27. GROWA-SI

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Brief description	
The regional water balance model GROWA-SI (Water Quality model) is the official state model for reporting Nitrate directive implementation on a country wide level. It was developed by JULICH Institute form Germany for Slovenian Environmental Agency (SEA). It can calculate groundwater recharge rates for Slovenia and N balances.	
Contaminants covered (e.g. nitrate, pesticides etc.)	N
Intended end-users (e.g. farmer, water quality manager, policy maker)	Policymakers, water managers
Level of expertise and/or training required	High level of expertise and training required to understand and use the model.
Geographical resolution (e.g. field, catchment, national)	National, Regional, Catchment scale
Temporal resolution (e.g. daily, annual, long-term).	Annual, Monthly
Real-time component (e.g. live weather data, soil moisture data feeds etc.)	No
Number and type of mitigation measures included	No
Platform (e.g. paper-based tool, phone app, bespoke software).	Bespoke software. Only for SEA use. http://www.arso.gov.si/novice/datoteke/036813-Energie_Umwelt_339.pdf https://link.springer.com/article/10.1007/s12665-015-4639-5 https://www.sciencedirect.com/science/article/pii/S1001074214000734 http://mvd20.com/LETO2013/R17.pdf http://meteo.arso.gov.si/met/sl/watercycle/growa-si/ https://meteo.arso.gov.si/met/sl/watercycle/maps/growa_si/ http://www.fz-juelich.de/ibg/ibg-3/EN/Research/Modelling_and_management_of_catchments/Water_Balance_And_Climate_Change/_node.html
Frequency of updates	Every few years, with a new development of knowledge
Cost/availability	Not publicly available.
Number of users or number of copies distributed/ downloaded/purchased	In use only at Slovenian Environmental Agency by one user. It is also available at JULICH institute.
Links to demo material and other relevant information (e.g. user guides).	http://www.arso.gov.si/novice/datoteke/036813-Energie_Umwelt_339.pdf https://link.springer.com/article/10.1007/s12665-015-4639-5
Additional comments	GROWA – DENUZ / WEKU model has been introduced in Slovenia to determine the diffuse nitrogen inputs into groundwater and surface water. For this purpose, the agricultural nitrogen balance (Eurostat/OECD) surpluses derived by the Agricultural Institute of Slovenia were coupled with the model system GROWA – DENUZ / WEKU.

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Input data required to run the DST	Information needed for getting the tool adequately used are: - Agrarian statistical data on N fertilizer input, manure per animal, crop withdrawal etc., - Atmospheric deposition of oxidized and reduced nitrogen, - Precipitation data summer/winter (1971–2000), annual potential evapotranspiration (1971–2000), - Land cover, Soil types, soil texture, effective field capacities for arable land, - Effective field capacities, influence of perching water, rooting depth, - Depth to groundwater, Artificially drained areas, - Digital elevation model (DMR 100) - Geological and hydrogeological map, River network, political boundaries, cities etc., - Catchments areas, daily runoff data (1971–2000)
Outputs (including links to water quality and economic or financial aspects)	- water balance, total runoff, direct runoff and groundwater runoff (groundwater recharge), - nitrate in leachate (percolation water)
Age/provenance of supporting data used to develop the DST	- Professional research and scientific knowledge was used to develop this model http://www.arso.gov.si/novice/datoteke/036813-Energie_Umwelt_339.pdf https://link.springer.com/article/10.1007/s12665-015-4639-5 https://www.sciencedirect.com/science/article/pii/S1001074214000734
Country-specific calibration or data requirements (including restrictions on use)	Yes. Model specially developed for Slovenian conditions.
Details of validation and testing	The model was calibrated and validated by monitoring data from surface and groundwater bodies.
Date developed/released (or planned release date)	Developed in 2013 and regularly updated.
Author/developer names and affiliations	Slovenian Environmental Agency Forschungszentrum Jülich GmbH, Institute of Bio- and Geosciences Agrosphere
Member state(s) where developed	SI
Member State(s) where currently used	SI
Key publication references (including url)	http://www.arso.gov.si/novice/datoteke/036813-Energie_Umwelt_339.pdf https://link.springer.com/article/10.1007/s12665-015-4639-5 https://www.sciencedirect.com/science/article/pii/S1001074214000734

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Any other useful information (e.g. screenshots of DST input/outputs)