Data Report WP5

Overview

Fieldwork took place along three different periods:

1) January 2008 – April 2008
2) October 2008 – January 2009
3) August 2009 – September 2009

Fieldwork Campaign 1

Part of February and March was devoted to installing water level sensors at selected locations along the river and in the delta, salinity sensors in the delta, a horizontal ADCP discharge station and a turbidity sensor near Samarinda city. After installing the permanent stations for long-term measurements, several surveys were conducted to collect bed samples, bathymetry and hydrography along the study area (from Samarinda until the delta apex). In total, eight hydrographic surveys were completed during spring and neap tides (Table 1). Along with the cross sectional transects to describe local flow conditions, CTD/OBS and LISST-100 casts in addition to water samples, were collected to describe suspended sediment concentrations and particle sizes.

Table 1. Repeated transect measurements, each covering a semidiurnal tidal cycle (~13 hs)

Date	Transect Name	Tide	Location	CTD Casts	Water Samples	LISST Casts
14-3-2008	HADCP Samarinda	mean	*90deg in front of HADCP*			
17-3-2008	Bif01 Neap	Neap	*Muara Berau* *Mahakam* *SangaSanga*			
18-3-2008	Bif02 Neap	Neap	*TanjungDewa* *Mahakam*	52 Casts 2x Mahakam 1x Tj Dewa		
31-3-2008	HADCP Samarinda	Neap	*90deg in front of HADCP*		12 samples 13x in front HADCP	42 Casts 1x in front of HADCP
6-4-2008	Bif01 Spring	Spring	*Muara Berau* *Mahakam* *SangaSanga*		9 samples 13x Muara Berau	36 Casts 1x Muara Berau 2x Mahakam 1x Sanga Sanga
7-4-2008	Bif02 Spring	Spring	*TanjungDewa* *Mahakam*	23 Casts 2x Mahakam 1x Tj Dewa	3 samples 13x Tj Dewa	23 Casts 2x Mahakam 1x Tj Dewa
19-4-2008	HADCP Samarinda	Spring	*90deg in front of HADCP*			31 Casts 1x in front HADCP
21-4-2008	Bif02 Spring	Spring	*TanjungDewa* *Mahakam*	36 Casts 2x Mahakam 1x Tj Dewa		36 Casts 2x Mahakam 1x Tj Dewa

Data analysis has been focused on water level variation along the river from the outer delta until the lakes area. Water level data shows the transition between tidal and fluvial dominated river along ~300 km distance from the sea. Tidal prediction at

Samarinda city was compared with a standard tidal analysis performed to the recorded elevation data. Amplitude of the four main constituents K_1, O_1, M_2 and S_2 is slightly overestimated in the predictions, particularly K_1 and M_2, which are doubled. Observed data shows a significant low frequency compound tide at all stations along the river from near the delta apex until the lakes. This compound tide is related to the fortnightly variation in tidal amplitude, which under the effect of a net current produce a fortnightly variation in bottom friction and hence in water level. Different levels of interaction with a flooding wave travelling from upstream are also observed, however, a more precise description of this events requires acquiring more long-term data, given the low frequency of the cycles (half and one month for MSf and MS compound tides, respectively).

Production of tidally corrected bathymetric maps reveal the same feature at the delta apex and a second bifurcation downstream: the northern branch is characterized with a deeper and narrower channel while the southern branch with a wider and shallower one. This wider branch also presents a linear sandbank which possibly creates threading in the flow, at the second bifurcation the sandbank rises above the surface during spring tides. A tributary located just near the apex shows a comparatively deeper cross section along its reach than the mean river depth, however, the origin of this channel is not known. The river also presents anomalous scour holes up to ~50 m depth in junctions, bends and narrow cross sections.

Fieldwork Campaign 2

Part of October and November was devoted to fieldwork in the lakes region and upstream locations of the Mahakam river. Preliminary results of water level analysis indicate that tides reach until the lakes region, close to Kota Bangun city. During a flooding period, tides in this region and downstream until Muara Kaman are completely extinct, hence, this became a suitable upstream boundary condition for the tide dominated river. In December, a survey was conducted in Muara Kaman consisting of ADCP transects, bed sampling, bed load transport sampling and calibration of the ADCP backscatter signal with OBS, LISST-100 and in situ water samples. The latter, a methodology developed to use the response signal of the ADCP, calibrated against particle size distribution and concentration, to measure suspended

sediment concentration along ADCP transects. A resume of this data collection is presented in Table 2.

Table 2. Repeated transect measurements, each covering a semidiurnal tidal cycle (~13 hs)

Date	Transect Name	Tide	Location	Calibration BS signal	Bed Load Sampling
16-12-2008	Muara Kaman	Mean	*Muara Kaman*	X	
19-12-2008	Muara Kaman	Mean	*Muara Kaman*		X
30-11-2008	HADCP Samarinda	Spring	*90deg in front of HADCP*	X	
26-12-2008	Bif01	Spring	*Muara Berau-Mahakam*		X
27-12-2008	Bif02	Spring	*TanjungDewa-Mahakam*		X
3-1-2009	Bif02	Neap	*TanjungDewa-Mahakam*	X	
4-1-2009	Bif01	Neap	*Muara Berau-Mahakam*	X	
14-1-2009	Muara Kaman	Mean	*Muara Kaman*		
17-1-2009	HADCP Samarinda	Neap	*90deg in front of HADCP*		
24-1-2009	Muara Kaman	Mean	*Muara Kaman*		
25-1-2009	Tributaries	Mean	*Tributaries close to Muara Kaman*	X	

In the meantime, a bathymetry of the delta was performed in collaboration with LIPI staff, this was finished by the beginning of January (Figure 1). During December and January, two large campaigns where conducted at the delta apex and downstream bifurcation consisting of ADCP transects and bed load sampling during spring tide, and ADCP transects and calibration of ADCP backscatter signal during neap tide (Table 2). The aim of these fieldwork campaigns was to establish water and sediment discharge distribution at the apex and subsequent bifurcation. Besides these campaigns, much effort was devoted to the leveling of the pressure sensors in the bifurcations with conventional DGPS leveling to estimate water surface slope; regular campaigns to measure discharge in front of the horizontal ADCP station close to Samarinda city and the deployment of a frame with an ADCP and LISST-100 to further understand the relationship between acoustical and optical backscattering response due to suspended sediments. Finally, all the analysis of bed, bed load and water samples was performed in the soil laboratory at Mulawarman University. Standard granulometric analysis was conducted on bed and bed load samples, organic matter determination also on the latter. Water samples were filtrated and later on the dry mass determined, altogether to yield mass concentration.

The large amount of transects in front of the horizontal ADCP allowed the use of these data as a calibration set for continuous discharge estimation at Samarinda

station. Production of continuous discharge time series follows from a conversion of measured velocities with the horizontal ADCP from sporadic conventional cross sectional transects. A semi-empirical approach involves the correlation analysis between both estimates of mean water velocity and a corresponding "index" or conversion factor. Alternatively, inspecting the velocity profiles yields information on the vertical and transversal flow structure, as well as the hydrodynamic parameters across the section, allowing to determine discharge in a semi-deterministic fashion.

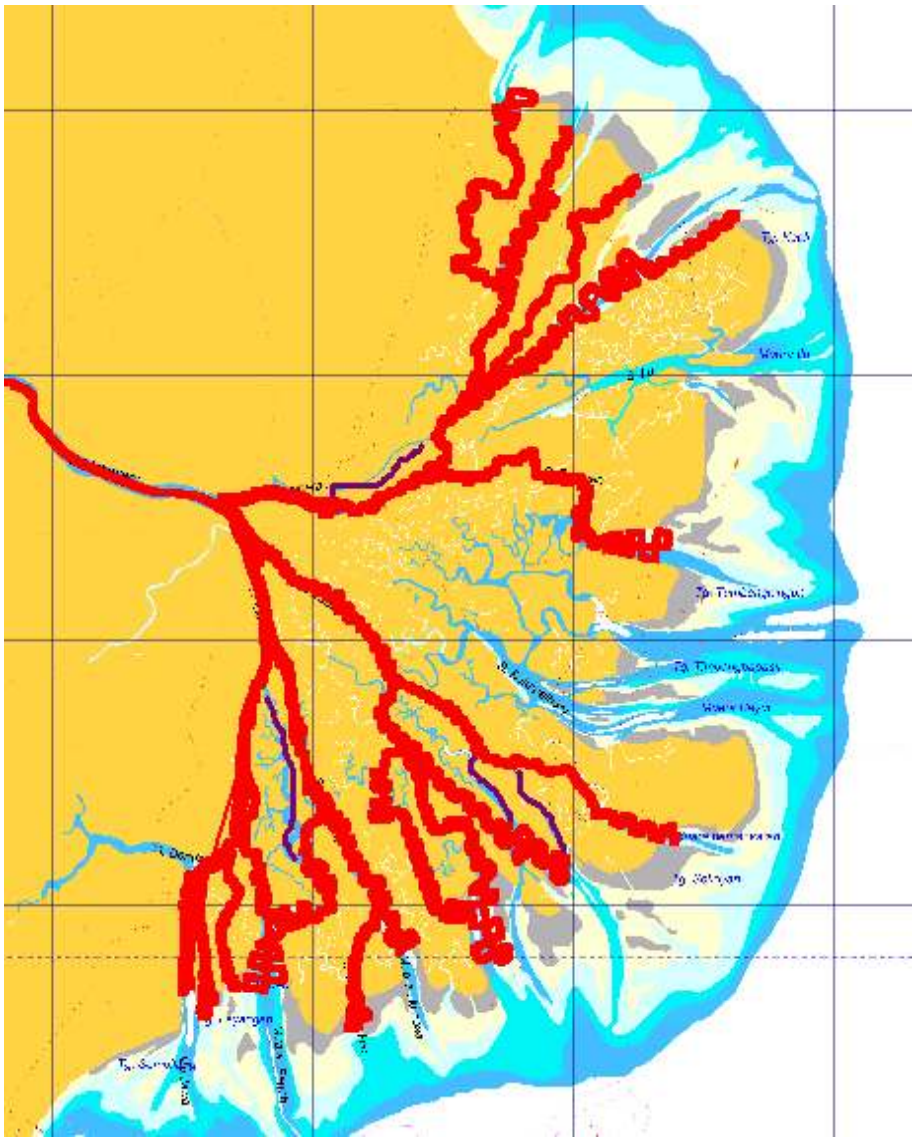

Figure 1. *Map of the Mahakam delta showing bathymetric track (red). In violet, tracks planned and recently finished (track data not available yet).*

Fieldwork Campaign 3

The last fieldwork campaign was set to finalize measurements which where lacking and for the complete removal of all the instruments initially installed. During this campaign much effort was devoted to flow measurements in the lakes and upstream region, bed sampling in several spots along the river, bed load transport sampling at Melak station and finally, the deployment of a frame with two synchronized ADCP's to measure turbulence at Melak and Samarinda stations. The double ADCP frame was positioned just in front of the horizontal ADCP, which was also set to measure at a high frequency. The aim of this campaign is to understand the momentum exchange induced by turbulence anisotropy or another physical mechanism acting along the cross section. This gained knowledge will help to improve the semi-deterministic computation of discharge at complex cross sections in tidal rivers.