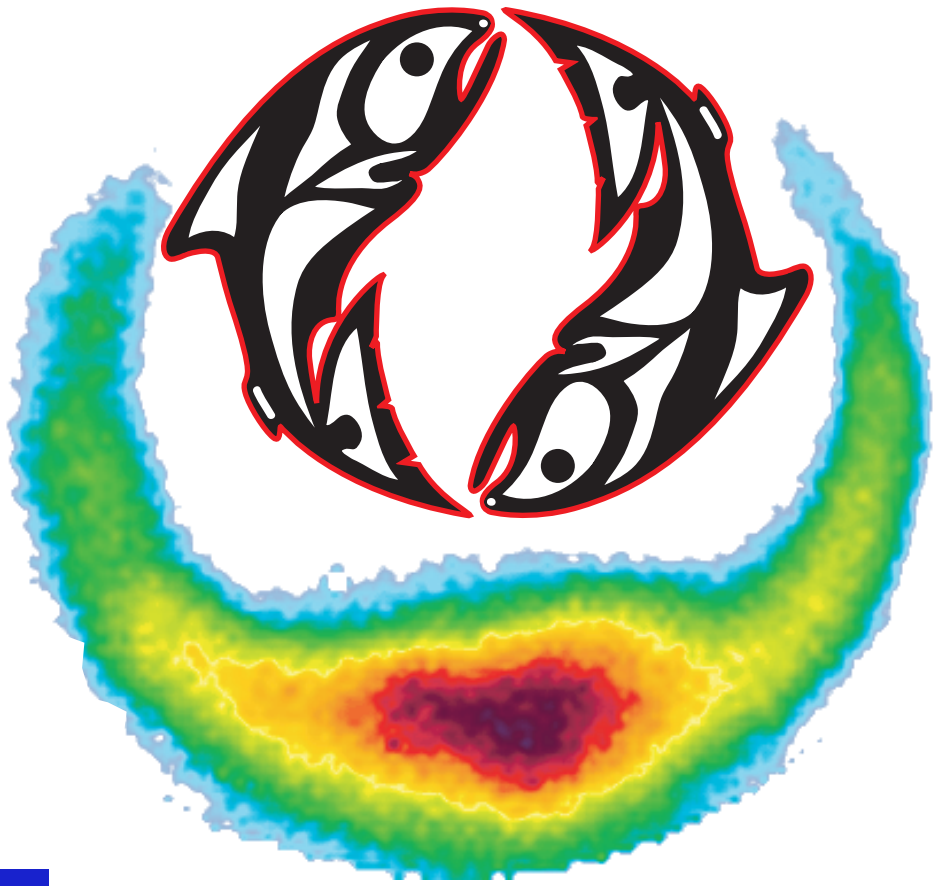
Sixth International Conference on Substorms



Edited by
R. M. Winglee

Sixth International Conference on Substorms

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Cover**:** Image of the northern auroral oval taken by the Ultraviolet Imager (UVI) on the Polar spacecraft. The convection pattern is symbolized through the northwest style of two salmon. Image developed by D. Chua, M. Fillingim and J. Cascarden.

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With many thanks to Stacy Williamson and assistants Debra Bryant, Emily West, and Christy Pack at the conference and Heather Davis, Heidi Delaney, and Awad Awad working behind the scenes. Their unfaltering support throughout ensured that all attendees had a productive conference.

To Erika Harnett, Damien Chua, Matt Fillingim, Carol Paty, and John Williams for conference technical support – may your studies take you along the road to your dreams.

For Jennifer, Kathryn and Matthew

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Tail Processes

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Preface

At this time substorms remain an enigma to space physics. Many of their gross features are well known. These include the typical solar wind conditions needed to provide the free energy to drive the substorms, the auroral manifestations associated with onset, and the typical reconfiguration of the magnetosphere through the growth and recovery phases, including tail thinning and expansion, magnetic reconnection, enhanced ionospheric outflows and the injection of energetic particles into the inner magnetosphere. What are presently missing are the details in linking the actions and reactions of different regions as the substorm develops. A full understanding of substorms is not going to be achieved unless we can fully map the flow of energy, momentum and mass from the solar wind into the magnetosphere and ionosphere, and the physical processes that control these flows.

In order to improve our understanding of some of these key processes, the Sixth International Conference on Substorms focused its attention on the processes that control the energization of plasma that links critical regions during substorms. These issues that where investigated include:

- What are the observational and theoretical particle/kinetic signatures for substorm processes?
    - particle acceleration processes - boundary layer processes versus bulk heating
    - ionospheric signatures of magnetospheric particle acceleration
    - manifestations of current sheet dynamics
    - role of reconnection in substorms - is reconnection a necessary condition for substorm onset or just a manifestation?
    - new insights from Cluster 2
- What are signatures of substorm ionospheric processes in the magnetosphere?
    - how do the structures seen at low altitudes reflect substorm development in the magnetosphere?
    - what are the magnetospheric signatures of Alfvén resonance heating, and ionospheric outflows and mass loading?
    - what is the relationship between fast local processes and the global reconfiguration?
    - new insights from IMAGE
- What are the macroscopic manifestations of ionospheric/magnetospheric coupling?
    - are there differences between quiet time and active time substorms, or in other words, is there feedback between the ionosphere and magnetosphere?
    - are there asymmetries produced by summer/winter hemispheric differences?
    - what is the influence of the formation, injection and loss of energetic particle populations in the overall development of a substorm?
- What are space weather effects, from the heating of the upper atmosphere, to the modification of the ionosphere and inner magnetosphere associated with solar wind drivers, and insights provided by global modeling?

These proceedings document both the state of our understanding prior to the conference and advances being made with new in-situ data and enhanced modeling. This compilation of papers represents about 66% of the actual papers presented. The debate on substorm processes remains lively, as evidenced by many fruitful discussions that were held during the conference. It is clear from the papers presented herein that substantial progress is being made in identifying key processes and their signatures in the particle and magnetic field data. The dilemma is that the new results show that the original paradigms may have been too simple and the system is much more complex and highly structured than previously envisioned. Resolving this complexity will have to await future studies.

In developing the themes discussed at the conference I wish to give thanks to the other members of the Program Committee including

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