APPLICATION FORM FULL PROPOSALS JOINT RESEARCH PROJECTS SPIN 2012-2016

FILE NUMBER: 29-SPIN-RP

Part I: Hydrology-geomorphology links in the Kapuas River system

Joint Research Projects

1. Title of the Joint Research Programme

Hydrology-geomorphology links in the Kapuas River system

2. Applicants

a. Main applicant in the Netherlands
Name / Title(s): Dr. Ir. A.J.F. Hoitink, Associate Professor of Environmental Fluid Mechanics
University: Wageningen University

b. Co-applicant in Indonesia
Name / Title(s): Prof. Dr. R.M. Delinom, Professor of Hydrogeology
Institute: Research Center for Geotechnology, LIPI / Indonesian Institute of Sciences

c. Additional project partners in The Netherlands (minimum of one)
Name / Title(s): Dr. Ir. R.J. Labeur
Institute: Delft University of Technology, Faculty of Civil Engineering and Geosciences

Name / Title(s): Dr. Ir. A.J. Teuling, Assistant Professor of Catchment Hydrology
University/ Institute: Wageningen University

Name / Title(s): Dr. Ir. H.J.A. van Lanen, Associate Professor of Hydrogeology
University/ Institute: Wageningen University

d. **Additional project partners in Indonesia (minimum of one)**

Name / Title(s): Dr. G.S. Haryani
University/ Institute: Research Centre for Limnology, LIPI / Indonesian Institute of Sciences

Name / Title(s): Dr. Eng. N.S. Ningsih, Associate Professor of Physical Oceanography
Institute: ITP/ Bandung Institute of Technology

Name / Title(s): Dr. G.Z. Anshari, Chair Centre for Wetlands People and Biodiversity
Institute: UNTAN / Tanjupura University

Research Proposal

3. Summary of the Joint Research Project Proposal *(Max. 800 words)* **Word count: 779**

The Kapuas is the largest river system in Indonesia and the world's longest river on an island, stretching over more than 1100 km in a relatively pristine region dominated by lowland forest and peatlands. The length of the river, the complex geomorphology of the lowland channel network and the hydrological links with the adjacent peat bogs and inland wetlands render the Kapuas river system a scientific challenge to study. We plan to improve and apply novel methods of monitoring and modelling, developed in the context of previous research in the Mahakam basin. We will expand our scope towards quantitative analysis of

sediment transport and river morphology, and towards understanding the hydrological interactions in wetlands and in peat regions. The overall objective of this research project is to establish and understand the interlinked processes governing the hydrology and geomorphology of the Kapuas River, its delta, the Kapuas Hulu wetland region and the peatlands connected to the river. This will yield new scientific insights in the fields of hydrology and geomorphology, which can be linked to aquatic ecology and form a solid basis for science-based water resources management and river engineering in the future. Within the project, the gained scientific knowledge will be used to reveal the main factors controlling drought in peat forests and wetland areas, including the associated wildfires, and to analyse problems of flooding and salinity intrusion in the downstream lowland region. The Joint Research project will include three PhD projects and a Postdoc project.

The approach includes basin scale and local scale components. At the basin scale, processes governing the terrestrial water cycle, subsurface hydrology, land-sea surface water interactions and the factors controlling river channel morphology will be studied, each in a separate subproject. The terrestrial water cycle will be studied using the Community Land Model (CLM), simulating overland flow including interception of water by plant foliage and wood, throughfall and stemflow, infiltration, runoff and soil water. Subsurface storage dynamics will be studied using the outcome of an ensemble of offline global hydrological models. In the primary catchments, surface and sub-surface runoff are routed downstream to the main river using a simple river routing model. Flow in the main river will be modelled using a multi-scale hydrodynamic model with variable mesh size (SLIM), which stretches from the Kapuas Hulu region to the deep sea, including the complete channel network in the coastal plain. The models will be tested, calibrated and validated with existing remote sensing information, and new measurements from surface and subsurface level gauges, soil moisture stations, rain gauges and two discharge monitoring stations in the river, equipped with horizontal acoustic Doppler current profilers. The initial aim for the coupled models is to simulate and understand the hydrological functioning of the Kapuas River basin, and historic and projected events of floods and droughts. Subsequently, the CLM and SLIM models will be used to simulate basin-scale sediment runoff and transport in the river channel network, and to establish the links with river channel morphology.

Each of the four subprojects has a separate local focus, viz. (i) wetland functioning, (ii) hydrogeology of peat forests, (iii) water and sediment division at channel junctions and (iv) morphology of complex river bends. These local foci serve both stand-alone and integrated objectives. The study focussing on the terrestrial water cycle will zoom in to the details of in the Kapuas Hulu wetlands, which present a great challenge for the CLM. The CLM and an integrated sediment transport module will be used to establish the vulnerability of the Kapuas Hulu wetlands to changes in the hydrological regime and in sediment runoff. Also, the CLM results will be used to establish the buffering function of the wetlands region, and be related to the pristine aquatic ecology. The groundwater dynamics project will have an emphasis on drought development. At the local scale, a subsurface system will be analysed, roughly at the scale of a peat bog, aiming to specify conditions leading to forest fires, and to quantify dynamic recharge, storage and aquifer-surface water exchange. In the channel network study, the local focus will be placed on two key channel junctions, to understand the processes controlling the division of water and sediment over distributary channels. To this end, a local-scale morphodynamic model will be setup in an online coupled hydrodynamics-morphodymics model (Delft3D) to explore the impacts of changes in discharge regime and sediment runoff on channel junction morphology, affecting the development of coastal geomorphology. In the river geomorphology study, finally, local processes of channel bends of high morphological complexity will be analysed, by assimilating results from detailed flow simulations in a high-resolution hydrodynamic model (Finlab) with geomorphological information, and with the outcomes of the hydrological studies.

4. Detailed description of the Priority Programme *(Max. 2500 words)* **Word count: 2103**

a. Scientific Background (shared research question(s) or mutual research theme, problem definition)

Recent progress in large-scale hydrological modelling, in field instrumentation and in satellite remote sensing has opened the possibility to adopt a holistic approach to address the hydrologic and geomorphic aspects of large river basins. The East Kalimantan Research Programme offers an example showcasing the merits of a multi-scale, integrated river basin analysis approach, by focussing on the river Mahakam and its

delta. The Mahakam research cluster comprised the hydrology of a subsiding inland region, the geomorphology of an actively meandering river and the geology and tidal dynamics of the delta. The core of the research cluster is a rainfall-runoff model combined with a multi-scale hydrodynamic model (De Brye et al., 2011), which features a variable spatial resolution throughout the model domain. The scale of the model, which extends from small tributaries to the deep ocean, rendered it possible to formulate boundary conditions using publically available global-scale models and datasets. Acoustics-based methods were developed to obtain continuous measurements of river discharge (Hoitink et al., 2009; Sassi et al., 2011a; Hidayat et al., 2011a) and suspended sediment transport (Sassi et al., subm), which were used for model calibration and validation. The combined model was then used to understand physical mechanisms of river-tide interaction controlling discharge dynamics (Sassi et al., 2011b), geometry of the delta channels (Sassi et al., 2011c), salinity intrusion (Pham Van et al., 2011) and the morphology of sharp river bends (Vermeulen et al., 2011b).

The present proposal is to continue the line of research started in the East Kalimantan Programme, by setting up an integrated project of four interlinked research projects focussing on hydrology-geomorphology links in the Kapuas river system, and including additional disciplines. The Kapuas is the largest river system in Indonesia and the world's longest river on an island (Loh, 2012), stretching over 1.143 km in a relatively pristine region dominated by lowland forest and peatlands (Janssen, 2012). It is situated in the province of West Kalimantan, which is locally referred to as *Provinsi Seribu Sungai* (land of the thousand rivers) . The length of the river, the complex geomorphology of the lowland channel network (Fig. 1), and the hydrological link with the adjacent peat bogs and inland wetlands render the Kapuas basin a scientific challenge to study. We plan to improve and apply the novel monitoring methods developed in the context of the Mahakam research, and plan to expand our scope towards quantitative analysis of sediment transport and river morphology and towards understanding the hydrological interactions in wetlands and in peat regions where fires cause high carbon emissions during droughts, contributing to global climate change.

Geographically, the Kapuas catchment can be subdivided into three regions: an upstream region (Kapuas Hulu), where one of Indonesia's most pristine wetlands is located, the central lowland area, where the river is surrounded by peat bogs, and the coastal plain encompassing the Kapuas Delta. Our scientific efforts to better understand the hydrology-geomorphology links in each of the three regions will go hand in hand with addressing local societal needs. The river and delta play an important role in sustaining the livelihoods in West Kalimantan, as a waterway for shipping of goods and as a source of water for irrigation, industry, fisheries and domestic use. The key societal problems occurring locally in the region include flooding of cities related to storm surges, disruptions in drinking water supply due to saltwater intrusion during the dry season, and impediment of navigation by river sedimentation. Each of those problems can be analysed using the continuous river observations, remote sensing approaches and coupled models we aim to realize in this proposal. From a global-scale perspective, the drought events both in in the Kapuas Hulu wetlands and the peat forests surrounding the middle reaches of the river pose a serious concern in terms of biodiversity and global change by carbon emissions, which is why an emphasis will be placed on drought events.

b. Objective(s)

The overall objective of this research project is to establish and understand the interlinked processes governing the hydrology and geomorphology of the river Kapuas, its delta, the Kapuas Hulu wetland region and the peatlands connected to the river. This will yield new scientific insights in the fields of hydrology and geomorphology, which can form a solid basis for science-based water resources management and river engineering in the future. Within the project, the gained scientific knowledge will be used to reveal the main factors controlling drought in peat forests and wetland areas, and to analyse problems of flooding and salinity intrusion in the downstream lowland.

c. Workplan (approach, methods, deliverables, management)

The approach includes basin scale and local scale components. At the basin scale, we plan to study processes governing the terrestrial water cycle, subsurface hydrology, land-sea surface water interactions and the factors controlling river channel morphology, each in a separate subproject with state-of-the-art models and

monitoring techniques. The terrestrial water cycle will be studied using the Community Land Model (CLM[1]), simulating overland flow including interception of water by plant foliage and wood, throughfall and stemflow, infiltration, runoff and soil water. Subsurface storage dynamics will be studied using an ensemble of 8 to 10 offline global hydrological models (Haddeland et al., 2011). In the primary catchments, surface and sub-surface runoff are routed downstream to the main river using the CLM river routing model. Flow in the main river will be modelled using a multi-scale hydrodynamic model with variable mesh size (SLIM[2]), which stretches from the Kapuas Hulu region to the deep sea, including the complete channel network in the coastal plain. This suite of large-scale models will be tested, calibrated and validated with existing remote sensing information and new measurements from surface and subsurface level gauges, soil moisture stations, rain gauges and two discharge monitoring stations in the river, equipped with horizontal acoustic Doppler current profilers. The initial aim for the coupled models is to simulate and understand the hydrological functioning of the Kapuas River basin, and explore historic and projected events of floods and droughts. Subsequently, the CLM and SLIM models will be used to simulate basin-scale sediment runoff and transport in the river channel network, and to establish the links with river channel morphology.

Each of the four subprojects has a separate local focus, viz. (i) wetland functioning, (ii) hydrogeology of peat forests, (iii) water and sediment division at channel junctions and (iv) morphology of complex river bends. These local foci serve both stand-alone and integrated objectives, as explained hereinafter. The study focussing on the terrestrial water cycle will zoom in to the details of in the Kapuas Hulu wetlands, which present a great challenge for the CLM. The CLM and an integrated sediment transport module will be used to establish the vulnerability of the Kapuas Hulu wetlands to changes in the hydrological regime and in sediment runoff. Also, the CLM results will be used to establish the buffering function of the wetlands region, and be related to the pristine ecology. The groundwater dynamics project will have an emphasis on drought events. At the local scale, a subsurface system will be analysed, roughly at the scale of a peat bog, aiming to specify conditions leading to forest fires, and to quantify the spatio-temporal recharge mechanisms, storage and aquifer-surface water exchange. In the channel network study, the local focus will be placed on two key channel junctions, to understand the processes controlling the division of water and sediment over distributary channels. To this end, a local-scale morphodynamic model will be setup in Delft3D[3] to explore the impacts of changes in discharge regime and in sediment runoff on channel junction morphology, affecting the development of coastal geomorphology. In the river geomorphology study, finally, local processes of channel bends of high morphological complexity will be analysed, by assimilating results from detailed flow simulations in Finlab (Labeur, 2009) to geomorphological information, and outcomes of the hydrological studies.

It is expected that each of the subprojects will yield at least four peer-reviewed papers and several conference proceeding papers, and a PhD thesis for the three PhD projects. The multi-scale hydrodynamic model to be developed for the Kapuas channel network will improve an existing model at the Institute of Technology Bandung, where the new model will remain operational after completion of the project. The continuous data series and field survey data will not only support PhD and Postdoc research, but also BSc and MSc projects at the involved universities and research institutions. At the Hydrology and Quantitative Water Management Group at Wageningen University, a central data archive will be setup, accessible for all parties involved. Model implementations will remain documented by the Indonesian and Dutch project leaders of the individual subprojects. Consolidated datasets will become publically available after publication of results.

d. Scientific Relevance (including relevance of anticipated results)

The prospective cluster of research projects is relevant within the context of four scientific themes.

1. *Drought vulnerability of wetlands*

[1] http://www.cgd.ucar.edu/tss/clm/
[2] http://sites.uclouvain.be/slim/
[3] http://oss.delft3d.nl/

Water level dynamics of inland tropical wetlands strongly depend on seasonal distribution of excess rainfall. Besides changes in precipitation dynamics, there is evidence of increased soil moisture limitation on evapotranspiration in (sub)tropical regions with seasonal droughts (Jung et al., 2010). Such combined changes in the terrestrial water balance upstream can propagate through soil moisture and groundwater reservoirs ultimately impacting the seasonal dynamics of wetland extension. This, in turn, can trigger land use changes at the wetland perimeter. Combined observations of soil moisture, groundwater, river discharge, lake levels and wetland extension will shed light on the hydrological and land use controls of wetland dynamics and its resilience to local and basin changes.

2. *Drought in peat swamp forests*

Tropical peat swamp forests are important reservoirs of biodiversity (Page et al.,1999; Wosten et al., 2008), and carbon dioxide (Page et al., 2002). They contain a large number of endemic tree species and rare and endangered animals (Ismail, 1999). Over the past decade, the government of Indonesia has drained over 1 million hectares of the Kalimantan peat swamp forests for conversion to agricultural land (Wosten et al., 2008). Current studies are primarily focused on carbon dioxide impacts of peat swamp degradation (Hirano et al., 2007; Jauhiainen et al., 2008) and there is an increasing concern about the loss of biodiversity. Both topics heavily depend on hydrological subsurface processes, controlling the degree in which peat swamp forests act as a retention area of rainfall (Hoekman, 2007) and fall dry to become prone to wild fires. Few studies have focussed on the hydrology of peat land forests, which not only limits knowledge about the factors controlling peat degradation, but also raises questions about the quantitative role of peat forests to act as a buffer preventing low-flows in the river system.

3. *Fluvial sediment delivery to the coastal ocean in the tropics*

At a global scale, tropical rivers are the principal source of sediment delivery to the coastal ocean (Milliman and Meade, 1983). This relates to the intensity of rainfall events at low-latitudes and the high erodibility of tropical soils (Allen, 1997). The anticipated results will increase understanding of the dynamics of terrestrial sediment delivery to the coast, which in a general context is relevant to ecological research focusing on coral reefs (Hoitink and Hoekstra, 2003), mangroves (Wolanski, 1995), sea grasses (Hovel et al., 2002) and fisheries (Bilotta and Brazier, 2008), and to geological research related to the formation of deltas, coasts and continental shelves (Bridge and Demicco, 2008). Studying the development of sediment discharge waves in a system like the Kapuas will reveal the controls of fluid dynamics over the transfer of terrestrial sediment from sources to sinks in a large tropical river.

4. *Integrating hydrology and geomorphology of large rivers*

In a systematic overview of the world's largest tropical rivers, Latrubesse et al. (2005) conclude that the geomorphology of tropical rivers has received insufficient attention when compared to the advances realized by other scientific disciplines in the tropics. Science of the tropics has focussed particularly on biodiversity, in studies of terrestrial and aquatic ecology, which often lack a solid knowledge base regarding geomorphology and hydrology. Integration hydrology and geomorphology will provide a solid conceptual framework of the functioning of the physical hydrosystem, enabling progress in each of the separate disciplines and in ecology. A key issue connecting hydrology to the geomorphological behaviour of tropical rivers regards the hydrological exchange processes between a river and its surrounding aquifers, controlling river bank stability and the buffering effect of aquifers. We will focus on river-aquifer exchange by coupling of models, monitoring of hydrometeorological variables and direct measurement using ^{222}Radon tracer surveys (Peterson et al., 2010; Lubis et al., 2011) in two of the four subprojects.

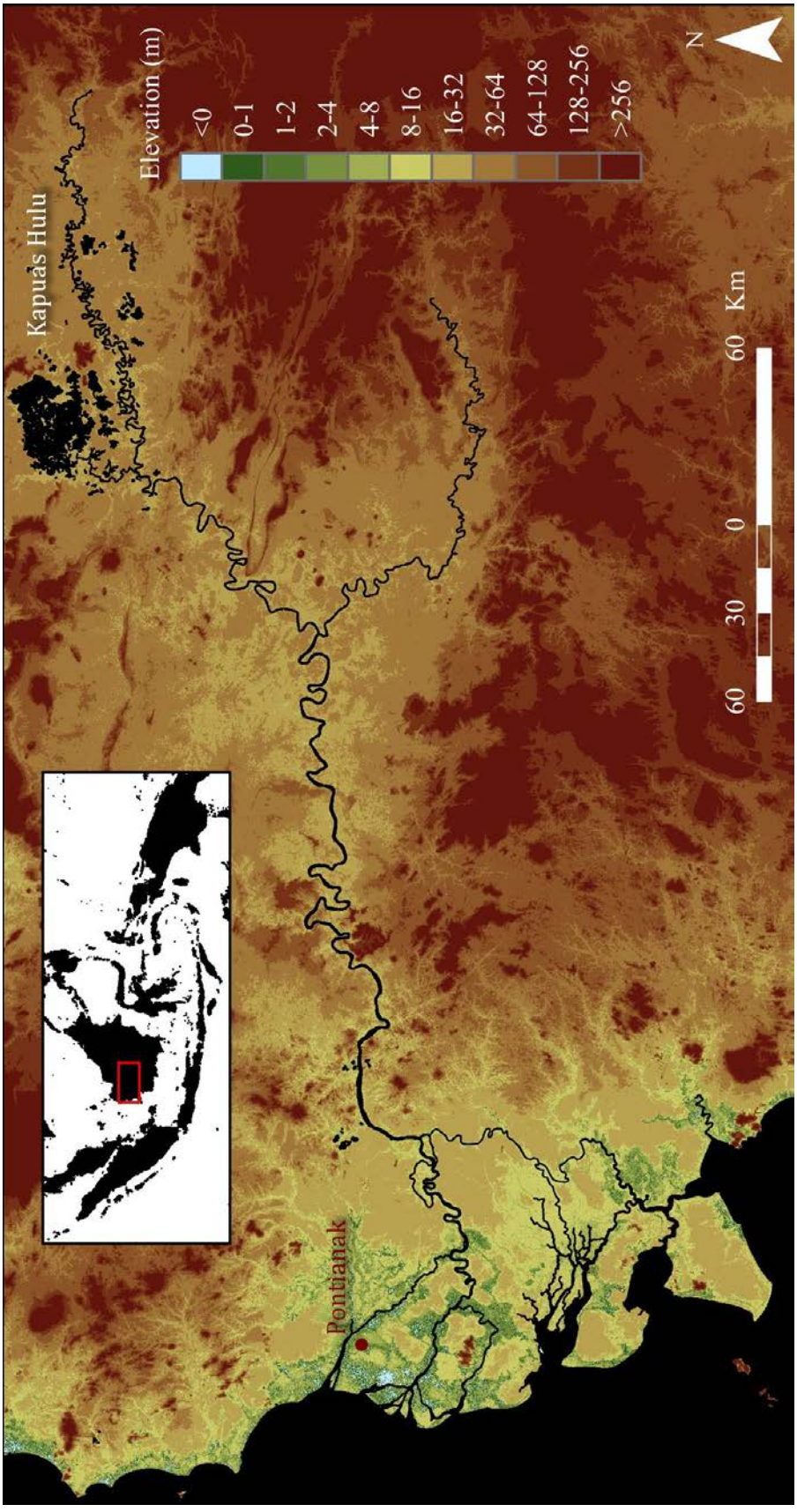

Figure 1. Surface elevation map of the Kapuas catchment from SRTM data, with surface water in black

5. Projects within the programme (include project title and reference number, names of Project Leaders and abstracts) *(Max. 400 words per project)* **Word count: 1586**

Subproject 1 (SPIN Postdoc)

Resilience of the terrestrial water cycle in the Kapuas catchment to local and global change

Project leaders: A.J. Teuling and G.S. Haryani; prospective Postdoc: Hidayat

This project aims at developing an understanding of the resilience of the terrestrial water cycle and processes directly impacted by the water cycle in the Kapuas catchment to local and global changes. Here, local changes are those associated with land use changes, incl. deforestation. Global changes, on the other hand, are changes in climate conditions and precipitation patterns as induced by global warming and changes in atmospheric circulation. Special emphasis will be put on the impact of changes in terrestrial hydrological and biogeochemical cycles incl. land degradation on water level dynamics, water quality, and ecology of the Kapuas lakes region. The proposal is a direct follow-up of an existing cooperation between Wageningen University (WU) and LIPI-Limnology, established in the context of a research program focussing on the Mahakam basin. As is the case in the Mahakam, the Lake Sentarum area in the Upper Kapuas has a water regulating role by alternately feeding and draining the Kapuas River, potentially preventing extreme floods or low flow conditions.

We will study these processes with a state-of-the-art land surface model (the Community Land Model CLM) which couples terrestrial hydrological and biogeochemical cycles and which features dynamic vegetation and wetland modules required to study the sensitivity of water level, discharge, and sediment dynamics on land cover and climate conditions. The model will be run offline driven by estimated current climate forcings, and by perturbed forcings representative for future climate projections in order to study the resilience of the system to change. The simulated results of climate variability on terrestrial hydrological and biogeochemical cycles, land degradation and ecology will be primarily controlled by the representation of the land surface hydrological processes, which are known to be uncertain in tropical regions due to the lack of historical observations required for validation. Therefore, validation forms an integral part of this proposal. As part of the current proposal, profile soil moisture observations will be collected at five locations in the upper Kapuas area. Discharge observations will provide an integrated signal of the hydrological functioning of the Kapuas, and will be obtained by means of ADCP. Ecological issues to be addressed in this project include the role of riparian vegetation in supporting aquatic biota, community structure and distribution of aquatic biota, and the effect of seasonal and long-term changes of hydrodynamics patterns on the reproduction behaviour of fish in Lake Sentarum.

Subproject 2 (DIKI PhD):

Hydrological drought in the Kapuas river basin (West Kalimantan): understanding the role of subsurface water

Project leaders: H.A.J. van Lanen and R.M. Delinom

The subproject will study subsurface water dynamics to investigate how meteorological drought propagates into a hydrological drought (groundwater and streamflow) in the Kapuas basin, where drought development is strongly controlled by El Niño. Knowledge on drought development will be used to study potential conditions for peatland fires, which is a major environmental concern. Additionally, fresh water inflow into the delta under drought conditions is investigated, which is relevant for socio-economic development. The study will address two scales, i.e. the whole Kapuas basin and a representative sub-basin in the order of 25-50 km^2, which coincides with the size of a peat dome. A preparatory desk study complemented with a reconnaissance field visit will be used to select the sub-basin. At the sub-basin scale, time series of rainfall, groundwater and streamflow will be collected through two-year of continuous monitoring, which will be complemented with intensive field campaigns. In these campaigns, tracer experiments will be carried out using ^{222}Radon, which is innovative in Indonesian environments. Comprehensive field surveys and targeted hydrological data collection at denser spatial scales will complete the tracer tests. Spatially-distributed

groundwater recharge – discharge relationships, including subsurface storage dynamics, will be derived from the observed data, which will be synthesized to develop a transient, spatially-distributed groundwater flow model. Data from analogue stations and re-analysis data (e.g. WATCH Forcing Data) will extend the rather short time-series of weather data from the sub-basin. Time series of precipitation and simulated groundwater levels and streamflow will be analysed to identify meteorological droughts and how these propagates into hydrological drought. Drought characteristics will be associated to potential peatland fire conditions. This will be done both for historic and future weather conditions (the latter will be retrieved from downscaled, bias-corrected output from three GCMs). At the scale of the whole Kapuas basin, a similar hydrological drought analysis will be conducted using gridded time series of hydrometeorological data from 8-10 large-scale models (EU WATCH project). The CLM modelling in subproject 1 will contribute to this regional hydrological drought analysis. The links between occurrence of large-scale hydrological drought and El Niño will be explored. The drought study will investigate potential conditions for peat fires in the whole basin and fresh water inflow in the delta area during low flow periods, incl. projected changes due to climate change. The sub-basin model will be applied to put these changes in the context of other developments in the basin.

Subproject 3 (SPIN PhD researcher):

Multi-scale modelling and monitoring of the Kapuas surface water land-sea continuum

Project leaders: A.J.F. Hoitink and N.S. Ningsih

Coastal lowland areas over the world are increasingly vulnerable to floods and droughts, which is caused by climate change and by a variety of direct human interventions in the physical system. The Kapuas lowland area presents a complex tropical tidal channel network, where increased vulnerability is manifest as salinity intrusion, as impediment of navigation by river sedimentation and as flood events related to hurricanes. While much is known about tidal propagation and salinity intrusion in single-channel estuaries, and many studies have focussed on morphodynamics of river deltas void of tidal influence, generic understanding of mixed river-tide dominated channel networks is lagging behind. Tidal junctions play a central role in the hydrodynamics and morphodynamics of tidal channel networks, by controlling the division of river discharge and alluvial sediment over distributaries. The main objective of this study is to increase the understanding of processes controlling the division of water and sediment over distributaries impacted by tides, and to establish the consequences for delta geomorphology and hydrological extremes.

The proposed research includes field monitoring and numerical modelling, both at a global scale and at the scale of a channel junction. Field work at the global scale will consist of installation of water level gauges, two horizontal acoustic Doppler current profilers (HADCPs), salinity sensors and optical backscatter sensors to monitor suspended sediment concentration. In collaboration with subproject 4, channel bathymetry along a total transect length of 3500 km will be collected. At a local scale, hydrographic surveys of two selected channel junctions will be carried out, aiming to reveal the division of water and sediment over downstream distributary systems. We aim to improve existing methods to convert HADCP data to river discharge of both water sediment. The unstructured mesh, finite-element model SLIM[4] will be applied, in which one-dimensional and two-dimensional domains are online coupled. This will be an improvement of an existing model of at the Institute of Technology Bandung. Sediment transport processes and local morphological developments at the two selected tidal junctions will be modelled in Delft3D. The SLIM model domain will stretch from the central reach of the Kapuas, near the city of Sanggau, to the boundaries of the Karimata Strait. After setup, calibration and validation of the model, scenario simulations will be performed in collaboration with the other subprojects, offering insights into the physical mechanisms causing salinity intrusion up to the city of Pontianak, and storm surges related to hurricanes.

[4] www.climate.be/slim

Subproject 4 (SPIN PhD researcher):

River morphology in peat environments

Project leaders: A.J.F. Hoitink and G.Z. Anshari

The geomorphology of tropical rivers has received insufficient attention when compared to the advances realized by other scientific disciplines in the tropics. Policy makers and scientists in tropical countries, such as Indonesia, whether focussing on water management, or on global concerns of biodiversity and carbon cycling, generally cope with an incomplete and incoherent understanding of the physical hydrosystem. The Kapuas River represents a large tropical river in an area hosting peat bogs. The main objective of this subproject is to identify the key environmental factors and hydrodynamic processes controlling changes in meander behaviour apparent in the Kapuas River. The approach consists of a systematic geographic analysis, hydrographic field surveys of selected meander bends, hydrodynamic and morphodynamic modelling using a state-of-the-art numerical model, and synthesis of each of these components with results from other subprojects.

The geographic river analysis aims to find relations between the spatial series of river planform and bathymetry parameters such as curvature, sinuosity, depth, width and valley slope, and environmental properties including soil type, land cover class, vegetation density, soil moisture and river channel-aquifer exchange fluxes. In collaboration with subproject 3, channel bathymetry along a total transect length of 3500 km of river will be collected for this purpose; satellite radar images will be processed to yield the river bank lines, and raw-data SRTM images will be processed to obtain highly accurate estimates of valley slope along the river. An existing land cover map and knowledge about soil moisture and river channel-aquifer exchange fluxes will be gained in collaboration with subprojects 1 and 2 (respectively).

Two high-curvature meander bends will be selected which show distinct geomorphological features typical for rivers in tropical peat environments, including outer bank benches and deep scours. Detailed measurements of the mean flow will be taken using an acoustic Doppler current profiler, by repeatedly navigating along about 20 cross-river transects. To obtain measurements of the turbulence structure, a new monitoring technique developed at Wageningen University will be applied to obtain vertical profiles of turbulence parameters (Vermeulen, 2011a). To understand the mechanics of the complex flow observations, models will be setup in a finite-element Large Eddy Simulation model (Finlab) appropriate for intrinsically three-dimensional flow over complex topography. In a first stage, field observations will be simulated with a fixed bed. In a final stage of the project, idealized morphodynamic model simulations will be performed aiming capture the essence of the anomalous river behaviour.

6. Relevant publications by members of the research group(s) (as defined under 2)
(a limit of 25 publications applies for each research group member referred to. Only list those publications most pertinent to this application.

- **International (refereed) journals**
  (include journal impact factors. Mandatory if your proposal is entered in the themes: Infectious diseases and Health or Food, Non-Food and Water Research. Optional for Social and Economic Development

A.J.F. Hoitink

De Brye, B., S. Schellen, M.G. Sassi, B. Vermeulen, T. Karna, E. Deleersnijder and A.J.F. Hoitink. (2011) Preliminary results of a finite-element, multi-scale model of the Mahakam Delta (Indonesia), Ocean Dyn. 61:1107–1120 doi:10.1007/s10236-011-0410-y. (impact factor: 1.677).

Hidayat, H., Vermeulen, B., Sassi, M. G., Torfs, P. J. J. F., and Hoitink, A. J. F. (2011): Discharge estimation in a backwater affected meandering river, Hydrol. Earth Syst. Sci., 15, 2717-2728, doi:10.5194/hess-15-2717-2011. (impact factor: 2.463).

Hoitink, A. J. F., Buschman, F. A., & Vermeulen, B. (2009). Continuous measurements of discharge from a horizontal acoustic Doppler current profiler in a tidal river. Water Resources Research, 45(11). (impact factor: 2.737).

Hoitink, A. J. F., Dommerholt, A., & van Gerven, L. P. A. (2008). Hydraulic design of a tilting weir allowing for periodic fish migration. Journal of Hydraulic Engineering, 134(11), 1559-1569. (impact factor: 1.227).

Hoitink, A. J. F., & Hoekstra, P. (2003). Hydrodynamic control of the supply of reworked terrigenous sediment to coral reefs in the bay of Banten (NW java, Indonesia). Estuarine, Coastal and Shelf Science, 58(4), 743-755. (impact factor: 1.887).

Hoitink, A. J. F., & Hoekstra, P. (2005). Observations of suspended sediment from ADCP and OBS measurements in a mud-dominated environment. Coastal Engineering, 52(2), 103-118. (impact factor: 1.624).

Hoitink, A. J. F., Hoekstra, P., & Van Maren, D. S. (2006). Comment on "On the role of diurnal tides in contributing to asymmetries in tidal probability distribution functions in areas of predominantly semi-diurnal tide" by P.L. Woodworth, D.L. Blackman, D.T. Pugh and J.M. Vassie [Estuarine, Coastal and Shelf Science 64 (2005) 235-240]. Estuarine, Coastal and Shelf Science, 67(1-2), 340-341. (impact factor: 1.887).

Hoitink, A. J. F., Hoekstra, P., & Van Maren, D. S. (2003). Flow asymmetry associated with astronomical tides: Implications for the residual transport of sediment. Journal of Geophysical Research C: Oceans, 108(10), 13-1. (impact factor: 3.303).

Hoitink, A. J. F., Peters, H. C., & Schroevers, M. (2007). Field verification of ADCP surface gravity wave elevation spectra. Journal of Atmospheric and Oceanic Technology, 24(5), 912-922. (impact factor: 1.86).

Hoitink, A. J. F., van Maren, D. S., & Hoekstra, P. (2011). Mixing and stratification in a tropical tidal embayment subject to a distributed freshwater source. Journal of Marine Systems, 88(1), 34-44. (impact factor: 2.005).

Hoitink, A. J. F. (2008). Comment on "The origin of neap-spring tidal cycles" by Erik P. Kvale [marine geology 235 (2006) 5-18]. Marine Geology, 248(1-2), 122-125. (impact factor: 2.517).

Hoitink, A. J. F. (2004). Tidally-induced clouds of suspended sediment connected to shallow-water coral reefs. Marine Geology, 208(1), 13-31. (impact factor: 2.517).

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Added Value and Cooperation

8. Added value of the integrated approach (including scientific disciplines involved)
(*Max. 500 words*) **Word count: 232**

The scientific disciplines involved in the programme include hydrology, geology, physical geography, environmental fluid mechanics, physical oceanography and aquatic ecology. Researchers from these disciplines all have their own view on the Kapuas catchment, but have enough common grounds to share similar earth scientific interests. In many university systems, the disciplines involved in the proposal fall under the same environmental science department, but participation of a large number of scientists from the same environmental department in a focussed project is rare. The three project leaders from the Department of Environmental Science Group at Wageningen University (Hoitink, environmental fluid mechanics; Van Lanen, hydrogeology and Teuling, catchment hydrology) are close colleagues. They will cooperate naturally with four Indonesian project leaders who have complementary knowledge about aquifer-surface water exchange processes (Delinom, LIPI-Geotechnology), tropical peatlands (Anshari, Tanjupura University), wetland ecology (Haryani, LIPI-Limnology) and storm surges (Ningsih, ITB). All seven project leaders have a clear niche in the Joint Research Project. The cross-linkages are numerous, which are detailed in Sections 8 of each of the four subproject descriptions. Scientific breakthroughs are most likely to occur at the interface between disciplines. The Kapuas river basin features peatlands, wetlands, a lowland channel network and a meandering river in a nearly pristine setting, which offer a variety of scientific challenges, which can best be approached with a team of environmental scientists sharing logistics, data, and most of all knowledge and insights.

9. Relevance of the programme for development issues in Indonesia
(Max. 1000 words) **Word count: 547**

a. Societal relevance;

The province of West Kalimantan is at the brink of becoming an area of rapid development. Palm oil plantations are being installed, which implies an inland movement of people and the creation of job opportunities of various kinds. The JRP can provide a basis for planning of palm oil plantations and other agro business, by indicating the regions in the Kapuas Basin where water availability is sustainable. More in general, the models to be developed in the JRP can serve goals in land use planning, in civil engineering works and in the development of ecotourism. Considering the key societal problems of the region, viz. flooding of cities, disruptions in drinking water supply and impediment of navigation, the JRP will focus on the underlying governing processes causing of those problems, whereas we foresee close ties will develop with engineering companies, like in the Mahakam project. The main applicant in The Netherlands has been approached by Royal Haskoning, who have carried out a feasibility study for port development in the capital of West Kalimantan (Pontianak). On a global scale, potential carbon emissions related to peat forest fires bear a high societal relevance. The drought research in the JRP intends to contribute to understanding of peat forest fire occurrence by studying subsurface hydrology, including groundwater and soil moisture, which may yield insights that can serve as a basis for efforts to prevent peat forest fires.

b. Scientific capacity / institution building;

Scientific capacity and institution building of this JRP will extend far beyond the researchers who are directly involved. Tanjungpura University will be the first institution to gain from this JRP, being located in West Kalimantan and having the closest links with regional stakeholders. The Postdoc researcher in this this JRP will enjoy a part-time function in this program at Wageningen University (0.5 fte) and a part-time function at LIPI-Limnology (0.5 fte), which is formally approved in an accompanying letter by the Director of LIPI Limnology. This job configuration of employment will be promote scientific exchange. The use of open access models will be an additional stimulus of scientific capacity and institution building, facilitating the transfer of model implementations.

c. Dissemination and knowledge sharing;

The dissemination of results and knowledge sharing is ensured by joint Indonesian-Dutch project leaderships, the construction of a common data base (also beyond the lifetime of the JRP), by general assemblies and specified workshops on drought and hydrodynamic modelling, both in Indonesia and in the Netherlands (respectively), by publication in International and National journals and by presentations in National and International conferences and symposia. The two intensive field campaigns in the Kapuas River basin will be used to share common knowledge and experiences of the JRP team with a large group of Indonesian experts. A field course on hydrological measurements and a master class about hydrographic monitoring methods will be given (see Section 13). The JRP will offer a platform of intensive knowledge sharing on hydrology and geomorphology among the Indonesian postdoc (subproject 1), DIKTI PhD (subproject 2), and the two Dutch PhDs (subprojects 3 and 4). At the kickoff meeting and the concluding conference, one day will be allocated to a science-stakeholder-policy dialogue that will address sustainable development of tropical peatland river basins in general, and the Kapuas River basin in particular.

10. Embedding and additional support (science policy and activities of participating research groups)
(Max. 500 words) **Word count: 168**

The research set out in the current proposal coincides with the missions of the involved institutions, which is confirmed in the six accompanying Letters of Commitment. The staff involvement in PhD and Postdoc supervision, field research, project management and lecturing during workshops forms the main form of in-kind support by the participating institutions. Wageningen university places a suite of field instruments at the disposal of the JRP. In case of granting of this proposal, the Indonesian Institute of Science / LIPI Geotechnology guarantees an additional fund of €100.000,- for fieldwork expenses, workshops in Indonesia,

and publication costs. The University of Tanjungpura will support fieldwork in the Danau Sentarum National Park for an amount of €10.000. During the project, additional support will be generated locally and nationally by the four participating Indonesian institutions. The Dutch partners foresee additional support from engineering companies who have an interest in West Kalimantan, including Royal Haskoning and Deltares. Finally, we foresee additional DIKTI PhD student project will be embedded in the present JRP.

11. International co-operation and network building (*Max. 2000 words*) **Word count: 1771**

a. Report on joint programme development

A joint workshop has been organised during the World Delta Summit, held from 21 through 24 November 2011 at the Jakarta Convention Center. During this gathering, R.M. Delinom (LIPI-Geotechnology), G.S. Haryani (LIPI-Limnology), Lukman (LIPI-Limnology), A.J.F. Hoitink (WU), Hidayat (WU, LIPI-Limnology), B. Vermeulen (WU), M.G. Sassi (WU) have extended the general layout of the present proposal, based on the Letter of Intent written by R.M. Delinom and A.J.F. Hoitink. Subsequently, contact between partners from Wageningen University and Tanjungpura University took place during the Fall Meeting of the American Geophysical Union (AGU) in San Francisco, December 2011, where A.J.F. Hoitink and G.Z. Anshari were co-convenors of separate sessions. During the AGU Fall Meeting, many of the results obtained during the EKP projects were presented. In January 2012, staff members from Wageningen University and LIPI-Geotechnology have conducted a pilot study in the Kapuas basin. This started with a workshop hosted by Dr. Anshari at Tanjungpura University in Pontianak, during which presentations were given by members of each of the three participating institutions. The team, including the prospective Postdoc Hidayat, then visited local stakeholders, including port authorities, the Pontianak Meteorological Office, the Public Works Office and the BAPPEDA-Board of Provincial Development Planning. The pilot study was concluded by field trips in three regions: (1) the delta, (2) the central reaches of the Kapuas River and (3) in the Kapuas Hulu area. In the week between 5 and 11 March 2012, Prof. Delinom visited Wageningen University for proposal writing.

b. Level of co-operation

The principal aim of the co-operation will be to conduct joint research, to be published in peer-reviewed journals, at the highest possible level. An apparent proof of willingness to fully cooperate is the part-time appointment that was agreed upon regarding the prospective Postdoc, Hidayat. He will be employed by LIPI-Limnology for 50% of time, and by Wageningen University for the remaining 50% of time, which guaranties a lively exchange of scientific knowledge. The other strong act of commitment from the Indonesian side is the allocation of €100.000,- by LIPI-Geotechnology to support the participation of Indonesian partners in the scheduled activities, fieldwork and cover publication costs. The prospective PhD and Postdoc candidates will conduct field work during two intensive field campaigns, which are about one year apart (see schedule in point 15). In the period in between the field campaigns, Indonesian staff members will ensure maintenance and reading out of data from all continuous monitoring stations. The Dutch participants will make a high in-kind contribution in terms of PhD supervision, fieldwork management, lecturing during workshops and organization of all planned activities. The investments from both sides in joint activities will guarantee the highest level of cooperation.

c. Prior scientific collaboration between the research groups

Previously, there has been a close cooperation between ITB, LIPI-Limnology and Wageningen University in the framework of the Indonesian-Dutch East Kalimantan (EKP) Programme, run by the Netherlands Organisation for Scientific Research, the Royal Netherlands Academy of Arts and Sciences, and the Indonesian Consortium of Coastal and Marine Research. LIPI-Limnology was the Indonesian counterpart in the EKP project entitled: 'Discharge regimes, morphometry and tides in the Mahakam delta channel network'[5], led by Dr. Hoitink in The Netherlands. The two PhD candidates who carry out this project (Hidayat and M.G. Sassi) are expected to defend their thesis by mid-2012 and the end of 2012, respectively. As the Director of LIPI-Limnology, Dr. Gadis Sri Haryani was the Indonesian project leader for this project. In this role she has given full support in all logistics regarding fieldwork, providing staff support for

[5] http://www.nwo.nl/nwohome.nsf/pages/NWOP_8DFDEX

maintenance and reading out of data, when the PhD researchers were not in the field. Her staff has been invaluable in collecting bathymetry information in the Mahakam River. She has recently resigned as a Director of LIPI-Limnology, and will continue her career as a senior researcher. The new Director, Dr. Tri Widiyanto, will give the same kind of support as Dr. Haryani has given in the Mahakam project, while Dr. Haryani, in her new function, will have more time to conduct research and publish results in international, peer-reviewed journals.

ITB was the formal counterpart in the EKP projects entitled: 'Mixing and dispersion in marine waters surrounding coral reefs'[6] and 'Water and sediment distribution at lowland river junctions: the Mahakam Lakes region'[7]. The PhD candidates carrying out these projects (A. Tarya and B. Vermeulen) are expected to defend their thesis by the end of 2012 and early 2013, respectively. Each of these PhD projects was led by Dr. Hoitink in The Netherlands, as a staff member at Utrecht University and at Wageningen University (see section 14). Prof. Safwan Hadi was the formal Indonesian project leader of both those projects, who also has given excellent support during fieldwork activities. Prof. Hadi has recently retired, and part of his duties at ITB will be taken over by Dr. Nining Sari Ningsih, who is co-applicant in the present proposal. Dr. Ningsih was on sabbatical leave in Japan at the time during the period when this proposal was written. She is eager to participate in the proposed JRP, which will allow her to conduct scientific research on the Kapuas which builds upon results from short-duration contract research she conducted at ITB.

d. Linkages with other national, regional and international research initiatives or research groups

At a national level in the Republic of Indonesia, this project will be linked to the Ministries of Public Works and Agriculture, to Indonesian Hydrology Community (Masyarakat Hidrologi Indonesia – MHI), to the International Center for Interdiscplinary and Advance Research (ICIAR) – LIPI and to the Consortium on Urban Subsurface Environment Management in Asia (CUSEMA). A recent stated mission of MHI is to better understand river behaviour in Indonesia, in which the Kapuas River is explicitly mentioned. This mission coincides well with the central objective of this JRP, focussed on hydrology-geomorphology links. MHI has an interest in helping the Indonesian Government to keep the rice production to increase year by year. To reach their goals, MHI is going to evaluate several river basins to explore the possibilities to develop rice field areas, including the Kapuas Basin. ICIAR focusses on the history and development of delta areas, which bears a strong link with the channel network subproposal in this JRP. CUSEMA, as an Asian regional research initiative, can be potentially linked to this JRP as their primary research object is groundwater in urban areas. Pontianak, which located inside the Kapuas Basin, is a developing urban area where an optimized, sustainable water resources management can constructed, because most of the development is yet to come.

At a national level in The Netherlands, the JRP will be linked to the The Boussinesq Center for Hydrology[8] and to Netherlands Center for River Research[9]. These two research centers organize yearly gatherings, where the three PhD researchers and the Postdoc will present results and share their knowledge.

The JRP will link science groups in Europe with those in Southeast Asia, which are two key players in today's global economy who have much in common. Their population are nearly identical in terms of size, they have both moved towards regional economic integration, and they share many of the same values, incl. environmental concerns (e.g. global change, biodiversity). Over the last decades, the European Union and the Association of Southeast Asian Nations (ASEAN), incl. Indonesia have entered an increasingly positive and fruitful dialogue. In this context, the European Union' policy making ensures that the EU does not increase its pressure on the water resources (water footprint) of 3rd countries. Concrete water policy options are being discussed in EU will be published in the Blueprint to safeguard Europe's Waters that will be published in November 2012[10]. Dr. H.A.J. van Lanen is a key player in science-policy interfacing for the EU Water Framework Directive. His active involvement in the JRP will link EU river basin research and management to

[6] http://www.nwo.nl/nwohome.nsf/pages/NWOP_8DPDDV
[7] http://www.nwo.nl/nwohome.nsf/pages/NWOP_8DQGBK
[8] http://www.boussinesqcenter.nl/
[9] http://www.ncr-web.org/
[10]http://ec.europa.eu/environment/water/blueprint

river basin research and management in Indonesia.

JRP research, in particular on drought and its impacts, will be embedded in the UNESCO International Hydrological Programme (IHP) through a contribution to the IHP cross-cutting programme FRIEND (Flow Regimes and Experimental Network Data). Dr. H.A.J. van Lanen is a global coordinator of this programme, which will ensure that cooperation with Southeast FRIEND (Dr. Giuseppe Arduino, UNESCO Jakarta Office) and European FRIEND Regional Groups will be extended. The DIKTI PhD student will become a member of the FRIEND Project Group on Low Flows and Drought and will spend some time in a partner university, if the proposal for a new EU COST Action: FRIEND-Water: Low flows and droughts in a changing climate is granted (COST: European Cooperation in the field of Scientific and Technical Research).

The JRP research on drought and its impacts (subprojects 1 and 2) will also be included in the exchange of emerging research outcomes of the European Drought Centre (EDC)[11]. This virtual centre is a meeting place of over 250 drought experts, from which about 20% is from outside Europe, including members from Indonesia. Dr. H.A.J. van Lanen is one of EDC coordinators. In addition, Dr. A.J. Teuling has active collaborations with the ETH Zurich and the Max Planck institute for Biogeochemistry in Jena concerning the observation and modeling of land surface hydrological processes in the framework of his Veni grant provided by the Netherlands Organisation for Scientific Research[12].

At an international level, many of the participating project leaders are a member of the European Geophysical Union and the American Geophysical Union, which each have a yearly meeting. Focussing on linkages with institutes in East Asia, the Indonesian Project leaders are intend to link the JRP research results with research institutions in Japan, including the Research Center for Humanity and Nature (RIHN), Tokyo University, Kyoto University, Kumamoto University, Hiroshima Univeristy, Nagasaki University, Chiba University, Tsukuba University and the Advanced Institute Science and Technology (AIST), in Korea (Korea Research Institute for Human Settlement - KRIHS) and in the Philippines (University of the Philipines).

The main applicant in The Netherlands has an active collaboration with the State Key Laboratory of Hydrology-Water Resources and Hydraulic Engineering at Hohai University (China). A Joint Research Project was funded by National Science Foundation in China / NSFC and the Netherlands Organisation for Scientific Research (NWO) entitled: 'Morphodynamic developments in distributary channel networks: impacts on flood hazards in the Pearl River Delta and the Rotterdam Rijnmond channel network'[13], which has a strong connection to subproject 3 in this JRP proposed herein. Since Hohai University is involved in this proposal, the JRP can link Indonesian institutions like ITB to Hohai University, which ranks as one of the highest universities in China.

12. Stakeholder participation (communication and dissemination)
(Max. 500 words)

Word count: 160

The Ministry of Public works currently has many relevant projects in West Kalimantan, related to plans to build a bridge over the Kapuas River, building of roads, and new human settlements. Each of these projects requires water resources information. In a continuous effort, the Ministry of Agriculture is aiming to find appropriate areas for rice field developments. West Kalimantan offers several candidate regions in this respect. The Univerisitiy of Tanjungpura is much in need of acquiring supporting data, which will allow to increase their responsibility as the principal institute providing recomendations to Governor of West Kalimantan, concerning developments in the region. We will actively link our research to issues of regional development, and invite stakeholders during the opening and end workshops. At these meetings, one day will be allocated to a science-stakeholder-policy dialogue that will address sustainable development of the Kapuas River basin. Many of the national linkages in Indonesia as described under 12d will assure knowledge exchange with stakeholders.

[11] http://wwwhttp://www.geo.uio.no/edc/
[12] http://www.nwo.nl/projecten.nsf/vk2010/ned/2300161058
[13] http://www.nwo.nl/nwohome.nsf/pages/NWOP_8JYJ69

13. Joint activities *(Max. 1000 words)* **Word count: 684**

The joint activities include the following events:

Opening, mid-term and end workshops

Three plenary workshops are planned during which the entire JRP group will gather. The opening workshop will be held in Pontianak, hosted by the University of Tanjupura. The end of the opening workshop will coincide with the start of a field training, which in turn proceeds with the first field campaign. The mid-term and end workshops will be held at Wageningen University and LIPI-Geotechnology in Bandung (respectively). During the latter two workshops, all International partners from outside Indonesia and The Netherlands will be invited.

Field Training Hydrology in the Kapuas catchment

At the start of the field work part of the project, a field training in hydrology will be organized for up to 20 project staff members. The objective of this field training is to offer basic knowledge in hydrology and hydrological measuring techniques. After an introduction in hydrological theory, in particular from the catchment approach, a hands-on training in the field on installation and maintenance of the measurement equipment will be given. The data collection and manipulation is also a major topic in the training.

All components of water flow will be dealt with:

- Precipitation by using automatic tipping bucket rain gauges
- ET by using an automatic meteorological station (Penman-Monteith)
- River flow/discharge by using weirs, stilling wells, and automatic level recorders
- Groundwater by using piezometers and automatic level recorders
- Total dissolved solids by using automatic electric conductivity recorders Groundwater storage (change)
- Soil moisture observation

ADCP workshop at the Institute of Technology Bandung

Acoustic Doppler Current Profilers (ADCPs) are routinely employed to measure flow velocities in fluvial and marine environments, for more than two decades. ADCPs can also be used to quantify sediment concentrations in rivers and streams. This one-day workshop will intended to introduce students, researchers and practitioners in the fields of hydrology and coastal oceanography to the use of ADCPs for hydrographic surveying and continuous monitoring of water and sediment discharge. The workshop will be held in Bandung, hosted by Bandung Institute of Technology.

Workshop river flow modelling in Delft

A major effort in the PRP will be devoted to numerical modelling of flow, sediment transport and river morphology, using state-of-the-art models running at high-performance computer clusters. Right after the mid-term workshop, part of the Indonesian and Dutch project partners will proceed to exchange of results on numerical river flow modelling during a one-day workshop in Delft, hosted by Delft University of Technology.

Drought workshop in Cibinong

A Drought Workshop to be held in Cibinong provides participants with a unique opportunity to advance knowledge on hydrological drought and to learn both basic and advanced techniques to detect and to analyze drought, including the impact of human influences, incl. climate change. The course is taught by well recognized experts in the field (Henny A.J van Lanen and Lena M. Tallaksen), who are the editors of a Elsevier textbook on Hydrological Drought. The intensive four-day workshop will cover an introduction to drought (incl. terminology and its impacts) and hydroclimatology (incl. climate change), the significance of

hydrological processes leading to drought, data need, drought characterization, frequency analysis, regionalization (incl. prediction at the ungauged site), human influences (incl. climate change) and operational applications. The first two days of the workshop will mainly consists of lectures combined with some time for hands-on training using self-guided tours. On the last two days participants work in two parallel workshops. In the first workshop the participants get hands-on training on drought frequency analysis and in the second workshop the focus is on the assessment of the impact of climate change on drought using a physically-based hydrological model. Participants work in small groups on real world data. The workshop is concluded by a plenary presentation and discussion of the outcome of the workshops by the participants. The textbook on Hydrological Drought complemented with recent research results will be used as course material (Tallaksen & Van Lanen, 2004). The textbook includes a CD, on which data for different scales, worked examples, self-guided tours and drought analysis tools are stored. These data and tools will be used for the hand-on training.

Management and Administration

14. Information on the managing capacities of the Programme Coordinator

(Max. 250 words)

Word count: 244

Please refer to Section 9 in Subproject 2 for managing capacities of the Indonesian Programme Coordinator

Dr. Hoitink is an Associate Professor of Environmental Fluid Mechanics, as part of the Hydrology and Quantitative Water Management Group chaired by Remko Uijlenhoet (0.8 fte). He has an additional 0.2 fte tenured position at the Institute for Marine and Atmospheric Research Utrecht, where he received his PhD degree. He has been the principal investigator of a large number of hydrographical field campaigns in Indonesia and in The Netherlands, and is currently co-supervising a field campaign in the Pearl River in China. He received research grants to support 6 PhD projects. The first PhD researcher he supervised graduated in 2011 and three PhD thesis defences are planned in 2012. He is the scientific head of the Kraijenhof van de Leur Laboratory for Water and Sediment Dynamics[14], where contract research based on physical scale models of rivers and streams is being carried out. He participates regularly in the organization of national and international workshops and symposia. In December 2011, he was co-convenor of a session entitled *Land-Sea Interactions in Tropical Delta Regions in Transition* at the Fall Meeting of the American Geophysical Union in San Fransisco. He frequently acts as an advisor of monitoring programmes by Rijkswaterstaat, which is the executive arm of the Dutch Ministry of Infrastructure and the Environment in The Netherlands. As a university staff member, his responsibilities include management and lecturing of introductory and advanced courses in fluid mechanics, for students who specialize in hydraulics, hydrology, meteorology and soil sciences.

[14] http://www.watersedimentlab.wur.nl/

Duration and Planning

15. Time table of the programme and Milestones

	2012		2013				2014				2015				2016			
Activity	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Opening workshop University Tanjungpura																		
Fieldwork preparation																		
First joint field campaign																		
Continuous monitoring stations																		
Second joint field campaign																		
Field course hydrological measurements																		
Workshop ADCP field surveying at ITB, Bandung																		
Drought workshop at LIPI, Cibinong																		
Workshop numerical flow modelling, Delft																		
Mid-term workshop in Wageningen																		
Subproject 1: Indonesian Postdoc																		
Subproject 2: DIKTI PhD																		
Subproject 3: SPIN PhD																		
Subproject 4: SPIN PhD																		
Final workshop at LIPI, Bandung																		