

The LOIS delivery model

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Abstract

The purpose of the LOIS delivery model is to provide daily simulations of the diffuse source contribution of determinands to the main LOIS rivers. The model traces the passage of determinands from a quantified source to their discharge to the river. The determinands modelled are suspended sediment, those nutrients and metals which have a significant diffuse source, and a single herbicide, isoproturon.

The compartmental representation of the catchment is based on HRUs (hydrological response units) which are hydrologically independent as judged by topography. Each HRU delivers to an identified river reach. Each is modelled separately, using estimates of sources and process rates based on spatial databases.

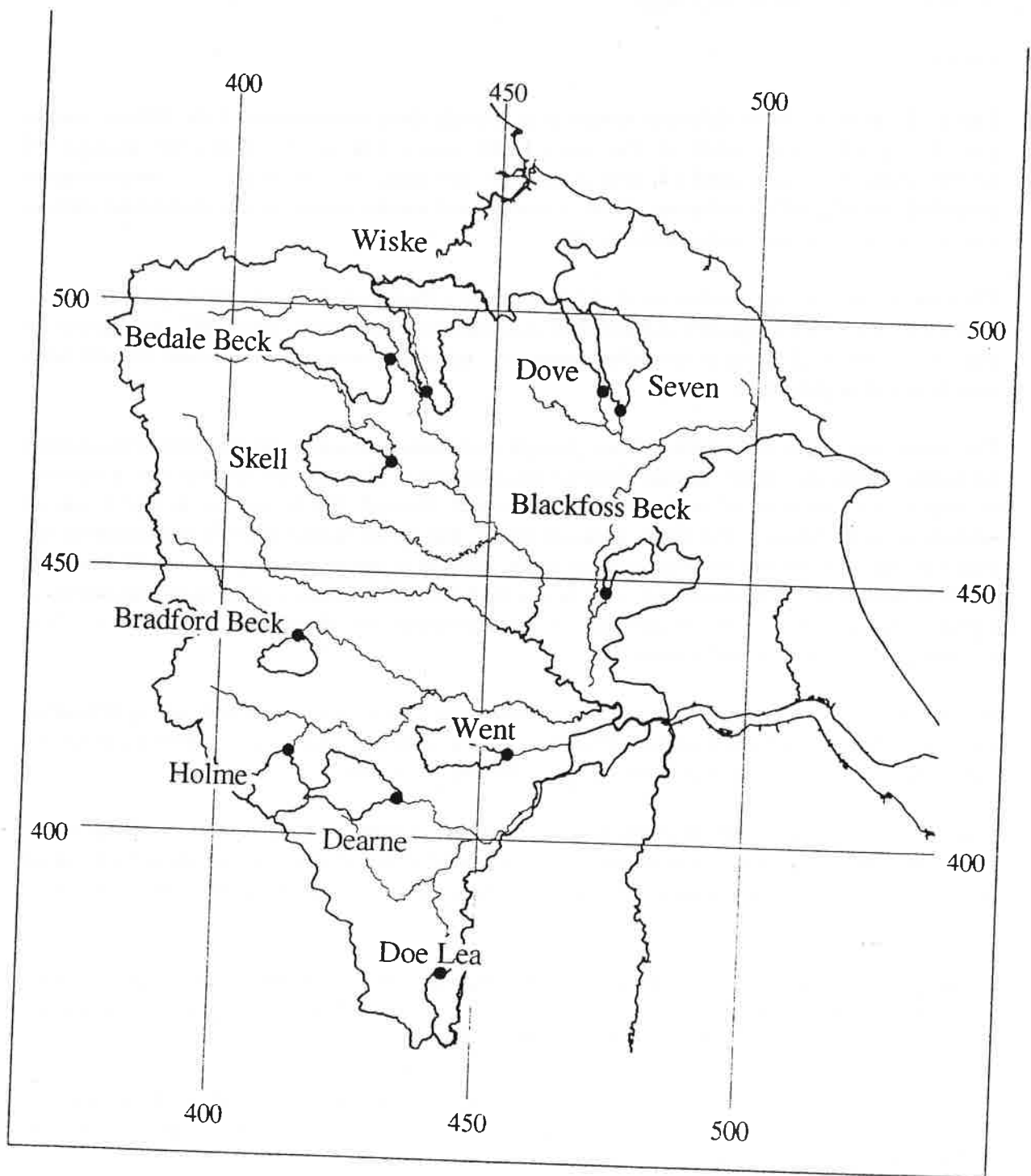
The water balance is determined from precipitation measurements and potential evaporation estimates. Subsurface water storage following infiltration is divided conceptually into a number of layers, with transfer of water either downwards through the layers, or in the event of saturation, as discharge to the river. In upper layers, part of the stored water is not available for drainage, but may be lost through transpiration. Storage in upper layers is estimated from the physical properties of the dominant soil class within the HRU. Loss by drainage is estimated as a power law function of the proportion of water available for drainage. There is no explicit modelling of lateral flow within an HRU.

Monthly sources magnitudes of some determinands are inferred from land use, taking estimates from the results of plot-scale experimentation or field sampling. These are located by layer, so that surface sources, for example, are added to the top layer only.

Sediment concentrations are at present determined by calibration against river concentrations, taking account of land use. Concentrations of sediment-associated determinands are estimated as a proportion of the sediment load, based on measured values at the LOIS core monitoring sites.

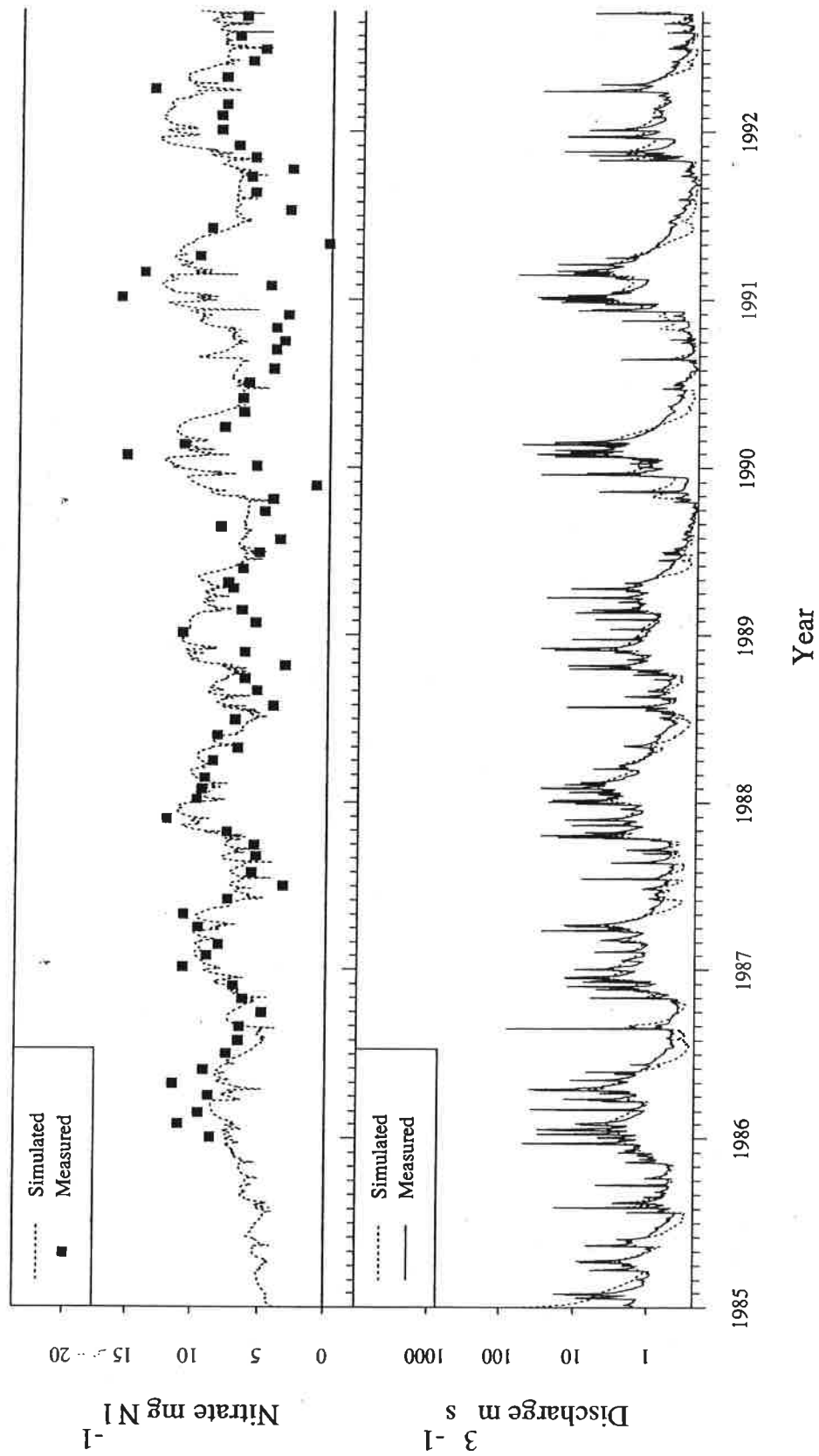
Biochemical changes in concentrations of some nutrients and isoproturon are computed, with rates based on field experiments. Otherwise non-source concentration changes are determined by mixing, or preferential water loss through evaporation.

The model has been tested against Environment Agency data collected at a number of representative catchments. This provides calibration of some rate parameters, and a statistical profile of model performance.



Bedale Beck

Discharge and nitrate



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