



A Comparison of Suspended Solids and Turbidity retrieval from MODIS and MERIS imagery in the Three Gorges Dam Area, China (ID 503)



Antonio Di Trapani¹, Chiara Corbari¹, Marco Mancini¹

¹ Politecnico di Milano, Milano, Italy

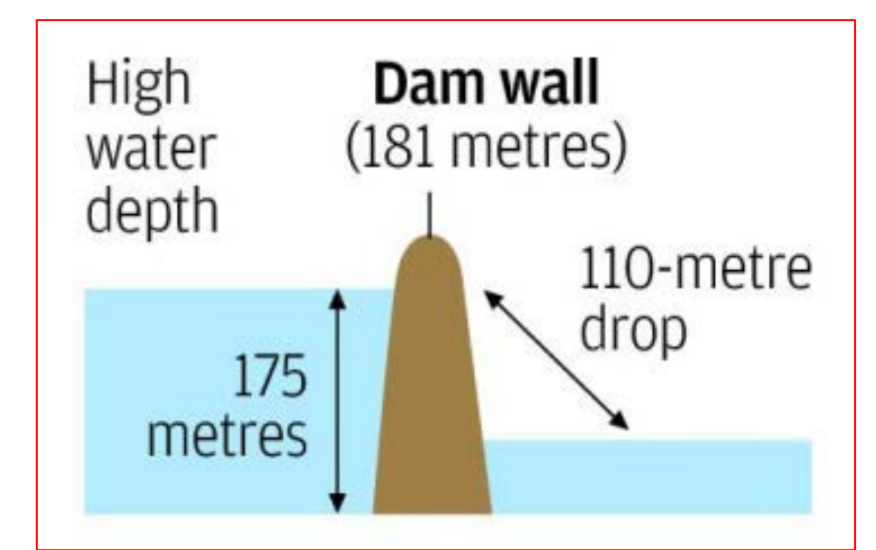
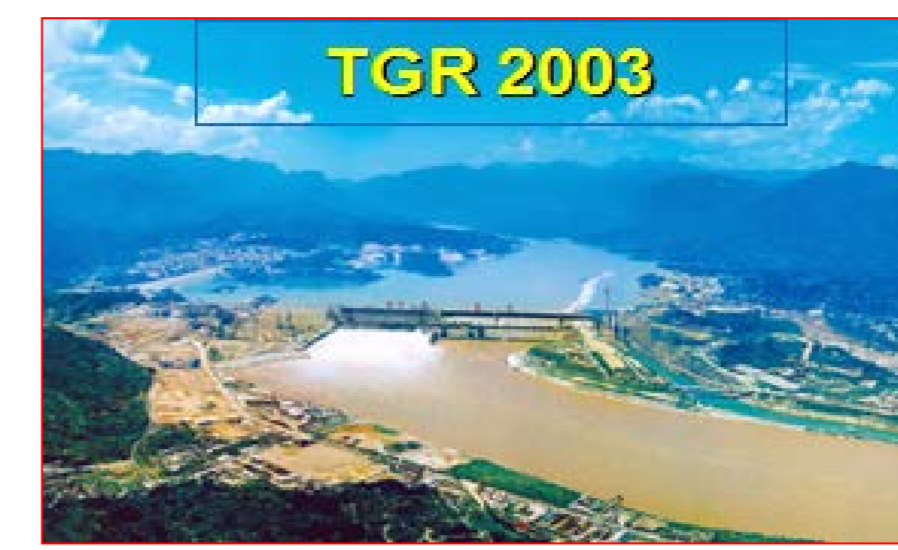
chiara.corbari@polimi.it ; antonio.ditrapani@polimi.it



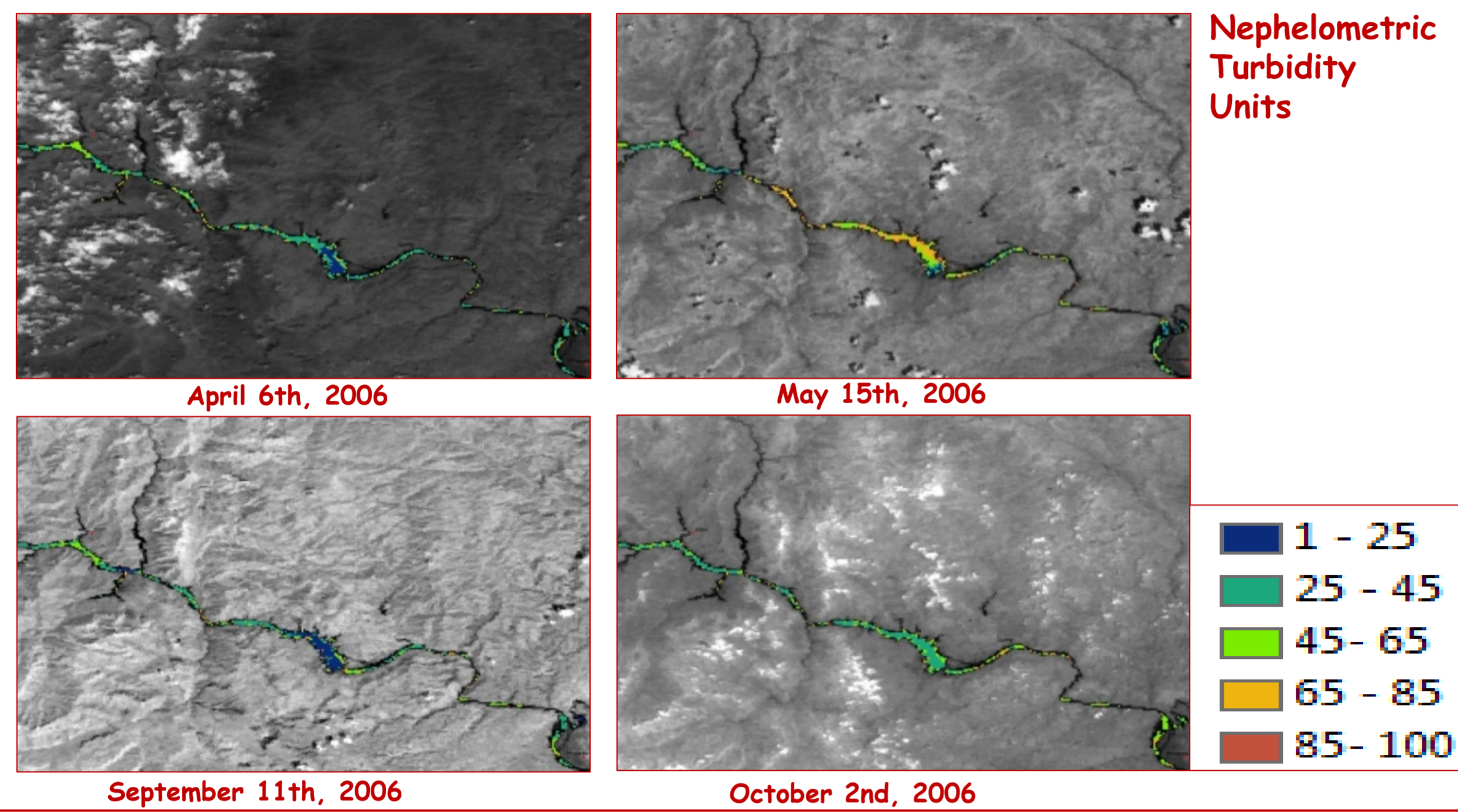
ABSTRACT

The aim of this work is to evaluate turbidity magnitude and total suspended matter (TSM) concentrations of the Three Gorges Reservoir, China, applying different retrieval algorithms to satellite imagery (MOD09GQ and MERIS FRS L2) 250 m: turbidity and TSM values retrieved from the satellite scenes were correlated to discharge values measured daily on the ground, leading to relations between TSM and discharge. Applying the obtained relations to the discharge dataset made possible to have daily estimations of TSM values even for the days for which satellite scenes were lacking. The estimations from the various retrieval algorithms and sediment discharge values were compared with literature values of solid discharge measured on the ground.

CASE STUDY: THE YANGTZE RIVER

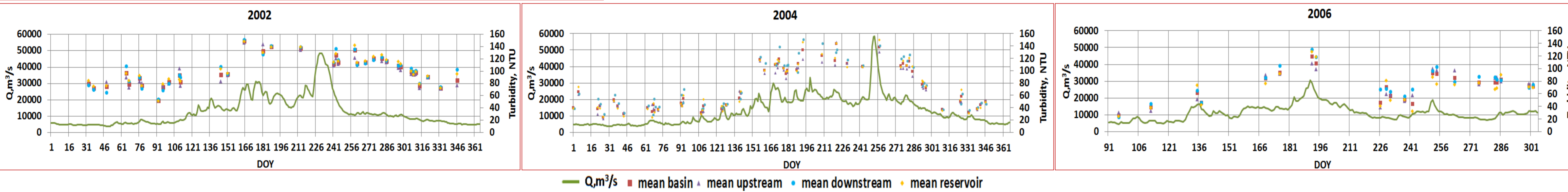
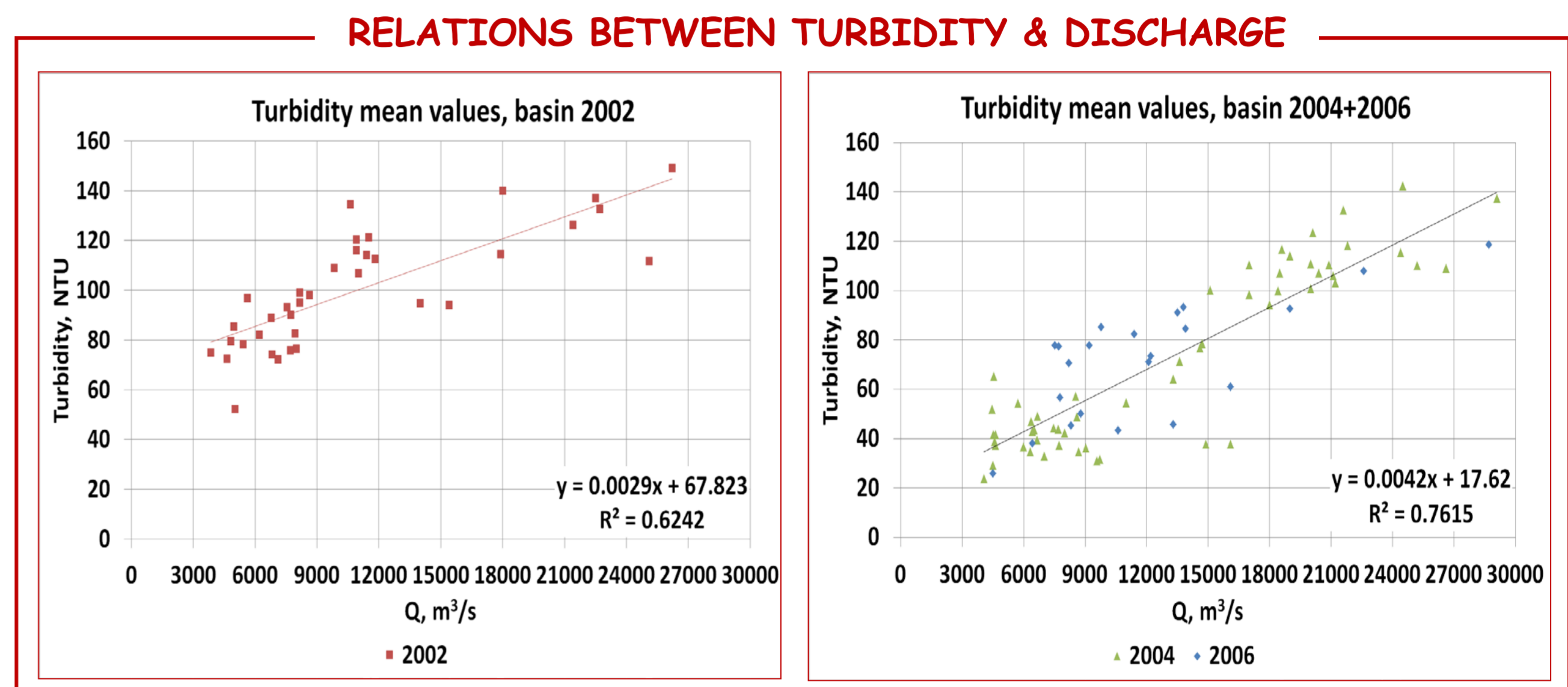


TURBIDITY MAPS

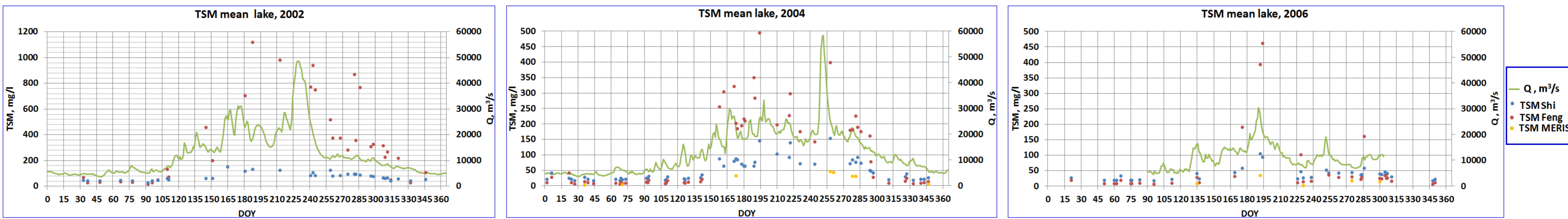


TURBIDITY RETRIEVAL FROM MODIS

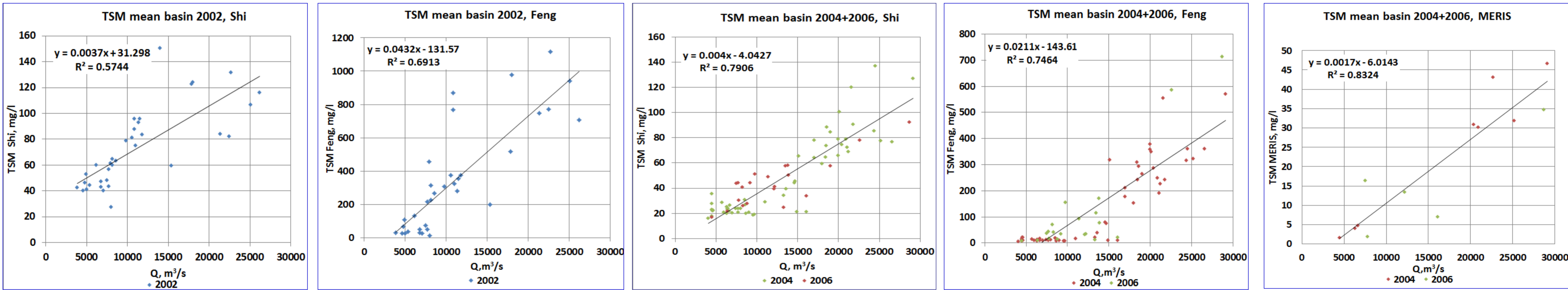
AVERAGED VALUES (NTU)			
YEAR	2002	2004	2006
mean basin	100	72	61
mean upstream	98	70	62
mean reservoir	102	73	85
mean downstream	102	76	66



TSM RETRIEVAL FROM MODIS & MERIS



RELATIONS BETWEEN TSM & DISCHARGE



COMPARISON WITH GROUND DATA

2002	Literature values of sediment discharge at Yichang, 10 ⁶ ton/month	TSM SHI, 10 ⁶ ton/month	TSM FENG, 10 ⁶ ton/month	Literature values of sediment discharge at Yichang, 10 ⁶ ton/month				
				TSM SHI, 10 ⁶ ton/month	TSM FENG, 10 ⁶ ton/month	MERIS susp, 10 ⁶ ton/month		
Jan	7.000	0.641	1.030	0.000	0.200	0.126	0.022	
Feb	5.000	0.559	0.866	0.000	0.170	0.112	0.016	
Mar	5.000	0.849	2.036	0.000	0.294	0.139	0.052	
Apr	5.000	1.127	3.860	0.000	0.497	0.417	0.122	
May	10.000	3.411	20.339	1.000	1.403	3.624	0.466	
Jun	45.000	7.132	54.128	2.000	4.243	16.721	1.645	
Jul	38.000	5.840	41.278	10.000	5.259	21.439	2.068	
Aug	115.000	14.371	124.068	8.000	4.009	15.385	1.537	
Sep	10.000	2.543	13.639	42.000	9.099	41.681	3.765	
Oct	5.000	1.981	9.138	1.000	2.582	8.781	0.944	
Nov	2.000	1.160	3.834	1.000	0.881	1.604	0.265	
Dec	1.000	0.706	1.324	0.000	0.408	0.281	0.089	
				Apr	0.000	0.328	0.207	0.064
				May	0.000	1.122	2.679	0.360
				Jun	0.000	1.638	4.638	0.561
				Jul	10.000	3.742	14.232	1.430
				Aug	3.000	0.841	1.354	0.246
				Sep	2.000	1.199	2.878	0.390
				Oct	1.000	0.991	1.951	0.305

CONCLUSIONS

- Three main results can be highlighted:
- 1) The estimates of turbidity and suspended solid sediments from MODIS and MERIS are affected by the presence of the Three Gorges Dam. In fact, the highest values of turbidity and TSM are found upstream the dam, while in the Three Gorges Reservoir turbidity and TSM are found to be constantly lower than in the rest of the river.
 - 2) High correlations have been found between TSM and Turbidity with discharge. It is interesting to note that a "base" value of around 40 NTU is observable for low discharge values of 5000 m³/s.
 - 3) From the correlation between MODIS estimates and river discharge, continuous estimates of turbidity and TSM were obtained and compared at monthly scale with literature values. A good agreement has been found. In particular, single band algorithm for MODIS and the total suspended matter product of MERIS are suitable for medium-low concentrations, while the dual-band algorithm for MODIS provides a better estimation for high concentrations, even if overestimates them. However, due to the lack of ground measurements, only a qualitative assessment of these parameters have been possible.

REFERENCES

Chen Z., Hu C., Muller Karger F. (2007). Monitoring turbidity in Tampa Bay using MODIS/Aqua 250 m imagery. Remote Sensing of Environment, 109: 207-202. doi:10.1016/j.rse.2006.12.019

Feng, L., Hu, C., Chen, X. & Song Q. (2014). Influence of the Three Gorges Dam on total suspended matters in the Yangtze Estuary and its adjacent coastal waters: Observations from MODIS Remote Sensing of Environment, 140 779-788 doi:10.1016/j.rse.2013.10.002

Shi, K., Zhang, Y., Zhu, G., Liu, X., Zhou, Y., Xu, H. & Qin, B. (2015). Long-term remote monitoring of total suspended matter concentration in Lake Taihu using 250 m MODIS-Aqua data. Remote Sensing of Environment, 164 45-56 doi:10.1016/j.rse.2015.02.029

Xu, K., Milliman, J.D. (2009). Seasonal variations of sediment discharge from the Yangtze River before and after impoundment of the Three Gorges Dam. Geomorphology 104 276-283. doi:10.1016/j.geomorph.2008.09.004

