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Preface

Data/model interactions: the biological perspective of understanding past global changes – a special issue honoring Dominique Jolly

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Dominique Jolly passed away on 5 July 2007. He was 46 years old, in the beginning of a promising and too short scientific career as professor of vegetal biology at the University of Montpellier 2 since 1999.

As a specialist in African tropical flora, Dominique expanded his expertise to Thailand, Greenland and the Mediterranean region, showing a high scientific curiosity. Passionate about paleontology, his interest moved from the origin of Tertiary flora in Thailand to the last few thousands years in the Mediterranean region, always giving precedence to a multidisciplinary approach, and collaborating with numerous specialists. The present issue was collected after a special session held during the EGU 2008 in Vienna and dedicated to model-data comparison, a subject that Dominique Jolly always had in mind and promoted with passion and energy.

1 Introduction to paleoenvironments and paleoclimates

Dominique Jolly carried out his DEA (Master's) at the University of Montpellier 2 in 1987, studying modern pollen deposition in the tropical rain forest in Gabon. He continued his investigation on the origin and distribution of Holocene African vegetation, studying fossil pollen records from peatbogs in the Burundi highlands in the laboratory of Quaternary Geology at Marseille Luminy, under the supervision of Dr Raymonde Bonnefille. His thesis gave him the op-

portunity to analyze new data on the evolution of Holocene aquatic vegetation, introducing statistics and a new approach in terms of understanding the dynamics of tropical forests, in relation to climatic cycles. His PhD was successfully defended in Marseille in 1991, with Professor Louis Thaler, the father of the current school of evolutionary biology and paleobiology in Montpellier in his thesis committee. Even during his early work, Dominique had shown a great interest in modeling vegetation dynamics. He understood that palynology could be a useful tool for providing well-dated and detailed records of past vegetation for testing this hypothesis. His post-doc in Sweden where he joined the scientific group lead by Colin Prentice, Professor in Lund and his wife Sandy Harrison, involved in the international project of mapping global vegetation 6000 yrs ago, provided the ideal scientific environment for expanding Dominique's expertise in modeling. Within a few years, he became the specialist of Africa in the international group, improving the first version of the Biome vegetation model for the African continent and the tropical regions. Well integrated in this group, his friendly nature, constant energy and enthusiasm were crucial to the success of this multidisciplinary endeavour. His effort to collaborate and cooperate with numerous scientists from many countries was greatly appreciated internationally. Dominique had a special sense of communicating and a strong desire to share knowledge and scientific issues that he could discuss at length during the memorable nights of the various international meetings held during the "Biome 6000" project.



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Fig. 1. Photos of Dominique Jolly (All photos taken by Denis-Didier Rousseau except center right by Ilhem Bentaleb, University Montpellier II).

2 A young professor in vegetal biology

Back in France, at Cerege, Aix-en-Provence where the palynological laboratory held by R. Bonnefille had moved on, after a short stay in Iena with Colin Prentice then at Max Planck Institute, Dominique Jolly was involved in the development of the African Modern Pollen database to improve the biome model for Africa. In his search for a more permanent job, he applied to a professorship in Vegetal Biology in Montpellier at the Institut de l'Evolution where Denis-Didier Rousseau was leading the team on paleoenvironments and paleoclimate. Dominique prepared his habilitation thesis in Aix-en-Provence and defended it in early 1999 in Montpellier in front of a high-level panel (Colin Prentice, Sylvie Joussaume, Jean-Claude Duplessy, Jean-Jacques Jaeger and Denis-Didier Rousseau).

Being in Montpellier was a great opportunity for Dominique to diversify his research through several disciplines, from genetics to paleoclimatology, passing by paleontology. He participated in projects ranging from analysing loess environments, modern pollen rain in Greenland to Tertiary environments in Thailand, rich in early hominoid remains and encouraged with Denis-Didier Rousseau the mite succession investigated in Chilean Holocene deposits by Alex Chepstow-Lusty. However during this period, Dominique deepened his studies in Africa, collaborating on the biome reconstuction of the environmental conditions of Australopithecus afarensis (Lucy) together with Raymonde Bonnefille, Françoise Chalié and Odile Peyron. In his last years, he launched several original and new projects in the tropical forest of Gabon and Cameroon. These were important as they revealed new crucial data concerning rainforest and climatic changes at the equatorial latitudes. The PhD thesis of Alfred Ngomanda was indeed the last major project that Dominique Jolly lead on Holocene environments in Gabon. Sadly, cancer prevented Dominique seeing the fruition of his next project on modern pollen rain from different forests for Judicael Lebamba's PhD. These latter investigations have been very rewarding and would not have been possible without the vision and energy of Dominique who initiated them.

3 An advised teacher

The transmission of knowledge was not just a job for Dominique, it was something he exuded with a tireless pleasure in equal quantities to students or respected Professors alike. A passionate teacher, Dominique was very much appreciated by his students and attracted them with enormous enthusiasm towards vegetal biology, palynology, and also environmental sciences and paleontology. Dominique deliberately decided to teach the practical courses that usually professors reserved for an assistant, spending time in the field collecting the plants he would ask his students to study and describe. He also spent considerable time reforming the teaching with his colleagues, while proposing new modules in Montpellier, and Madrid where he also taught, to broaden his students' interest in paleoenvironmental and paleoclimatic studies. He kept this passion until the very end at the hospital still transmitting his love of research and his curiosity far beyond palynology. Dominique's ambition in the highest sense was always the ability to think outside the box and to move forward the established habits.

4 An open-minded scientist

His friendliness was always an asset for convincing his colleagues to contribute to any scientific project, whether national or international. Many colleagues from all continents remember the time they spent with him in methodological discussions. His contribution to the use of climate vegetation model simulations remains crucial to young researchers. One of the most fundamental contributions of Dominique Jolly is an article published in Science with his colleague Alex Haxeltine, where they showed that low levels of CO_2 during the Last Glacial Maximum has to be taken into account to explain the altitudinal variation of mountain forest in East Africa. In Montpellier, Dominique developed new projects, collaborating with his new colleagues and doing fieldwork that he had somehow left aside when in Sweden. His willingness to contribute to the development of Africa remained strong, as attested by fieldwork in Gabon and Cameroon where he intended to develop teaching and training in the future. Locally, Dominique was also very interested in geological investigations of caves around Montpellier, looking for evidence of climatic history to test the established refuge hypothesis of arboreal vegetation.

5 Data/model interactions: the biological perspective of understanding past global changes (Climate of the Past special issue)

Scientists who collaborated with Dominique appreciated his openness and precise comments, which though sometimes critical, showed a deep understanding of the subject. Many of them replied positively to the proposed scientific session dedicated to model-data comparison held at EGU 2008. The strong attendance and the many contributions correspond to what Dominique represented for them. They all agreed to participate to this special issue. The 14 papers gathered in this volume show part of Dominique's scientific interests. The presentation of the different papers (or contributions) give preeminence to the relationship between ecosystems and CO2, as a reminder of Dominique Jolly's Science paper. This is followed by the paper on the Bayesian model that stresses the interest of Dominique Jolly in relation to models and their use for better interpreting data. Several papers concerning his beloved Africa represent the core of the issue followed by papers dealing with different time scales and regions such as Europe, the Arctic, the Mediterranean and South America; all these papers arose from interactions, collaborations and conversations with Dominique at some point in time, and for whom no subject was not worth discussing. This issue ends with a paper about Tertiary pollen record in Thailand related to hominoid occurrence.

Acknowledgement. We would like to thank all the participants of the special EGU session held in 2008, especially EGU president Gerald Ganssen who made this event possible. We thank all the authors, co-authors, editors and reviewers for the tremendous work they provided to complete this special issue. The different manuscripts show how wide was Dominique Jolly's scientific interest in paleoenvironments, as well as for the paleoclimate community, and the strong impact he made on a large scientific community. Acknowledgements are due to CNRS institutes, the National Institute for Earth Sciences and Astronomy (INSU) and the Institute of Ecology and Environment (INEE), which provided financial support for this special issue. We would like to thank Alex Chepstow-Lusty for improving the English of this preface.



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References

References of Dominique Jolly as listed in the Web of Science

- Bonnefille, R., Potts, R., Chalie, F., Jolly, D., and Peyron, O.: High-resolution vegetation and climate change associated with Pliocene *Australopithecus afarensis*, Proceedings of the National Academy of Sciences of the United States of America, 101, 12125–12129, 2004.
- Chaimanee, Y., Jolly, D., Benammi, M., Tafforeau, P., Duzer, D., Moussa, I., and Jaeger, J. J.: A middle Miocene hominoid from Thailand and orangutan origins, Nature, 422, 61–65, 2003.
- Cheddadi, R., Guiot, J., and Jolly, D.: The Mediterranean vegetation: What if the atmospheric CO² increased?, Landscape Ecol., 16, 667–675, 2001.
- Crochet, J. Y., Gence, J., Boulbes, N., Boutie, P., Cretin, C., Cregut-Bonnoure, E., Duzer, D., Jolly, D., Laudet, F., Lefevre, D., Mourer-Chauvire, C., Rousselieres, F., and Thouand, E.: New palaeoenvironmental data from southern France at ca. 30000 C¹⁴ yr bp: The case of the Marie cave (Herault), C. R. Palevol, 6, 241–251, doi:10.1016/j.crpv.2007.02.006, 2007.
- Delire, C., Ngomanda, A., and Jolly, D.: Possible impacts of 21st century climate on vegetation in central and west Africa, Global Planet. Change, 64, 3–15, doi:10.1016/j.gloplacha.2008.01.008, 2008.
- Edwards, M. E., Anderson, P. M., Brubaker, L. B., Ager, T. A., Andreev, A. A., Bigelow, N. H., Cwynar, L. C., Eisner, W. R., Harrison, S. P., Hu, F. S., Jolly, D., Lozhkin, A. V., MacDonald, G. M., Mock, C. J., Ritchie, J. C., Sher, A. V., Spear, R. W., Williams, J. W., and Yu, G.: Pollen-based biomes for Beringia 18,000, 6000 and 0 C¹⁴ yr BP, J. Biogeogr., 27, 521–554, 2000.
- Elenga, H., Peyron, O., Bonnefille, R., Jolly, D., Cheddadi, R., Guiot, J., Andrieu, V., Bottema, S., Buchet, G., de Beaulieu, J. L., Hamilton, A. C., Maley, J., Marchant, R., Perez-Obiol, R., Reille, M., Riollet, G., Scott, L., Straka, H., Taylor, D., Van Campo, E., Vincens, A., Laarif, F., and Jonson, H.: Pollen-based biome reconstruction for southern Europe and Africa 18,000 yr BP, J. Biogeogr., 27, 621–634, 2000.
- Farrera, I., Harrison, S. P., Prentice, I. C., Ramstein, G., Guiot, J., Bartlein, P. J., Bonnefille, R., Bush, M., Cramer, W., von Grafenstein, U., Holmgren, K., Hooghiemstra, H., Hope, G., Jolly, D., Lauritzen, S. E., Ono, Y., Pinot, S., Stute, M., and Yu, G.: Tropical climates at the last glacial maximum: A new synthesis of

terrestrial palaeoclimate data. I. Vegetation, lake levels and geochemistry, Clim. Dynam., 15, 823–856, 1999.

- Flores, O., Gritti, E. S., and Jolly, D.: Climate and CO_2 modulate the C_3/C_4 balance and $\delta^{13}C$ signal in simulated vegetation, Clim. Past, 5, 431–440, doi:10.5194/cp-5-431-2009, 2009.
- Gritti, E. S., Cassignat, C., Flores, O., Bonnefille, R., Chalié, F., Guiot, J., and Jolly, D.: Simulated effects of a seasonal precipitation change on the vegetation in tropical Africa, Clim. Past, 6, 169–178, doi:10.5194/cp-6-169-2010, 2010.
- Guiot, J., Torre, F., Jolly, D., Peyron, O., Boreux, J. J., and Cheddadi, R.: Inverse vegetation modeling by monte carlo sampling to reconstruct palaeoclimates under changed precipitation seasonality and CO₂ conditions: Application to glacial climate in Mediterranean region, Ecol. Model., 127, 119–140, 2000.
- Harrison, S. P., Jolly, D., Laarif, F., Abe-Ouchi, A., Dong, B., Herterich, K., Hewitt, C., Joussaume, S., Kutzbach, J. E., Mitchell, J., De Noblet, N., and Valdes, P.: Intercomparison of simulated global vegetation distributions in response to 6 kyr BP orbital forcing, J. Climate, 11, 2721–2742, 1998.
- Hoelzmann, P., Jolly, D., Harrison, S. P., Laarif, F., Bonnefille, R., and Pachur, H. J.: Mid-Holocene land-surface conditions in northern Africa and the Arabian peninsula: A data set for the analysis of biogeophysical feedbacks in the climate system, Global Biogeochem. Cy., 12, 35–51, 1998.
- Jolly, D. and Bonnefille, R.: Dynamic history of a tropical swamp – pollen evidence from Ndurumu, Burundi, Rev. Palaeobot. Palyno., 75, 133–151, 1992.
- Jolly, D., Bonnefille, R., and Roux, M.: Numerical interpretation of a high-resolution Holocene pollen record from Burundi, Palaeogeogr. Palaeocl., 109, 357–370, 1994.
- Jolly, D., Bonnefille, R., Burcq, S., and Roux, M.: Study and statistical treatment of pollen samples from surface soil of the rain forest in Gabon (Africa), Comptes Rendus De L Academie Des Sciences Serie Ii Fascicule a-Sciences De La Terre Et Des Planetes, 322, 63–70, 1996.
- Jolly, D. and Haxeltine, A.: Effect of low glacial atmospheric CO₂on tropical African montane vegetation, Science, 276, 786–788, 1997.
- Jolly, D., Taylor, D., Marchant, R., Hamilton, A., Bonnefille, R., Buchet, G., and Riollet, G.: Vegetation dynamics in central Africa since 18,000 yr BP: Pollen records from the interlacustrine highlands of Burundi, Rwanda and western Uganda, J. Biogeogr., 24, 495–512, 1997.
- Jolly, D., Harrison, S. P., Damnati, B., and Bonnefille, R.: Simulated climate and biomes of Africa during the late Quaternary: Comparison with pollen and lake status data, Quaternary Sci. Rev., 17, 629–657, 1998a.
- Jolly, D., Prentice, I. C., Bonnefille, R., Ballouche, A., Bengo, M., Brenac, P., Buchet, G., Burney, D., Cazet, J. P., Cheddadi, R., Edorh, T., Elenga, H., Elmoutaki, S., Guiot, J., Laarif, F., Lamb, H., Lezine, A. M., Maley, J., Mbenza, M., Peyron, O., Reille, M., Reynaud-Farrera, I., Riollet, G., Ritchie, J. C., Roche, E., Scott, L., Ssemmanda, I., Straka, H., Umer, M., Van Campo, E., Vilimumbalo, S., Vincens, A., and Waller, M.: Biome reconstruction from pollen and plant macrofossil data for Africa and the Arabian peninsula at 0 and 6000 years, J. Biogeogr., 25, 1007–1027, 1998b.
- Joussaume, S., Taylor, K. E., Braconnot, P., Mitchell, J. F. B., Kutzbach, J. E., Harrison, S. P., Prentice, I. C., Broccoli, A. J.,

Abe-Ouchi, A., Bartlein, P. J., Bonfils, C., Dong, B., Guiot, J., Herterich, K., Hewitt, C. D., Jolly, D., Kim, J. W., Kislov, A., Kitoh, A., Loutre, M. F., Masson, V., McAvaney, B., McFarlane, N., de Noblet, N., Peltier, W. R., Peterschmitt, J. Y., Pollard, D., Rind, D., Royer, J. F., Schlesinger, M. E., Syktus, J., Thompson, S., Valdes, P., Vettoretti, G., Webb, R. S., and Wyputta, U.: Monsoon changes for 6000 years ago: Results of 18 simulations from the paleoclimate modeling intercomparison project (pmip), Geophys. Res. Lett., 26, 859–862, 1999.

- Lebamba, J., Ngomanda, A., Vincens, A., Jolly, D., Favier, C., Elenga, H., and Bentaleb, I.: Central African biomes and forest succession stages derived from modern pollen data and plant functional types, Clim. Past, 5, 403–429, doi:10.5194/cp-5-403-2009, 2009a.
- Lebamba, J., Vincens, A., Jolly, D., Ngomanda, A., Schevin, P., Maley, J., Bentaleb, I., Favier, C., Fontugne, M., Nguetsop, F., Oslisly, R., and Members, R.: Modern pollen rain in savanna and forest ecosystems of Gabon and Cameroon, central Atlantic Africa, Rev. Palaeobot. Palyno., 153, 34–45, doi:10.1016/j.revpalbo.2008.06.004, 2009b.
- Moine, O., Rousseau, D. D., Jolly, D., and Vianey-Liaud, M.: Paleoclimatic reconstruction using mutual climatic range on terrestrial mollusks, Quaternary Res., 57, 162–172, doi:10.1006/qres.2001.2286, 2002.
- Ngomanda, A., Chepstow-Lusty, A., Makaya, M., Schevin, P., Maley, J., Fontugne, M., Oslisly, R., Rabenkogo, N., and Jolly, D.: Vegetation changes during the past 1300 years in western Equatorial Africa: A high-resolution pollen record from lake Kamalete, Lope Reserve, central Gabon, Holocene, 15, 1021–1031, 2005.
- Ngomanda, A., Jolly, D., Bentaleb, I., Chepstow-Lusty, A., Makaya, M., Maley, J., Fontugne, M., Oslisly, R., and Rabenkogo, N.: Lowland rainforest response to hydrological changes during the last 1500 years in Gabon, western equatorial Africa, Quaternary Res., 67, 411–425, 2007.
- Ngomanda, A., Chepstow-Lusty, A., Makaya, M., Favier, C., Schevin, P., Maley, J., Fontugne, M., Oslisly, R., and Jolly, D.: Western equatorial African forest-savanna mosaics: a legacy of late Holocene climatic change?, Clim. Past, 5, 647–659, doi:10.5194/cp-5-647-2009, 2009.
- Peyron, O., Jolly, D., Bonnefille, R., Vincens, A., and Guiot, J.: Climate of east Africa 6000 C¹⁴ yr BP as inferred from pollen data, Quaternary Res., 54, 90–101, 2000.
- Peyron, O., Jolly, D., Bonnefille, R., Vincens, A., and Guiot, J.: A response to "Climate of east Africa 6000 C^{14} yr BP as inferred from pollen data" by peyron et al. (2000) reply, Quaternary Res., 56, 136–137, 2001.
- Peyron, O., Jolly, D., Braconnot, P., Bonnefille, R., Guiot, J., Wirrmann, D., and Chalie, F.: Quantitative reconstructions of annual rainfall in Africa 6000 years ago: Modeldata comparison, J. Geophys. Res.-Atmos., 111, D24110, doi:10.1029/2006JD007396, 2006.
- Peyrot, D., Jolly, D., and Barron, E.: Palynological contributions for the palaeoenvironmental reconstruction of the Albo-Cenomanian from the Charentes (sw France), C. R. Palevol, 4, 151–165, 2005.
- Prentice, I. C., Guiot, J., Huntley, B., Jolly, D., and Cheddadi, R.: Reconstructing biomes from palaeoecological data: A general method and its application to European pollen data at 0 and 6 ka, Clim. Dynam., 12, 185–194, 1996.

- Prentice, I. C., Harrison, S. P., Jolly, D., and Guiot, J.: The climate and biomes of Europe at 6000 yr bp: Comparison of model simulations and pollen-based reconstructions, Quaternary Sci. Rev., 17, 659–668, 1998.
- Prentice, I. C., Jolly, D., and participants: Mid-Holocene and glacial-maximum vegetation geography of the northern continents and Africa, J. Biogeogr., 27, 507–519, 2000.
- Rousseau, D. D., Antoine, P., Hatte, C., Lang, A., Zoller, L., Fontugne, M., Ben Othman, D., Luck, J. M., Moine, O., Labonne, M., Bentaleb, I., and Jolly, D.: Abrupt millennial climatic changes from Nussloch (Germany) upper Weichselian eolian records during the last glaciation, Quaternary Sci. Rev., 21, 1577–1582, 2002.
- Rousseau, D. D., Duzer, D., Cambon, G. V., Jolly, D., Poulsen, U., Ferrier, J., Schevin, P., and Gros, R.: Long distance transport of pollen to Greenland, Geophys. Res. Lett., 30, 1765, doi:10.1029/2003GL017539, 2003.
- Rousseau, D. D., Duzer, D., Etienne, J. L., Cambon, G., Jolly, D., Ferrier, J., and Schevin, P.: Pollen record of rapidly changing air trajectories to the North Pole, J. Geophys. Res.-Atmos., 109, D06116, doi:10.1029/2003JD3985, 2004.
- Rousseau, D. D., Schevin, P., Duzer, D., Cambon, G., Ferrier, J., Jolly, D., and Poulsen, U.: New evidence of long distance pollen transport to southern Greenland in late Spring, Rev. Palaeobot. Palyno., 141, 277–286, 2006.
- Rousseau, D. D., Schevin, P., Ferrier, J., Jolly, D., Andreasen, T., Ascanius, S. E., Hendriksen, S. E., and Poulsen, U.: Long-distance pollen transport from north America to Greenland in Spring, J. Geophys. Res.-Biogeo., 113, G02013, doi:10.1029/2007jg000456, 2008.

- Tarasov, P. E., Jolly, D., and Kaplan, J. O.: A continuous Late Glacial and Holocene record of vegetation changes in Kazakhstan, Palaeogeogr. Palaeocl., 136, 281–292, 1997.
- Tarasov, P. E., Webb, T., Andreev, A. A., Afanas'eva, N. B., Berezina, N. A., Bezusko, L. G., Blyakharchuk, T. A., Bolikhovskaya, N. S., Cheddadi, R., Chernavskaya, M. M., Chernova, G. M., Dorofeyuk, N. I., Dirksen, V. G., Elina, G. A., Filimonova, L. V., Glebov, F. Z., Guiot, J., Gunova, V. S., Harrison, S. P., Jolly, D., Khomutova, V. I., Kvavadze, E. V., Osipova, I. M., Panova, N. K., Prentice, I. C., Saarse, L., Sevastyanov, D. V., Volkova, V. S., and Zernitskaya, V. P.: Present-day and mid-Holocene biomes reconstructed from pollen and plant macrofossil data from the former Soviet Union and Mongolia, J. Biogeogr., 25, 1029–1053, 1998.
- Texier, D., de Noblet, N., Harrison, S. P., Haxeltine, A., Jolly, D., Joussaume, S., Laarif, F., Prentice, I. C., and Tarasov, P.: Quantifying the role of biosphere-atmosphere feedbacks in climate change: Coupled model simulations for 6000 years BP and comparison with palaeodata for northern Eurasia and northern Africa, Clim. Dynam., 13, 865–882, 1997.
- Vincens, A., Ssemmanda, I., Roux, M., and Jolly, D.: Study of the modern pollen rain in western Uganda with a numerical approach, Rev. Palaeobot. Palyno., 96, 145–168, 1997.