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Academic formation

- **2011 : «** Habilitation à Diriger des Recherches », Université Pierre et Marie Curie (UPMC)
- **1997 :** UPMC Doctorate (PhD) in Atmospheric Sciences, summa cum laude
  The water cycle : modelling of continental hydrology and its interactions with the climate system
- **1990-1994 :** Ecole Normale Supérieure de Paris (top ranking « Grande Ecole » in France)
  - Master in Ecology and Plant Physicology
  - B.Sc. and M.Sc. in Biology and Biochemistry
- **1988-1990 :** Preparation to the selective entrance examination to « Grandes Ecoles » (Lyon)

Positions and professional experience

- **2013- :** Senior research scientist (DR2) at CNRS, Laboratory Sisyphe (renamed METIS since 01/01/2014)
- **2000-2013 :** Research scientist (CR) at CNRS, Laboratory Sisyphe, Paris
- **1999-2000 :** Visiting research scientist, Laboratory Sisyphe, Paris
- **1997-1999 :** Visiting research scientist, NASA/GSFC, Hydrological Sciences Branch (Maryland, USA)
- **1994-1997 :** Teaching assistant, UPMC
- **1990-1994 :** Fellow student at École Normale Supérieure (Paris)

Awards

- 2014 Member of the French Academy of Agriculture
- 2010, 2014, 2020 Premium for Scientific Excellence, CNRS
- 1999 Peer Award for Outstanding Post-Doc du Laboratory for Hydrospheric Processes, NASA/GSFC
- 1990-1994 Fellowship at Ecole Normale Supérieure, Paris

Research interests

- **Land surface and climate modelling**: I focus on the groundwater / soil / atmosphere continuum, and the related water and energy feedbacks, from the basin to the glocal scale. My main tools are the land surface models ORCHIDEE (IPSL) and Catchment (NASA/GSFC), and the hydrological model TOPMODEL. I compare these model's results to a wide spectrum of observational data sets including remote sensing products to guide their improvement.
- **Modelling of other environmental processes:** I also work on processes that are tightly linked to hydrology, and contribute to the definition of water quality, namely water temperature, and river and wetland biogeochemistry
- **Anthropogenic impacts on water resources**: I use the above models to address climate change impacts on river systems, under different climates; the novelties of my work are to consider the links to other evolution factors including land use change, and to examine how hydrological models contribute to uncertainties

Publications in peer-reviewed journals

ISI Web of Knowledge synthesis: h-factor = 32
with 88 referenced articles, average number of ISI citations per article = 40 (without self-citations)

Full list of publications on https://www.metis.upmc.fr/~ducharne/publis.html

Selected publications (supervised young scientists are underlined):

Tafasca S, **Ducharne** A, Valentin C (2020). Weak sensitivity of the terrestrial water budget to global soil texture maps in the ORCHIDEE land surface model. HESS, 24, 3753–3774, https://doi.org/10.5194/hess-24-3753-2020.

Wu WY, Lo MH, Wada Y, Famiglietti JS, Reager JT, Yeh PJF, **Ducharne A**, Yang ZL (2020). Divergent effects of climate change on future groundwater availability in key mid-latitude aquifers. Nature Communications, 11, 3710. https://doi.org/10.1038/s41467-020-17581-y

Padrón RS, Gudmundsson L, **Ducharne A**, Lawrence DM, Mao J, Peano D, Krinner G, Kim H, Seneviratne SI (2020). Observed changes in dry season water availability attributed to human-induced climate change. Nature Geoscience, 13, 477–481. https://doi.org/10.1038/s41561-020-0594-1

Cheruy F, **Ducharne A**, Hourdin F, Musat I, Vignon E, Gastineau G, Bastrikov V, et 13 others (2020). Improved near surface continental climate in IPSL-CM6 by combined evolutions of atmospheric and land surface physics. Journal of Advances in Modeling Earth Systems, 12, e2019MS002005. https://doi.org/10.1029/2019MS002005

Al-Yaari A, **Ducharne A**, Cheruy F, Crow WT, Wigneron JP (2019). Satellite-based soil moisture provides missing link between summertime precipitation and surface temperature biases in CMIP5 simulations over conterminous United States. Scientific Reports, 9, 1657, doi:10.1038/s41598-018-38309-5

Vereecken H, Weihermüller L, Assouline S, Šimůnek J, Verhoef A, Herbst M, Nicole A, Mohanty B, Montzka C, Vanderborght J, Balsamo G, Bechtold M, Boone A, Chadburn S, Cuntz M, Decharme B, **Ducharne A**, et al. (2019). Infiltration from the pedon to global grid scales: An overview and outlook for land surface modelling. Vadose Zone Journal, 18, doi: 10.2136/vzj2018.10.0191

Tootchi A, Jost A, **Ducharne A** (2019). Multi-source global wetland maps combining surface water imagery and groundwater constraints. ESSD, 11, 189-220, doi: 10.5194/essd-11-189-2019.

Wang F, **Ducharne A**, Cheruy F, Lo MH, Grandpeix JL (2017). Impact of a shallow groundwater table on the global water cycle in the IPSL land-atmosphere coupled model, Climate Dynamics, doi:10.1007/s00382-017-3820-9

Schneider AS, Jost A, Coulon C, Silvestre M, Théry S, **Ducharne A** (2017). Global scale river network extraction based on high-resolution topography, constrained by lithology, climate, slope, and observed drainage density. GRL, 44, doi:10.1002/2016GL071844

Guimberteau, Ciais, **Ducharne**, Boisier, et al. (2017). Impacts of future deforestation and climate change on the hydrology of the Amazon basin: a multi-model analysis with a new set of land-cover change scenarios. HESS, 21, 1455-1475, https://doi.org/10.5194/hess-21-1455-2017

van den Hurk, Kim, Krinner, Seneviratne, Derksen, Oki, Douville, Colin, **Ducharne**, Cheruy, Puma, Wada, et al. (2016). The Land Surface, Snow and Soil moisture Model Intercomparison Program (LS3MIP): aims, set-up and expected outcome. GMD, 9, 2809-2832, https://doi.org/10.5194/gmd-9-2809-2016

Berg, Findell, Lintner, Giannini, Seneviratne, van den Hurk, Lorenz, Pitman, Hagemann, Meier, Cheruy, **Ducharne**, Malyshev, Milly (2016). Land-atmosphere feedbacks amplify aridity increase over land under global warning. Nature Climate Change, doi:10.1038/nclimate3029

Zhao Y, Sultan B, Vautard R, Braconnot P, Wang HJ, **Ducharne A** (2016). Potential escalation of heat-related working cost with climate and socio-economic changes in China. PNAS, doi: 10.1073/pnas.1521828113.

Boisier JP, Ciais P, **Ducharne A**, Guimberteau M (2015). Projected strengthening of Amazonian dry season by constrained climate model simulations. Nature Climate Change, 5, 656-660, doi:10.1038/nclimate2658

Cheruy F, Dufresne JL, Hourdin F, **Ducharne A** (2014). Role of clouds and land-atmosphere coupling in systematic mid-latitude summer warm biases and climate change amplification in CMIP5 simulations. GRL, 41, 6493–6500, doi:10.1002/2014GL061145

Roudier P, **Ducharne A**, Feyen L (2014). Climate change impacts on river discharge in West Africa: a review. HESS, 18, 2789-2801, doi:10.5194/hess-18-2789-2014

Guimberteau M, Ciais P, **Ducharne A**, Boisier JP, Peng S, De Weirdt M, Verbeeck H (2014). Two soil hydrology formulations of ORCHIDEE tested for the Amazon basin. Geoscientific Model Development, 7, 1115-1136, doi:10.5194/gmd-7-1115-2014.

Alyaari A, Wigneron JP, **Ducharne A**, Kerr Y, de Rosnay P, De Jeu R, Govind A, Albitar A, Albergel C, Munoz J, Richaume P, Mialon A (2014). Global-scale evaluation of two satellite-based passive microwave soil

moisture datasets (SMOS and AMSR-E) with respect to Land Data Assimilation System estimates, Remote Sensing of Environment, 149, 181-195,doi:10.1016/j.rse.2014.04.006.

Magand C, **Ducharne A**, Le Moine N, Gascoin S (2014). Introducing hysteresis in snow depletion curves to improve the water budget of a land surface model in Alpine catchments. Journal of Hydrometeorology, doi: http://dx.doi.org/10.1175/JHM-D-13-091.1.

Habets F, Boé J, Déqué M, **Ducharne A**, Gascoin S, Hachour A, Martin E, Pagé C, Sauquet E, Terray L, Thiéry D, Oudin L, Viennot P (2013). Impact of climate change on surface water and ground water of two basins in Northern France: analysis of the uncertainties associated with climate and hydrological models, emission scenarios and downscaling methods. Climatic Change, doi:10.1007/s10584-013-0934-x.

Seneviratne S, Wilhelm M, Stanelle T, van den Hurk B, Hagemann S, Berg A, Cheruy F, Higgins ME, Meier A, Brovkin V, Claussen M, **Ducharne A**, Dufresne JL, Findell K, et al. (2013). Impact of soil moisture-climate feedbacks on CMIP5 projections: First results from the GLACE-CMIP5 experiment. GRL, DOI: 10.1002/grl.50956.

Sterling S, **Ducharne A**, Polcher J (2012). The impact of global-land cover change on the terrestrial water cycle. Nature Climate Change, doi:10.1038/nclimate1690.

Saleh F, **Ducharne A**, Oudin L, Flipo N, Ledoux E (2012). Impact of river bed morphology on discharge and water levels simulated by a 1D Saint-Venant hydraulic model. J. Hydrology, 476, 169-177.

Ringeval B, Decharme B, Piao S., Ciais P, Papa F, de Noblet N, Prigent C, Friedlingstein P, Gouttevin I, Koven C, **Ducharne A** (2012). Modelling sub-grid wetland in the ORCHIDEE global land surface model: evaluation against river discharges and remotely sensed data. GMD, 5, 941-962.

Ducharne A (2009). Reducing scale dependance in TOPMODEL using a dimensionless topographic index, HESS, 13, 2399-2412.

Boone A, de Rosnay P, Balsamo G, Beljaars A, Chopin F, Decharme B, Delire C, **Ducharne** A, Gascoin S, Guichard F, et al. (2009). The AMMA Land Surface Model Intercomparison Project (ALMIP). BAMS, 1865-1880.

Gascoin S, **Ducharne A**, Ribstein P, Lejeune Y, Wagnon P (2009). Dependence of bare soil albedo to soil moisture on the moraine of the Zongo glacier (Bolivia): implications for land surface modelling. JGR-Atmospheres, 114: D19102.

Gascoin S, **Ducharne A**, Ribstein P, Carli M, Habets F (2009). Adaptation of a catchment-based land surface model to the hydrogeological setting of the Somme River basin (France). J Hydrol., 368:105-116.

Ducharne A (2008). Importance of stream temperature to climate change impact on water quality. Hydrology and Earth System Science, 12, 797-810.

Sterling S, and **Ducharne A** (2008). Comprehensive Dataset of Global Land Cover Change for Land Surface Model Applications. Global Biogeochemical Cycles, 22: GB3017.

Curie F, Gaillard S, **Ducharne A**, Bendjoudi H (2007). Geomorphological methods to characterize wetlands at the scale of the Seine watershed. Science Total Environment, 375: 59-68.

Ducharne A, Baubion C, Beaudoin N, Benoit M, Billen G, Brisson N, Garnier J, Kieken H, Lebonvallet S, Ledoux E, Mary B, et al. (2007). Long term prospective of the Seine river system: Confronting climatic and direct anthropogenic changes. Science of the Total Environment, 375 : 292-311.

Ducharne A, Golaz C, Leblois E, Laval K, Polcher J, Ledoux E, de Marsily G (2003). Development of a High Resolution Runoff Routing Model, Calibration and Application to Assess Runoff from the LMD GCM. Journal of Hydrology, 280: 207-228.

Stieglitz M, **Ducharne A**, Koster RD, Suarez M (2001). The Impact of Detailed Snow Physics on the Simulation of Snow Cover and Subsurface Thermodynamics at Continental Scales, Journal of Hydrometeorology , 2: 228-242.

Ducharne A, Koster RD, Suarez MJ, Praveen K, Stieglitz M (2000). A catchment-based approach to modeling land surface processes in a GCM - Part 2: Parameter estimation and model demonstration, JGR-Atmospheres, 105 (D20): 24823-24838.

Koster RD, Suarez MJ, **Ducharne A**, Praveen K, Stieglitz M (2000). A catchment-based approach to modeling land surface processes in a GCM - Part 1: Model structure, JGR-Atmospheres, 105 (D20): 24809-24822.

Ducharne A, Laval K (2000). Influence of the realistic description of soil water-holding capacity on the global water cycle in a GCM, Journal of Climate, 13: 4393-4413.

Other publications and communications

- 8 book chapters, 18 proceedings, 5 outreach articles, 39 reports
- 14 invited conferences
- 117 communications in international conferences, 59 in national conferences or workshops
- 21 seminars et 5 outreach conferences

Supervision

Young PhD scientists

- L. Rinchiuso : Optimization of the ORCHIDEE land surface model over Europe for hydrological applications (18 months, 2021-2023, funding EUR IPSL)
- H. Mizuochi : Evaluation of the ORCHIDEE model against multiple remote sensing observations (9 months, 2017-2018, funding by the JSPS, Japan Society for the Promotion of Science)
- T. Verbeke : Développement et évaluation d'une parametérisation des interactions nappes-sols dans le modèle ORCHIDEE (24 mois, 2017-2019, funding ANR I-GEM)
- Y. Zhao : Assessing the robustness of multi-region and multi-sectoral indicators of climate change impacts (24 months, 2013-2015, funding L-IPSL, co-supervision with B. Sultan)
- F. Wang : Evaluation of a physically-based soil water flow representation for modelling large scale land surface hydrological processes in the IPSL climate model (24 months, 2013-2015, funding FP7 EMBRACE; co-supervision with F. Chéruy, LMD)
- M. Guimberteau : Improvement of land hydrology modelling in the Amazon basin and consequences on its response to climate change (36 months, 2011-2014, funding AMAZALERT, FP7 ; co-supervision with Ph. Ciais, LSCE)
- V. Bustillo : Climate change impact in the Loire River basin (27 months, 2008-2010, funding Plan Loire, co-supervision with Florentina Moatar, UMR ISTO-Tours)
- F. Curie : Denitrification in riparian wetlands (24 months, 2007-2008, funding PIREN-Seine)
- S. M. Sterling : ROSEORCHIDEE: influence if land use change on land hydrology (18 months, 2005-2007, Marie Curie fellowship, FP6)

PhD students

- G. Daas: Hydro-thermal trajectories of the Bassée, Sorbonne Université, co- supervision: A. Jost (METIS), to be defended by the end of 2023.
- P. Arboleda: Influence of groundwater and irrigation on past and futur climate extremes, Sorbonne Université, to be defended by the end of 2022.
- A. Belemtougri: Towards an exhaustive characterization of the river network and flow intermittency in Africa, Institut International de l'Eau et de l'Environnement (2iE, Burkina Faso) and Sorbonne Université, co-supervision : H. Karambiri (2iE), to be defended by the end of 2021.
- S. Tafasca: Impact of soil properties on the simulated hydrology by the ORCHIDEE land surface model, Sorbonne Université, co-supervision: C. Valentin (IEES-Paris), defended on November 13, 2020.
- A. Tootchi: Riparian at the interface between groundwater, soils and streams : modelling in the IPSL climate model and vulnerability to climate change, Université Pierre et Marie Curie, co-supervision : A. Jost (METIS), defended on July 1st, 2019.
- Yvan Altchenko: Mapping irrigation potential with renewable groundwater in Africa for reducing African food insecurity, Université Pierre et Marie Curie, co-supervision : Karen Willholth (IWMI-South Africa), defended on December 14, 2018.
- A. Schneider: Estimation of the base flow time constant for global scale applications, Université Pierre et Marie Curie, co-supervision : A. Jost (Sisyphe), defended on June 22, 2017.
- A. Al-Yaari : Use of remote sensig and geographic information systems to study land surface hydrological responses : Case studies from the Amazon basin, Université Pierre et Marie Curie, co-supervision : JP Wigneron (Ephyse, INRA, Bordeaux), defended on Nov 14, 2014.
- C. Magand : Climate change impacts on the Durance River hydrology – Uncertainties related to modelling choices, Université Pierre et Marie Curie, defended on June 6, 2014.
- A. Campoy : Influence of groundwater hydrodynamics on climate modelling at the regional and global scales, Université Paris 6, co-directeur : F. Hourdin, F. Chéruy (LMD), defended on 21/06/2013.

- F. Saleh : Contribution of 1D local hydraulic modeling to improve simulations of river stages and stream-aquifer interactions at regional scale, Université Pierre et Marie Curie, co-supervisors : E. Ledoux, L. Oudin, N. Flipo, defended on 15/12/2010.
- S. Gascoin : Modelling of water transfers within the groundwater / atmosphere continuum, Université Paris 6, co-supervisor : P. Ribstein, defended on 13/03/2009.
- F. Curie : Caracterisation of alluvial wetland retention potential in the Seine River basin, based on their geomorphologic and hydrologic properties, Université Pierre et Marie Curie, co-supervisor : H. Bendjoudi, defended on 01/12/2006.

Master Students : Curie, 2002 ; L'Heureux, 2002 ; Latu, 2003 ; Lavaud, 2004, Lhoste, 2005 ; Carli, 2005 ; Cantin, 2006 ; Zhao, 2007 ; Bellier, 2008 ; Crespi, 2008 ; Labbas, 2009; Bourgin, 2009 ; Boulay, 2010.Meza, 2011 ; Ouissa, 2011 ; Boutinot, 2011 ; Lemaire, 2012 ; Stamati, 2013 ; Turko, 2014 ; Lu, 2014 ; Goullet, 2015 ; Hallier, 2015 ; Tootchi, 2015 ; Otalora, 2016 ; Belemtougri, 2017 ; Mahenc, 2019.

Selected research projects

Project	***Coordinator***	***Funding***	***Period***
BLUEGEM - Biosphere and Land Use Exchanges with Groundwater and soils in Earth system Models	**A. Ducharne**	Belmont Forum	2021-2024
SMOS-TE (Terres émergées)	Y. Kerr	CNES	2017-2021
I-GEM - Impact of Groundwater in Earth system Models	**A. Ducharne** **M.H. Lo**	ANR-MoST	2014-2019
EMBRACE : Earth system Model Bias Reduction and assessing Abrupt Climate change	C. Jones	FP7	2011-2015
AMAZALERT : Raising the alert about critical feedbacks between climate and long-term land use change in the Amazon	B. Kruijt	FP7	2011-2015
$R^2D^2$2050 : Risque, Ressource en eau et gestion Durable de la Durance en 2050	E. Sauquet **A. Ducharne**	GICC AERMC	2010-2013
RExHySS: Influence du changement climatique sur la ressource en eau et les extrêmes hydrologiques dans les bassins de la Seine et de la Somme	**A. Ducharne**	GICC	2007-2009
ALMIP : AMMA Land Surface Model Intercomparison Project	A. Boone, P. de Rosnay	AMMA	2006-2007
GICC-Seine : Influence du changement climatique sur le fonctionnement hydrologique et biogéochimique du bassin de la Seine	**A. Ducharne**	GICC	2002-2005
NSIPP: NASA Seasonal to Interannual Prediction Project	M. Rienecker	NASA	1997-1999

Teaching

- 2012-2014 : Module MEC558 « Continental hydrology and water resources », Master level, Ecole Polytechnique, 18h/yr
- 2011-2015 : « Climate change and water resources », Master level, Univ. Tours, 5h/yr
- 2006-2013 : Module MF202 « Introduction to global environment and biogeochemistry », Master level, ENSTA, 3h/yr
- 2010-2013 : « Hydological modelling : the example of TOPMODEL», Master level, UPMC, 3h/yr
- 2011-2013 : « The water cycle », Master level, AgroParisTech, 6h/yr
- 2006-2008 : « Climate change impact in the Seine River basin», Master level (ENGREF, AgroParisTech, Univ. Paris Sud) , 5h/yr
- 2000-2005 : Earth Sciences (hydrology, biogeochemistry, climatology), Bachelor level, UPMC (15 - 20 h/yr)
- 1994-1997: Cell and plant physiology, Bachelor level, UPMC, 64h/yr
- 1992: Mathematics, High school (16h/mon for 4 months), Maison d'Éducation de la Légion d'Honneur (Saint-Denis).

Service

- **At laboratory level (Sisyphe /METIS):**
  - Deputy-head (2018-)
  - Head of the HYDRO team, and deputy head of the laboratory (2009-2011)
  - Head of the « Land surface hydrology » team (2005-2008)
  - Organization of the laboratory seminars (2001-2004)
- **At university level (UPMC/SU):**
  - Member of the board of trustees of the OSU Ecce Terra (2015-2019)
  - Member of the board of the Doctoral Formation Institute (2014-2020)
  - Member of the PhD and HDR commission (2012-)
- **At national level:**
  - CNAP, evaluation section SCOA "surfaces continentales océan atmosphère" (2020-)
  - CNES (French Space Agency): evaluation committees TAOB (2001-2002) and TOSCA (2009-2014), head of the land surface group (2014-2018)
  - Project evaluation committee for the national research programme CYTRIX/EC2CO (2006-2010)
- **Scientific committees :**
  - Scientific Council of the BRGM (French USGS), 2021-
  - Steering committee of the CATDS (Centre Aval de Traitement des Données SMOS), 2019-
  - Scientific Council of the Comité de Bassin Seine-Normandie (2010-2016)
  - Scientific Council of the ONEMA (National Office for Aquatic Environment, 2008-2012)
  - Steering committee of PIREN-Seine regional research programme (2000-2006)
- **Editorial activities :**
  - Co-editor of HESS special issue « Man and river systems: long-term interactions between societies and nature in regional scale watersheds » (2007)
  - Reviews for Clim. Dyn., MWR, J. Clim., JGR, CRAS, PCE, IAHS, HESS, J. Hydrol., Hydrology Research, WRR, Hydrological Processes, Climatic Change, J. Hydromet, GMD, JAMES, ERL, Plos One, STOTEN, ESD, RSE
- **Organization of scientific meetings:**
  - International conference Man and River Systems 2 (5-7 December 2006, Paris)
  - Meeting « ORCHIDEE : more than 25 years of history » (May 13-14,2013, Paris, France)
  - International workshop « Impact of Ground water in Earth system Models» (October 3-5,2016, Paris, France)
  - Scientific conference of the TOSCA/CNES programme (March 2017, Paris, France)
  - Journées de Modélisation du Fonctionnement des Surfaces Continentales (November 13-14, 2017, Montpellier, France)
  - Journées de Modélisation des Surfaces Continentales 2019 (November 14-152019, Paris, mainn organizer)
  - Second Workshop international "Impact of Groundwater in Earth system Models" (18-20 mars 2019, Taipei, Taiwan, scientific committee)
  - OZCAR-TERENO international conference "Advancing Critical Zone Science", October 4-8 2021, Strasbourg, France (co-chair of session “Earth system models : water and carbon cycle”)
  - “Groundwater, key to the Sustainable Development Goals”, UNESCO, IAH-CFH, IHP International Conference, Paris, France, May 26-28, 2021 (scientific committee)

Done in Paris on February 12, 2021.