Integrating soil data into hydrological models

1. What can we achieve from integrating distributed soil data into our hydrolo...

SURVEY PURPOSE: What can we achieve from integrating distributed soil data into our hydrological models and by modelling lateral flow?

In New Zealand, hydrological models do not yet take fully advantage of the available distributed soil data. The objective of this survey is to establish the advantages of developing a hydrological modelling platform which can better take advantage of distributed soil data and which can model lateral flow.

The proposed platform will enable users to easily plug and play their model of interest (e.g. nitrate leaching) and take advantage of the output of the hydrological modelling platform at the scale and time step of interest.
The results of this survey will be made public on the Landcare Research website and we hope that it will foster future collaboration within Landcare Research and other researchers.

Please contact Joseph Pollacco (pollaccoj@landcareresearch.co.nz) if you have questions or concerns.

WHO SHOULD COMPLETE THIS SURVEY?
Any researcher who uses or develops models that require or compute hydrological components.

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2. About you

1. To enable us to contact you to better understand your needs, and to keep you informed about this survey and its results, please complete the following:

Your name?

***2. Your email address?**

3. Your institute?

If OTHER, please specify

4. How experienced are you in coding / developing models?

- No
- Limited experience
- Experienced

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3. About your modelling

5. Scale of interest?

- ☐ Plot scale (0.5ha)
- ☐ Paddock scale (0.5 - 5ha)
- ☐ Farm/ subcatchment scale
- ☐ Catchment scale
- ☐ Regional to national scale

6. Topography of your landscape?

- ☐ No slope
- ☐ Gentle slope (<15 degrees)
- ☐ Steep slope (>15 degrees)

7. Spatially output of your model?

	Currently of interest	Of possible future interest
Non spatial 1D model (e.g. bucket model or physically based)	☐	☐
Spatially distributed 1D model (e.g. by using GIS)	☐	☐
Fully spatially distributed 2D model	☐	☐

8. Do you currently take into account lateral flow?

- ☐ Do not think it is important for my research
- ☐ Believe it is important but have not yet taken it into account
- ☐ Taken it into account statistically such as by using curve numbers
- ☐ Taken it into account by using Green-Amp model
- ☐ Taken it into account fully by computing flow paths from a digital elevation model

9. Model time step?

- ☐ Hourly (or less)
- ☐ Daily
- ☐ Monthly
- ☐ Seasonally
- ☐ Yearly
- ☐ Many years

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4. Outputs of interest

10. Hydrological output of interest?

	Currently of interest	Of possible future interest
Aeration	☐	☐
Bypass flow	☐	☐
Channel flow	☐	☐
Drainage	☐	☐
Evapotranspiration	☐	☐
Groundwater recharge	☐	☐
Irrigation requirement	☐	☐
Lateral flow	☐	☐
Macroporosity	☐	☐
Potential evapotranspiration	☐	☐
Rainfall interception	☐	☐
River discharge	☐	☐
Snow melt	☐	☐
Soil moisture	☐	☐
Surface runoff	☐	☐
Water table level	☐	☐

Other hydrological outputs?

11. Do you require hydrological modelling to computes outputs such as:

	Currently of interest	Of possible future interest
Carbon	☐	☐
Erosion	☐	☐
Greenhouse gases	☐	☐
Leaching of chemicals other than nitrate and phosphate	☐	☐
Microbes	☐	☐
Nitrogen	☐	☐
Phosphorus	☐	☐
Plant growth	☐	☐
Sediment transport	☐	☐

Other outputs of interest?

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5. Hydrological input of interest

12. Which soil database do you currently use?

- ☐ Do not use soil database
- ☐ Collect data in-house
- ☐ Fundamental soil layers (FSL)
- ☐ Published soil reports
- ☐ National soil database
- ☐ S-map
- ☐ Others

Other (please specify)

13. What soil parameters would you like to be able to derive from soil database?

- ☐ Do not require
- ☐ Available water holding capacity (AWC)
- ☐ Curve number
- ☐ Curve: soil water release (characteristic)
- ☐ Curve: unsaturated hydraulic conductivity curve
- ☐ Field capacity (FC)
- ☐ Infiltration rate
- ☐ Macroporosity
- ☐ Saturated hydraulic conductivity
- ☐ Saturated soil moisture
- ☐ Wilting point

Other parameters:

14. How do you perform spatial scaling of the soil parameters?

- ☐ Model does not require scaling of the soil parameters
- ☐ Would prefer that Landcare Research provides a suite of POLYGON spatial scaling options
- ☐ Would prefer that Landcare Research provides a suite of RASTER spatial scaling options
- ☐ Perform the spatial scaling of the soil parameters in-house, please specify below:

What soil parameters do you need to scale:

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6. Models

15. Which models do you use or will probably use in the future?

	Currently using	May use in the future
APSIM-SoilWat	☐	☐
APSIM-SWIM	☐	☐
AquiferSim	☐	☐
BNZ	☐	☐
C-CALM	☐	☐
CenW	☐	☐
CESIT	☐	☐
CLUES (Catchment Land Use for Environmental Sustainability)	☐	☐
Delft3D	☐	☐
DHSVM	☐	☐
DNDC (Denitrification – Decomposition)	☐	☐
DYRESM- CAEDYM	☐	☐
Eigenmodel	☐	☐
ELCOM-CAEDYM	☐	☐
FEFLOW	☐	☐
FEMWATER	☐	☐
GLEAMS	☐	☐
HEC-RAS	☐	☐
HEM (Hillslope Erosion Model)	☐	☐
Hydrus 1d	☐	☐
Hydrus 2d	☐	☐
Hydrus 3d	☐	☐
IDEAS (Integrated Dynamic Environmental Analysis System)	☐	☐
IFS	☐	☐
IRRICALC	☐	☐
LURNZ	☐	☐
Mike11	☐	☐
MODFLOW	☐	☐
NManager	☐	☐
NZEEM (NZ Empirical Erosion Model)	☐	☐
Overseer	☐	☐

PLM	☐	☐
ROTAN	☐	☐
SedNet (Sediment budgets for river Networks)	☐	☐
SHETRAN	☐	☐
Soil Vulnerability Modelling (formerly EnSus)	☐	☐
SPARROW	☐	☐
SPASMO	☐	☐
SSYE	☐	☐
SWAP	☐	☐
SWAT	☐	☐
Topnet	☐	☐
Waikato Integrated Scenario Explorer (WISE)	☐	☐
WATYIELD	☐	☐
WEPP	☐	☐

Do you use any other models?

16. Do you believe that the accuracy of your model outputs will be increased, if you had a more accurate spatially distributed generated time series hydrological data set at the scale of interest where you can simply plug and play with your model?

- ○ Don't know
- ○ The model I am using is accurate enough and I do not need another model
- ○ Yes, this will be highly beneficial

17. Do you know of an open source hydrological modelling platform that you highly recommend, such as PCRaster http://pcraster.geo.uu.nl/pcraster-4-0-0/

18. To couple/integrate different models, which of the following software do you strongly recommend?

○ Don't know ○ LUMASS ○ OMS3 ○ OpenMI ○ Other

If OTHER, please specify

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7. Global uncertainty analysis and global optimisation; platform development

19. Would you be interested in having a powerful calibration tool to:
(1) optimize your parameters,
(2) have the uncertainties in the predictions,
(3) determine the key parameters - which may vary during time (e.g. dry or wet period)?

- ○ Don't know
- ○ Not important
- ○ Important

20. If you perform optimisation or sensitivity analyses, which open-source optimisation tools do you use?

	Currently using	May use in the future
Bayesian	☐	☐
Frequentist approach	☐	☐
Global sensitivity analysis	☐	☐
Markov Chain Monte Carlo	☐	☐
Maximum likelihood	☐	☐
Multi objective calibration	☐	☐
PEST http://www.pesthomepage.org/	☐	☐
Single objective calibration	☐	☐

Could you recommend a particularly powerful toolbox?

21. For the long term, would you be interested in participating in developing a hydrological platform which better takes advantage of distributed soil information and computes lateral flow?

- ○ No
- ○ Yes

If YES, how would you like to contribute?

22. Have you got any general comments?

Many thanks for your time and participation, we will send you the results of the survey shortly