ward to see you in Deggendorf in September 1998.With best regards Prof. Dr. H. Seeger, dr. P. Sperber, President and professor chairman, program committee, Bundesamt für eleventh international workshop, Kartographie und geodäsie on laser ranging

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Book review

Pedlosky J (1996), *Ocean Circulation Theory*
Springer-Verlag, Berlin, Heidelberg, New York, ISBN 3-540-60489-8, pp 453

After J Pedlosky had dealt with the fundamentals of the basic fluid–dynamic equations and their systematic approximations in the second edition of his book *Geophysical Fluid Dynamics*, he turns in the new book *Ocean circulation Theory* his attention to the developments of the last years in this field.
The title correctly describes intention and content of this book, but perhaps it should be complemented with the subtitle *Theory under the microscope of observations.*
The book is divided into seven chapters. Chapter one and two have an introductory character in the classical ocean circulation theory including Sverdrup's theory and the wind-driven circulation of fluids with standardized density. The problem of the vertical structure of the wind-driven circulation in quasi-geostrophic approximation is picked up in chapter three. The theory of the ventilated thermocline is the topic of chapter four and buoyancy-driven circulations are presented in chapter five. The next in order is the distinctive feature of the equatorial dynamics of the thermocline including the necessary link between midlatitudes and equator. In the final chapter the abyssal circulation is dealt with.
The book offers a fascinating possibility to gain an insight into the theory of ocean circulation and increases the understanding of the system ocean. It makes it much more accessible. Nevertheless, it cannot be expected to get a full account of all the new important details of the results recently obtained.
Modelling of motion and deformation is increasingly important in describing the yielding earth.
Due to the aim of the exact determination of the geoid it will become essential also for the geodetic community, to have knowledge of ocean circulation theory. Thus, the book can only be recommended to those working in physical geodesy.

Johannes Ludwig

Greenberg, John Leonard. *The Problem of the Earth's Shape from Newton to Clairaut*. Cambridge University Press, 1995. xviii + 781 p. ISBN 0-521-38541-5, Hardback $90.00

One wondered if since Isaac Todhunter's *A History of the Mathematical Theories of Attraction and the Figure of the Earth* first appeared in 1873 –a Dover reprint was published in 1962– anything else remained to be said about the historical evolution of the problem of the Earth's shape. But there was much more to be said, judging by the contents of John L. Greenberg's book *The Problem of the Earth's Shape from Newton to Clairaut* appropriately subtitled «The Rise of Mathematical Science in Eighteen-century Paris and the Fall of 'Normal' Science». Unlike Todhunter, who covers almost two centuries of progress, from the earliest investigations in the seventeenth century to the middle of the nineteenth century, Greenberg limits his chronology to the period from Newton's *Principia* up to the publication of Clairaut's *Théorie de la Figure de la Terre*, a mere 50 years span. Thus, eminent icons who concerned themselves with this specialized realm of science, acclaimed celebrities like Laplace and Legendre, are left out of the narrative which concentrates on a peculiar historical era characterized by a turbulent clash of ideologies.

The quest for the real shape of the Earth is one of the most colourful affairs in the history of physical sciences and the book skilfully exposes this fact. Although the author presents a thoughtful and vivid study of the theories circulating among the most accomplished and successful scientists of their time, he ultimately tells a sad story. Greenberg's account is really about controversies, the minute dissection of every argument, debate, dispute, and quarrel that surfaced at the dawn of mathematical geodesy inside the Paris Academy of Sciences. This involves luminary participants with names such as Pierre-Louis Moreau de Maupertuis, a fervent defender of Newton's ideas for which he was ostracized by his own countrymen; the child prodigy Alexis-Claude Clairaut who, in the text, is not spared mistake in reasoning or formulation; Johann I Bernoulli, caught up in the middle of the fight due to his alliance with Maupertuis; the belligerent Pierre Bouguer, always incapable of pulling through his innovative ideas; and other minor figures such as Jean-Jacques Dortous de Mairan (a hard-hearted defender of Cartesianism) and the forgotten Alexis Fontaine who introduced partial differential calculus into France; to name just a few.

To produce a book that retraces the events –big and small– of an epoch fermented under the aura of post-Newtonian mechanics and which blends them into an animated potpourri of mathematical discussion, scientific history, and concise biography –in this order of importance– is a remarkable achievement. However, at times the author loses sight of his goal in a swirl of details which he seems unable to sort out according to significance. He searches into his ample source of meticulously arranged research notes and indiscriminately

pours out everything. Notably missing are the final corroborating results of the geodetic surveys themselves. Greenberg does not address, not even lightly, the practical side of the problem, the important contribution of meridian arc measurements that, ultimately and conclusively, resolved the perennial question of the true size and flattening of the Earth. It is a disfavour to accurate reporting to neglect the impact that experimental science, nurtured by ever improved observations, has had in granting postulated theories –like Newton's ''intuitions''– their universal acceptability. In that it overlooks geodetic measurements, Greenberg's story is incomplete. For example, a discussion of the triumphs of theoretical claims such as Kepler's laws, stellar aberration, and polar motion, would be impaired without mentioning the extraordinary effort afforded by meticulous data gatherers and/or analysts of the caliber of Tycho Brahe, James Bradley, and S.C. Chandler. Perhaps, the practical contribution of terrestrial measurements –no less controversial and explosive than its theoretical counterpart in the struggle to untangle this saga– could be published as a sequel to fully close this chapter in geodetic history.

All in all, Greenberg has produced an inspired and vibrant critical historical account that broadens the reader's understanding of the circumstances surrounding the mathematical difficulties of properly formulating the problem of the shape of the Earth. In the process, he transforms himself into something of a private detective, a relentless seeker of information about a subject tinted by the obvious egocentric and patriotic tendencies of some of the protagonists. This is not a book for the casual reader. The author is writing for a highly technical audience, already interested in and aware of the subject matter. It is essentially for serious investigators who will find their curiosity far expanded by the wealth of information discovered when perusing the many pages of this treatise. There are exhaustive, well documented citations and references which cover all facets of the investigation and painstakingly explore the primary hand-written manuscript sources.

Greenberg's great revelation is to capture the essence of the mini-science wars going on among French academicians during the first half of the eighteenth century. Nothing at this level of detail was previously available in the published literature. In the process he offers harsh criticism of the conduct of some of the academicians, in particular Maupertuis; in a single paragraph (p. 118) he identified the methods of the Lapland veteran as chicanery, machinations, stratagems, calling him brazen, impudent, arrogant, presumptuous, and conniving, arguing at the end of the sentence that his ''reprehensible conduct was exactly what was required in Paris at the time!''. The abundant layers of intrigue rekindled through the description are in a sense very human and not unlike some of today's headlines: blunt plagiarism or appropriation of ideas without proper acknowledgement; presumed favouritism when awarding Paris Academy's coveted prizes; faulty research conclusions and fallacies in judgement; astonishing third party rederivation of incorrect equations and tinkering of results; anonymous caustic criticism of other colleagues' propositions and relentless personal attacks; complaints about excessively verbose writing and artificially inflated paper length; spreading rumours and innuendo about other people's quality of work; unethically biased censorship of articles by partisan editors; etc. Students of the politics of scientific disputes throughout history will be amused by the numerous tales intercalated in the text, most of them well supported by documented evidence.

Apart from writing with a fluid style and clearly displaying a dominance of the theme selected –several of Greenberg's scholarly papers on this subject appeared in various refereed journals devoted to the history of sciences– the topics were microscopically researched and scrupulously exposed. Nevertheless, too often he resorts to interminable sentences, not only elliptic and cumbersome in content, but very uncharacteristic of English prose. As an example I reproduce verbatim one of the juicier ones (p. 91):

> Bouguer did not mistake, as Mairan had done, the directions of *attraction* at points on the surfaces of homogeneous nonrotating figures of revolution, which *are perpendicular* to the surfaces of the homogeneous figures of revolution at these points when the principle of the plumb line holds at the surfaces of such figures of revolution, for the directions of *effective gravity* at points on the surfaces of homogeneous figures of revolution which revolve around their axes of symmetry, which *are not perpendicular* to the surfaces of the homogeneous figures of revolution at these points when the directions of attraction at these points are perpendicular to the surfaces of the homogeneous figures of revolution at these points.

In summary, neglecting some unnecessarily cryptic interpretations as the one shown above, this voluminous study includes several fascinating items: historical disclosures, delicious titbits, and poignant satire, but also quite a few large matters of real significance worth noting in a review, but which are impossible to enumerate due to space limitations. One must conclude by emphasizing that the book is an exhilarating work of great scope and substance and any person desiring to understand the scientific life that shaped the early history of the French Academy in the 1730s and 40s should not miss it.

Tomás Soler
National Geodetic Survey

Forthcoming Symposia related to Geodesy

A listing of forthcoming symposia related to geodesy can be found in the Journal of Geodesy (71/12), An active list of forthcoming symposia related to geodesy is available at the IAG homepage: www.gfy.ku.dk/˜iag/