentinel-2, etc...) - Integration of multi-sensor observation - Reflectance processing and computation of spectral indices for river discharge and flow velocity estimation applying different methodologies - Comparison with ground-based measurements <p>Novel and original results are expected: the starting point is the study of the broad existing literature.</p>
Bibliography:	<p>-Domeneghetti A., Schumann G., Tarpanelli A. (2019). Preface: Remote Sensing for Flood Mapping and Monitoring of Flood Dynamics. <i>Special Issue on Remote Sensing: Remote Sensing for Flood Mapping and Monitoring of Flood Dynamics</i></p> <p>-Moramarco T., Barbeta S., Bjerklie D., Fulton J., Tarpanelli A., (2019) River bathymetry estimate and discharge assessment from remote sensing. <i>Water Resources Research</i>, 55(8), 6692-6711</p> <p>-Tarpanelli A., Santi E., Tourian M.J., Filippucci P., Amarnath G., Brocca L. (2019). Daily river discharge estimates by merging satellite optical sensors and radar altimetry through artificial neural network. <i>IEEE Transactions on Geoscience and Remote Sensing</i>, 57(1), 329-341.</p>

	<p>-Zaussinger F., Dorigo W., Gruber A., Tarpanelli A., Filippucci P., and Brocca L. (2019): Estimating irrigation water use over the contiguous United States by combining satellite and reanalysis soil moisture data, <i>Hydrology and Earth System Sciences</i></p> <p>-Tarpanelli A., Camici S., Nielsen K., Brocca L., Moramarco T., Benveniste J. (2019) Potentials and limitations of Sentinel-3 for river discharge assessment. <i>Advances in Space Research</i></p> <p>-Domeneghetti A., Tarpanelli A., Grimaldi L., Brath A., Schumann G. (2018). Flow duration curve from satellite: potential of lifetime SWOT mission. <i>Remote Sensing</i>, 10, 1107. doi: 10.3390/rs10071107</p> <p>-Tarpanelli A., Amarnath G., Brocca L., Massari C., Moramarco T. (2017). Discharge estimation and forecasting by MODIS and altimetry data in Niger-Benue River, <i>Remote Sensing of Environment</i>, 195, 96-106.</p> <p>-Tarpanelli A., Brocca L., Barbetta S., Faruolo M., Lacava T., Moramarco T. (2015) Coupling MODIS and radar altimetry data for discharge estimation in poorly gauged river basin. <i>IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing</i>, 8(1), 141-148.</p> <p>-Tarpanelli A., Brocca L., Melone F., Moramarco T., Lacava T., Faruolo M., Pergola N., Tramutoli V. (2013) Toward the estimation of river discharge variations using MODIS data in ungauged basins. <i>Remote Sensing of Environment</i>, 136, 47–55.</p>
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