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Global wetland dynamic derived from multi-satellite estimates: a 12-year record for hydrological studies and methane emission modelling

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Wetlands cover only 5% of the Earth's ice-free land but exert major impacts on global biogeochemistry, hydrology, and wildlife diversity. Until now, quantitative, global time-series of spatial and temporal dynamics of inundation have been unavailable. A globally-applicable remote-sensing technique employing a suite of complementary satellite observations has been developed: it uses passive microwave land-surface microwave emissivities calculated from SSM/, ERS scatterometer responses, and AVHRR visible and near infrared reflectances. Combining observations from different instruments makes it possible to capitalize on their complementary strengths, to extract maximum information about inundation characteristics, and to minimize problems related to one instrument only. The technique is globally applicable without any tuning for particular environments. The satellite data are used to calculate inundated fractions of equal-area grid cells (0.25˚x0.25˚ at the equator), taking into account the contribution of vegetation to the passive microwave signal. Global estimates of monthly-inundated areas for 1993-2004 will be presented.

Global inundated area varies from a maximum of $5.8 \times 10^6 km^2$ to a mean minimum of $2.1.10^6 km^2$. These values are consistent with existing independent, static inventories. The multi-satellite estimates also show good agreement with regional high-resolution SAR observations over the Amazon basin. The seasonal and inter-annual variations in inundation have been evaluated against rain-rate estimates from the Global Pre-

cipitation Climatology Project (GPCP) and water levels in wetlands, lakes and rivers measured with satellite altimeters. The inundation database is now being used for hydrology modeling: a promising synergy with radar altimetry can provide crucial information about hydrological parameters such as water storage and river discharge and is now under investigation. The 12-year record dataset shows a declining inundation extent, especially in the tropical region, that will be discussed and compared to other hydrological variables. In addition, wetland being the major source of atmospheric methane and the only one dominated by climate, simple parameterizations of methane emission have been developed from complex process models for wetlands and introduced into climate models. Realistic inundation dynamics derived from the satellite observations provide the opportunity to develop and calibrate simulations of methane emissions associated with surface hydrology and efforts are already underway.