

## Curriculum Vitae - Lars Robert Hole

### Current position

Senior Scientist (professor level)

Norwegian Meteorological Institute, Forecasting Division for Western Norway (since Nov. 2007)

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### Personalia

Born: 1971

Nationality: Norwegian

Gender: Male

Languages: Norwegian (native), English (excellent), French (some)

Status: Married, two children

### Education

1995-1998: Ph.D. Meteorology, Univ. of Bergen / Univ. Studies on Svalbard (UNIS).

1990-1994: M.Sc. Meteorology, Geophysical Institute, University of Bergen (UiB)

### Key scientific qualifications

Applications of micro-meteorological measurements, climate change effects, atmospheric transport and deposition of pollutants to vegetation and snow, trend analysis, snow characterisation, sound propagation in the atmosphere, marine meteorology and oil drift modelling.

### Professional experience

- Nov. 2007- : 80% position as scientist in met.no, 20% at Norw. Institute of Air Research (NILU).
- 2001-2007: NILU (10 % position in 2004 and parts of 2005). Senior scientist since 2005.
- 2003-2005: Associate professor, Univ. Centre in Svalbard, head of Dept. Geophysics.
- 2000-2001: Norwegian Defence Research Est., Div. for Protection and Material. (Scientist).
- 1999-2000: Otto Sverdrup Centennial Expedition (wintering in Canadian Arctic).
- 1995-2000: Norw. Defence Construction Service, Environmental Section (research engineer).
- 1995: Military Service, Norwegian Defence Construction Service.
- Sep-Dec 1994: Research assistant, UiB.
- Total of 11 months paternity leave in 2003 and 2006.

### Project and field work experience

Six years as project leader at NILU. Seven years of as participant and coordinator of NATO environmental projects and bilateral environmental cooperation between the Norwegian and the US Defence. Has spent four years on Svalbard and one year in the Canadian Arctic with extensive field work activities summer and winter.

### Teaching experience

- Assistant teacher in mathematics, UiB 1991-1994, incl. 30 hours course in pedagogics .
- Teaching and leading 12 week-long glacier courses in Norway from 1990.
- Teaching at UNIS as PhD student (1996-1998) and associate professor (2003-2005).  
Responsible for courses *polar meteorology* and *climate*(30 ECTS) and *snow and ice processes* (30 ECTS). Teaching in AGF 340 *Polar atmosphere chemistry* at UNIS 2005-2007. (Established this course and obtained support through NFR NORKLIMA in 2005).  
Responsible for education program for school classes during the Otto Sverdrup Centennial Expedition.
- Teaching at PhD course, *Air Pollution in the Arctic*, Univ. Helsinki, 2007.
- Oral exam censor at UNIS 2006, 2007 and 2008 (AGF 212 and AGF 213).
- Supervisor for two master students (completed in 2005 and 2007) and three PhD candidates. Gard Hauge (UiB) defended PhD-thesis in November 2006.

### Project leader experience met.no

- MyOcean – EU-project 2009-2012 (WP18 at met.no)

- Oil drift modelling – responsible for drifting oil drift forecasting system at met.no
- Offshore wind mills – Centre of Environmentally friendly energy (FME - NFR 2009-2017)

### **Project leader experience (NILU)**

- AMAP 2006 - Arctic monitoring and assessment progr. – Report on *Acidification in the Arctic and atmospheric transport* – [www.amap.no](http://www.amap.no). Lead author of two out of six chapters. 2004-2006.
- International Polar Year (IPY): POLARCAT Norway WP 3: Lagrangian Balloon experiment on Svalbard. [www.polarcat.no](http://www.polarcat.no). 2007- 2009.
- MOSJ - Environmental status on Svalbard – Heavy metals, acidification and eutrophication.
- NitroEurope IP – EU project in nitrogen/carbon cycle 2006-2011. [www.nitroeuropa.eu](http://www.nitroeuropa.eu)
- Mapping of deposition of inorganic compounds in Norway (acid rain and eutrophication– Project for SFT – State Pollution Agency). 2002-2003.
- Effect of climate change on flux of N and C: air-land-freshwater-marine links (NRF 2003-2007) - <http://www.umb.no/ipm/forskning/clue/>.
- Long term measurements and modelling of tropospheric ozone deposition to forests (in relation to UNECE ozone critical level II). 2002-2005.

### **Project leader experience, Norwegian Defence Construction Service**

- Long Range Sound Propagation, 1995-1997.
- Sound Propagation Models, 1997-2002.
- Mapping of Meteorology, 1996-1999.
- High Resolution Numerical Atmospheric Models (HINAM), 1998-2001.

### **Other project leader experience**

- Leader of the Sun Festival Committee on Svalbard, 1998.
- Blast Propagation and Snow Characterization, Otto Sverdrup Centennial Exp., 1999-2000.
- Acoustic and Seismic Modelling, Norwegian Defence Research Establishment, 2000-2001.

### **Other important NILU projects**

- Surface layer fluxes above snow in Ny Ålesund (EU project NICE). 2002.
- Biosphere Atmosphere Exchange of Pollutants (BIAFLUX) – ACCENT - The European Network of Excellence on Atmospheric Composition Change - [www.accent-network.org](http://www.accent-network.org). 2003-2007.
- Mercury in the Arctic NFR 2007-2009 (Supervising Ph.D. Student Anne O. Steen).
- Establishing eddy flux measurements of CO<sub>2</sub> and CH<sub>4</sub> at Andøya, NILU/Bioforsk/Smithsonian Environmental Research Center (USA), 2008.

### **Other relevant activities**

- Designated expert (heavy metals) - AMAP – Arctic monitoring and assessment programme.
- Reviewer in *Atm. Env.*, *J.Acoust.Soc.Am.*, *JGR*, *WASP*, *Boundary layer meteorology*, 1996- .
- Scientific expert, *Climate Witness project*, World Wildlife Fund, 2007- .
- Chairing employment committee for Kim Holmén (UNIS), 2005.

### **Recent important presentations**

- Inv. speaker to Workshop on non-CO<sub>2</sub> pollutants in the Arctic: *Wet deposition of acidifying compounds in the Arctic*. Arr. James Hansen, New York, 2007.
- Inv. speaker international seminar on food production: *The Nitrogen cycle and N<sub>2</sub>O*. Arr. Knut Anton Mork, Handelsbanken, 2008.
- Inv. speaker Landbrukets klimautvalg: *Nitrogen and climate (in Norwegian)*, 2007
- Inv. speaker planmøte, Vadsø kommune: *Consequences of climate change in the North*, 2008.
- Regional pollution meeting, Sør-varanger kommune: *Air pollution status*, 2007.
- Scientific expert, *Climate Witness project*, video press conference Tromsø, Harstad, Spain, Australia, Hawaii, 2007.
- Dagsrevyen (July-2007: Emission episode, Nikel Russia)

### **Countries cooperated with or worked in**

USA, UK, Germany, France, Switzerland, Russia, Canada, Vietnam, Scandinavia incl. Svalbard.

## Private interests

Mountaineering, glacier climbing, dog driving, folk dance.

## PUBLICATION LIST, LARS R. HOLE

### University thesis

1. Hole, L.R., *An experimental study of sensible heat flux from a heat island*. (In Norwegian), M.Sc. thesis, Geophysical Institute, University of Bergen, 1994. 57 pp.
2. Hole, L.R., *Sound propagation in the atmospheric boundary layer; an experimental and theoretical study*. Ph.D. thesis, Geophysical Institute, University of Bergen, 1998. ISBN-82-90569-65-3. 174 pp.

### Books and book chapters

1. Søvik, G. and L.R. Hole, *Der isen aldri går – Et år i Otto Sverdrups rike*. Expedition narrative and popular science. Mangschou, 2001. ISBN 82-91948-08-9, 112 pp.
2. Søvik, G. and L.R. Hole, *Et år i Otto Sverdrups Rike*, Norsk Polarklubbs årbok, 2001-2002.
3. Hole, L.R., J Christensen, M. Forsius, M. Nyman, A. Stohl and S. Wilson, *Sources of acidifying pollutants and Arctic haze precursors*. AMAP assessment report 2006 (p. 2-10), chapter 2.
4. Hole, L.R., J. Christensen, V. A. Ginzburg, V. Makarov, A.I. Polishok, T. Ruoho-Airola, V. N. Vasilenko, *Concentrations and deposition of acidifying air pollutants*. AMAP assessment report 2006 (p. 11-30), chapter 3.
5. Bleeker A, M.A. Sutton, B. Acherman, A. Alebic-Juretic, V.P. Aneja, T. Ellermann, J.W. Erisman, D. Fowler, H. Fagerli, T. Gauger, K.S. Harlen, L.R. Hole, L. Horváth, M. Mitosinkova, R.I. Smith, Y.S. Tang, A. van Pul. *Temporal trends in atmospheric ammonia: Ch. 4.1 Linking ammonia emission trends to measured concentrations and deposition of reduced nitrogen at different scales*. Springer Verlag, 2008.

### Lay literature

1999-2009: More than twenty articles in print in English and Norwegian. *Svalbard Science Forum, Quokka.com, expeditionzone.com, Dagens Næringsliv, forskning.no, Norway-America Association yearbook 2001, Norsk Polarklubbs årbok 2000-2001, Teknisk Ukeblad, Vi Menn, Seilmagasinet, Norsk Filatelistisk Tidsskrift, Breposten, Bergens Tidende (incl. kronikk) and Svalbardposten (several popular science articles)*).

### Published journal papers

1. Albert, D.G. and L.R. Hole, *Blast noise propagation over a snow cover*. J. Acoust. Soc. Am., **109**(6), 2675-2681, 2001.
2. Dong, H., A.M. Kaynia, C. Madshus, J. Hovem, and L.R. Hole, *Study of sound propagation over range-dependent and topographic ground by a finite-difference model*, J. Sound. Vib., **256**, 821-833, 2002.
3. Guice, R.L., L.R. Hole, A. Jenssen and G. Kerry, *Impulse noise measurements during summer and winter conditions - an overview of experiments*. Special Issue, Noise Cont. Eng. J., **46**(5), 185-189, 1998.
4. Hauge, G. and L.R. Hole, *Implementation of slope irradiance in Mesoscale Model version 5 and its effect on temperature and wind fields during the breakup of a temperature inversion*. J. Geophys. Res., **108**, D2, art. 4058, 2003.
5. Hole, L.R. and G. Hauge, *Simulation of a morning air temperature inversion break-up in complex terrain and the influence on sound propagation on a local scale*. Appl. Acoust., **64**, 401-414, 2003.
6. Hole, L.R. and H.M. Mohr, *Modelling of Sound Propagation in the Atmospheric Boundary Layer; Application of the MIUU Mesoscale Model*. J. Geophys. Res., **104** (D10), 11891-11901, 1999.
7. Hole, L.R., A. Semb and K. Tørseth, *Ozone deposition to a temperate coniferous forest in Norway; gradient method measurements and comparison with the EMEP deposition module*. Atmos. Environ., **38** (15), 2217-2223, 2004.
8. Hole, L.R., A.M. Kaynia and C. Madshus, *Measurement and simulation of low frequency impulse noise and ground vibration from airblasts*. J. Sound and Vibration, **214** (2), 309-324, 1998.
9. Hole, L.R., *An experimental and theoretical study of propagation of acoustic pulses in a strongly refracting atmosphere*. Applied Acoustics, **53**(1-3), 77-94, 1997.
10. Hole, L.R., *An experimental study of the validity of two methods for estimating sensible heat flux following a step change in surface temperature*. Contributions to Atmospheric Physics, **69** (3), 409-415, 1996.
11. Hole, L.R., P. Lunde and Y. Gjessing, *Effects of strong sound velocity gradients on propagation of low frequency impulse noise; comparison of FFP predictions and experimental data*. J. Acoust. Soc. Am., **102** (3), 1443-1453, 1997.
12. Hole, L.R., Y. Gjessing, T. de Lange, and J. W. Reed, *Meteorological measurements and conditions during Norwegian Trials*. Special Issue, Noise Control Eng. J., **46** (5), 199-207, 1998.
13. Madshus, C., F. Løvholt, A. Kaynia, L.R. Hole, K. Attenborough and S. Taherzadeh, *Air-ground interaction in long range propagation of low frequency sound vibration-field tests and model verification*. Applied Acoustics, **66**(5), 553-578, 2005.
14. de Wit, H.A., A. Hindar and L. Hole, *Winter climate affects long-term trends in streamwater nitrate in acid-sensitive catchments in southern Norway*. Hydrology and Earth System Sciences, **12**, 393-403. 2008.
15. Hole, L.R., Brunner, S.H., J.E. Hansen and L. Zhang, *Low cost measurements of nitrogen and sulphur dry deposition velocities at a semi-alpine site: Gradient measurements and a comparison with deposition model estimates*. Env. Poll., **154**, 473-481. Special issue on biosphere-atmosphere fluxes, 2008.

16. Hole, L.R., H. de Wit and W. Aas, *Trends in N deposition in Norway: A regional perspective*. Hydrology and Earth System Sciences **12**, 405-414. 2008.
17. deWit, H.A, Mulder, J., A. Hindar and L.R. Hole, *Long term increase in dissolved organic carbon in stream waters in Norway in response to reduced acid deposition*. Env. Science and Technology, **41**, (22), 2007
18. Hole, L.R. and M. Enghardt . *Climate change impact on atmospheric nitrogen deposition in northwestern Europe – a model study*. AMBIO **37** (1), 9-17, 2008.
19. Stuanes, A, H. deWit, LR Hole, Ø Kaste, J. Mulder, G Riise and RF Wright. *Effect of climate change on flux of N and C: air-land-freshwater-marine links – synthesis*. AMBIO **37** (1), 2-8, 2008 .
20. Hole, L.R, J. Christensen, T. Ruoho-Airola, K. Tørseth, V. A. Ginzburg and P. Glowacky. *Past and future trends in concentrations of sulphur and nitrogen compounds in the Arctic*. Atm. Env., **43**, 928-939, 2009.

#### Submitted

21. Forsius, M., M Posch, J. Aherne, G. J. Reinds, J. Christensen and L.R. Hole. *Assessing the impacts of long-range sulfur and nitrogen deposition on arctic and sub-arctic ecosystems*. Subm. Ambio 2009.
22. Manninen, S., S. Huttunen, H. Tømmervik, S. Solberg and L.R. Hole. *Nordic Plants and ozone*. Subm. Ambio, 2009.
23. Steen, A., K. Aspmo, T. Berg and LR Hole. *Evaluation of the GEM flux gradient micrometeorological method for measuring Hg fluxes in Ny-Ålesund, Svalbard*. Subm. Atm. Env., 2009.

#### In preparation

24. Tømmervik, H. Hole, L.R and Solberg, S. *The first indications of impacts of tropospheric ozone birch and rowan in Northern Fennoscandia*.
25. Lange, H., L.R. Hole. H. deWit and R. Wright. *Trends and breakpoints in N deposition and surface water nitrate concentrations at Storgama*.
26. Steen, A. and LR Hole, *Gaseous Elemental Mercury flux measurements in Ny-Ålesund, Svalbard* (February - August 2008).
27. Steen A. and LR Hole. *Post-depositional fate of atmospheric mercury in the Norwegian Arctic, Ny-Ålesund, Svalbard*.

#### Important popular science

1. Hole, L.R., *Arktisk dis, lav sol og spredt lys*. Invited, special issue of Ottar (3/2005) – *Arctic light* (in Norwegian).
2. Hole, L.R., *Arctic light, low sun and scattered light*. Invited, special issue of Way North – *Arctic light*. (2006).
3. Hole, L.R., *Nitrogen på avveier – en underkjent miljøtrussel*, nilu.no 26 oct 2007 (also at forskning.no, 2 Nov. 2007, Nationen (kronikk), 3 Dec. 2007, Dagens Næringsliv (interview), 26. Oct, 2007).
4. Symon, C. et al: *Arctic Pollution 2006: Acidification and Arctic Haze*. Popular report. ISBN 82-7971-045-0
5. Hauge, G. og L.R. Hole, *Simulation of temperature inversions in complex terrain and the influence on sound propagation*. NAS-Nytt 3/2001, 6 pp.
6. Hole, L.R., *Lavfrekvent lydforplantning - studier i regi av Forsvarets bygningsstjeneste*. Invitert bidrag, NAS-Nytt 3/2000. 6 pp.
7. Hole, L.R., *Et vendepunkt for luftovervåkingen?*, kronikk, Bergens Tidende, 2003.
8. Broström, G., and L.R. Hole, *Vindmøller til havs påvirker klimaet*, kronikk, Bergens Tidende, 2008.

#### Important NILU reports

1. Aas, W., A. Hjellbrekke, L.R. Hole and K. Tørseth, *Deposition of major inorganic compounds in Norway 2002-2006*. Naturens tålegrenser/SFT. OR 78/2008 , ISBN: 978-82-425-2051-7, 2008.
2. Hole, L.R. and T. Berg, *Tungmetaller i luft i Ny Ålesund - Talking av data i MOSJ*. (npolar.no), 2006.
3. Hole, L.R. *Forsurende komponenter i luft i Ny Ålesund - Talking av data i MOSJ*. (npolar.no), 2006.
4. Hole, L.R. and K. Tørseth, *Deposition of major inorganic compounds in Norway 1978-1982 and 1997-2001: status and trends*. Naturens tålegrenser/SFT. Rapport 115. OR 61/2002 , ISBN: 82-425-1410-0, 2002.
5. Hole, L.R., *Meteorological data from the NICE field campaign in Ny-Ålesund*, spring 2001. OR 38/2002.
6. Girard, L., L.R. Hole, T. Berg. *Investigation of minor mercury depletion events recorded during early and late spring 2003 at Zeppelin/Ny-Ålesund, Svalbard (Norway)*. TR 01/2005 2005.
7. Hindar, A., H. de Wit and L.R. Hole. *Betydningen av klimavariasjon for nitrogenutlekkning i vassdrag og feltforskningsområder*. Dir. for Naturforvaltning. 56 pp. NIVA report 5064-2005.
8. Brunner, S.H. And L.R. Hole. *Ozone deposition in Hurdal 2004–2006: Data analysis and testing of parameterisations*. NILU TR 4/2007.
9. Brunner, S.H. And L.R. Hole. *Analysis of dry deposition measurements in Storgama: The CoTAG method compared with wet deposition fluxes and module estimates*. NILU technical report TR5/2007

#### Other technical reports

1. Hole, L.R., *Some results from the projects sound propagation over long distances / sound propagation models*. Fortifikatorisk notat **254/97**, NDCS.
2. Hole, L.R. Y. Gjessing and T. de Lange, *On valley meteorology*. Meteorological Report Series **3-94**, Geophysical Institute, University of Bergen, 1994.
3. Hole, L.R., A. Jenssen and H. Langberg, *Sluttrapport for fou-prosjektet 2FU5206802 - Lydforplantning over Store Avstander*. (In Norwegian), Fortifikatorisk Notat **243/97**, NDCS.
4. Hole, L.R., *Rapport fra en reise til New Mexico and Utah*. (In Norwegian), Notat **2-1995**, Geophysical Institute, University of Bergen, 1995.

5. Hole, L.R., Y. Gjessing and T. de Lange, *Meteorological conditions at Haslemoen during trials Nor95/1, Nor95/2, Nor95/3*. Notat **1-95**, Geophysical Institute, University of Bergen, 1995.
6. Hole, L.R., Y. Gjessing and T. de Lange. *Vind og temperaturforhold ved Rena april-november 1995; effekter på utbredelse av støy*. (In Norwegian), Fortifikatorisk Notat **226/95**, 1995.
7. Hole, L.R., Y. Gjessing and T. de Lange., *Analyse av meteorologiske data fra Rødsmoen/Rena 95-96; Effekter på utbredelse av støy*. (In Norwegian), Fortifikatorisk Notat **240/96**, NDCS.
8. Hygen, H.O., J.E. Paulsen, Y. Gjessing, L.R. Hole, T. de Lange and N.I. Nilsen, *Utarbeiding av metoder for varsling av lydforplantning fra skytefelt i Norge. Del 2: Lydutbredelsesforhold ved syv skytefelt fra september 1996 til september 1997*. (In Norwegian), Fortifikatorisk Notat **256/98**, NDCS, 1997.
9. Mohr, H.M. and L.R. Hole, *Modelling of sound propagation in the atmospheric boundary layer – meteorological model simulations - a winter case study*. UNIS Report **2**, 1998.
10. L.R.Hole, *Blast propagation and snow characterization – field work report, Arctic wintering*. Fortifikatorisk Notat, NDCS 2000.