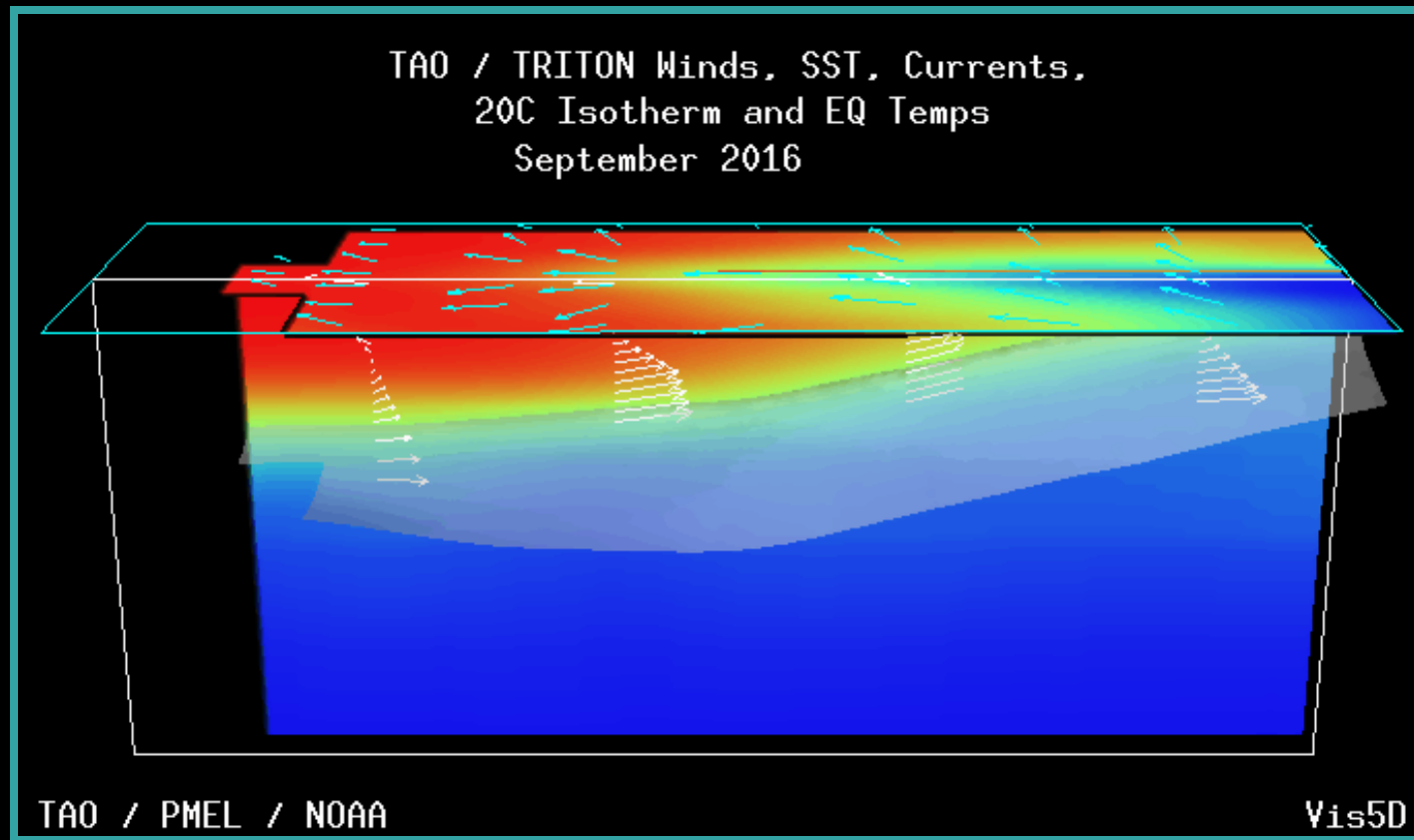




El Niño update from a NASA oceanographer

By Dr. Anna Borovikov

October 18, 2016



With a lot of help from my colleagues: Robin Kovach, Guillaume Vernieres, Christian Keppenne, Lena Marshak, Qing Liu, Yuriy Vikhlyaev, Bin Zhao, Ricardo Todling, Max Suarez, Richard Mollet and many, many, many others from the

Global Modeling and Assimilation Office

El Niño... How we can tell if it is changing from one phase to another? What the current status is and why we thought we were going to go into a La Nina, and what actually happened?

How?

- Numerical modeling
 - high-performance computing
- Observing systems
 - in-situ vs remote
- Data assimilation
 - multivariate error covariance

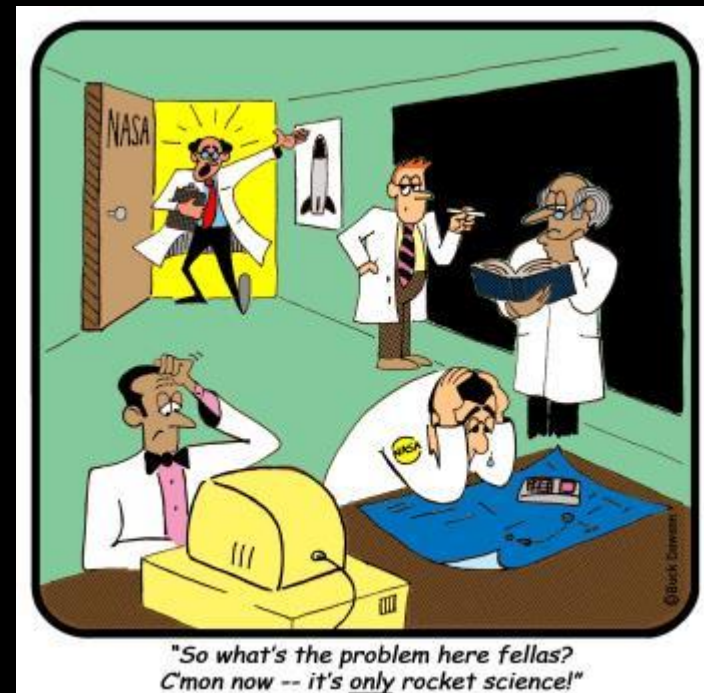
What?

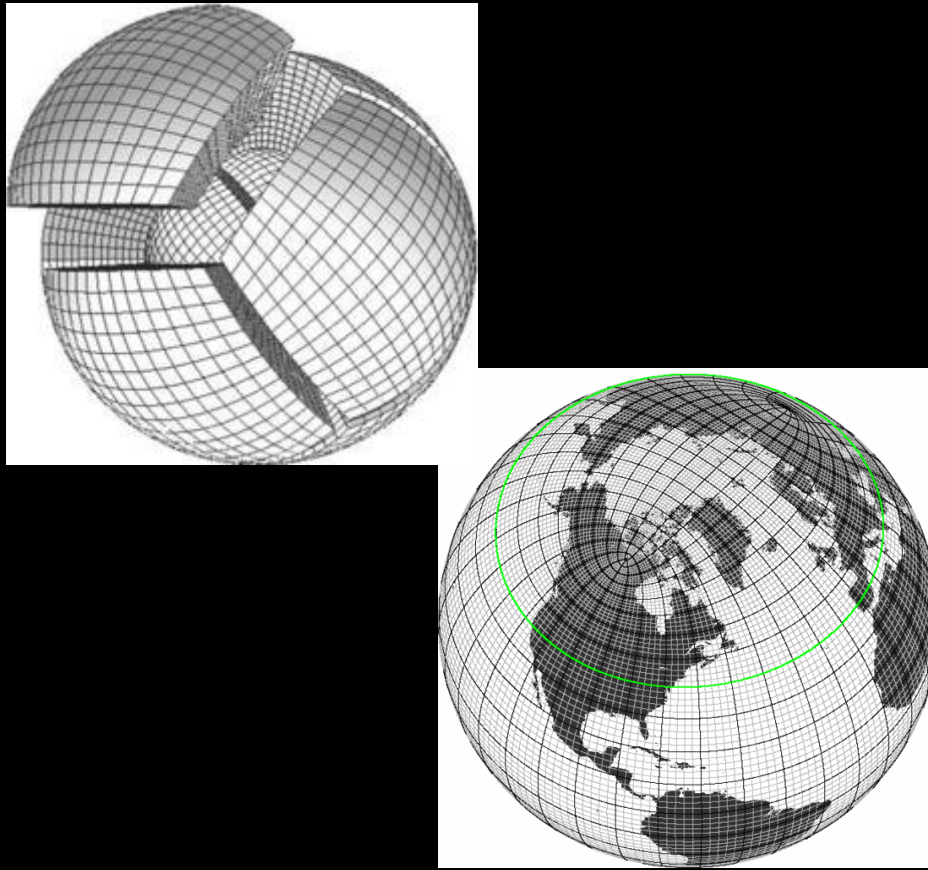
El Niño, La Nina, in between?

Why?

- Probabilistic forecast
- Prediction skill

Watch out for The Blob!



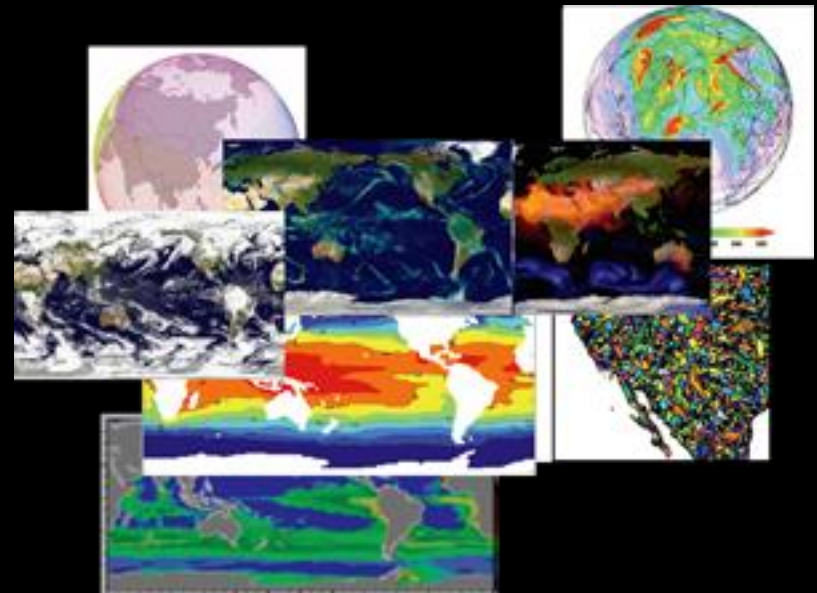


Pleiades

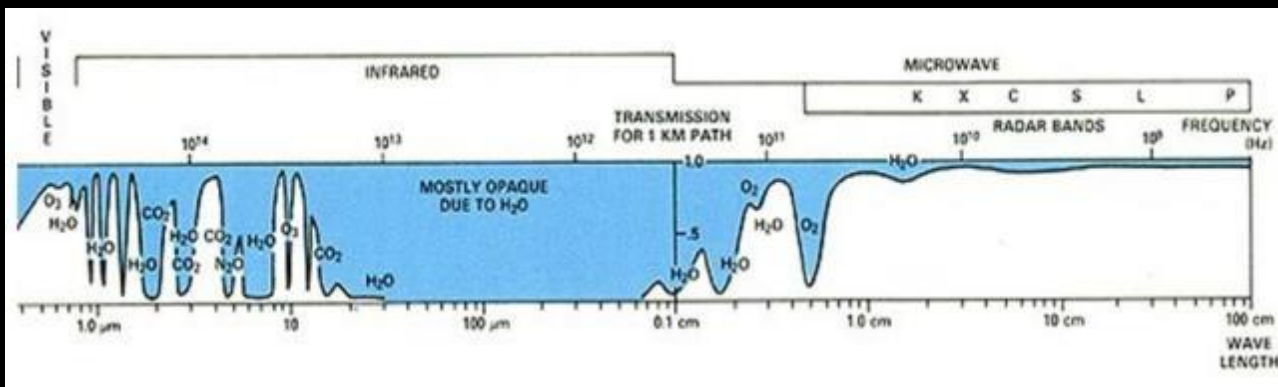
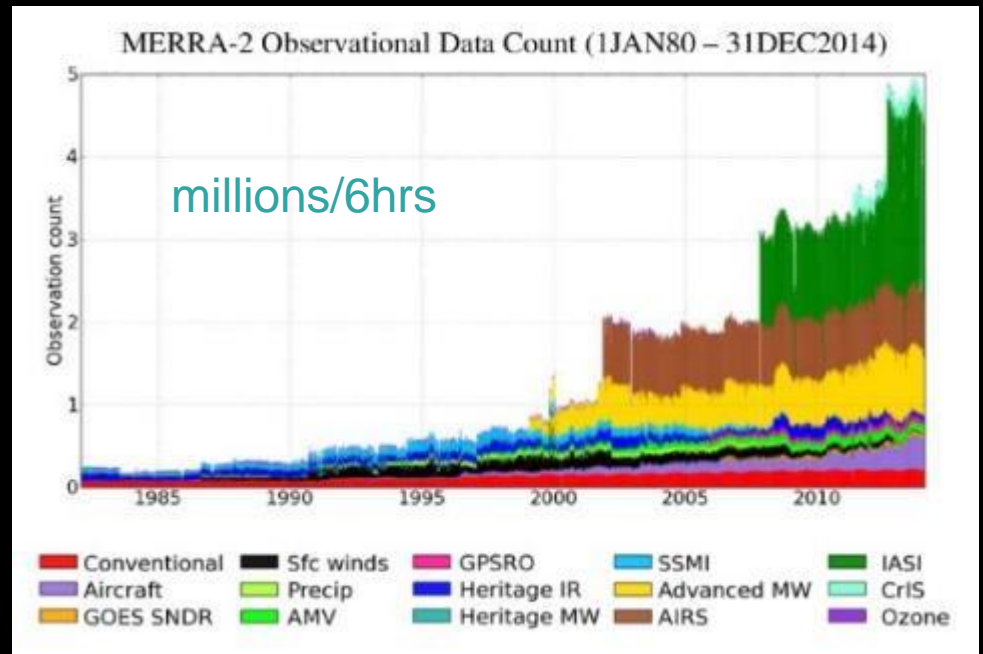
NASA's fastest supercomputer



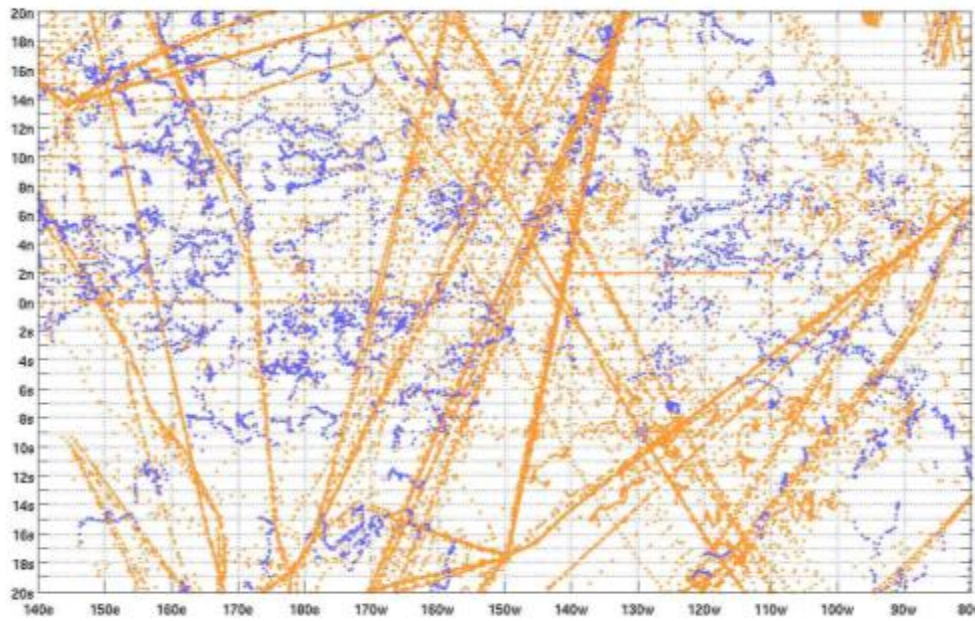
- ◆ state variables (T,S,U,V)
- ◆ grid
- ◆ continental boundaries and bottom topography
- ◆ domain decomposition
- ◆ parallel programming
- ◆ data storage and accessibility



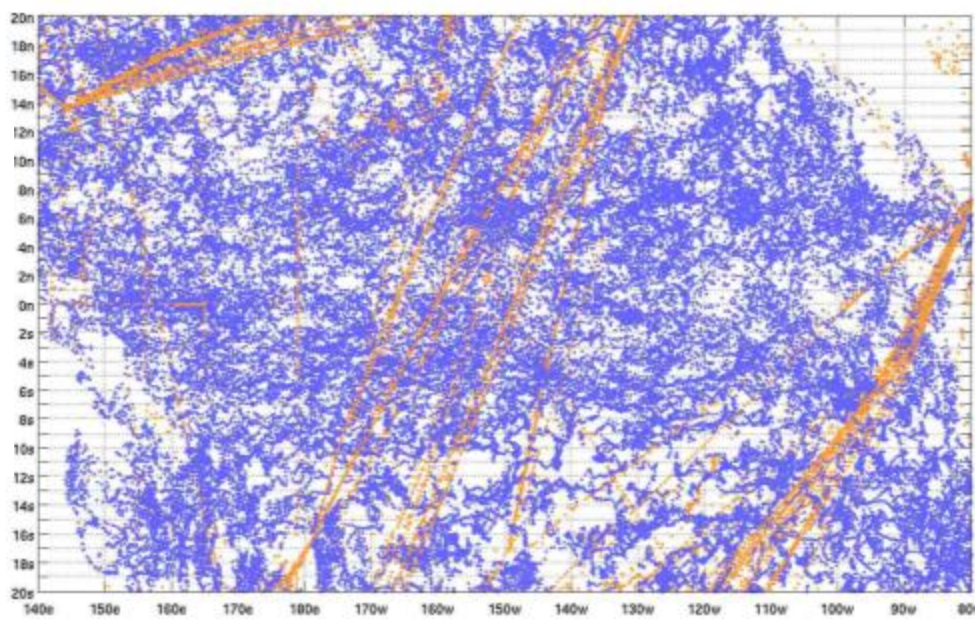
Remote sensing



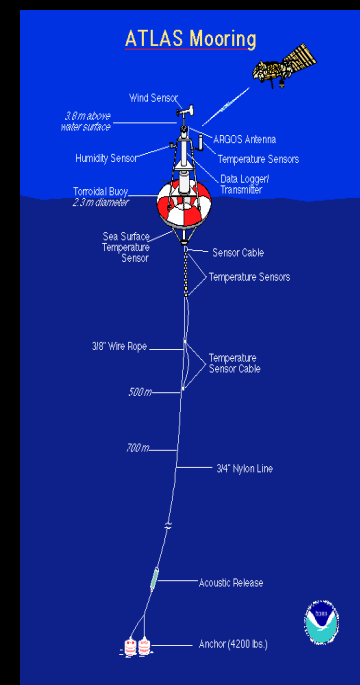
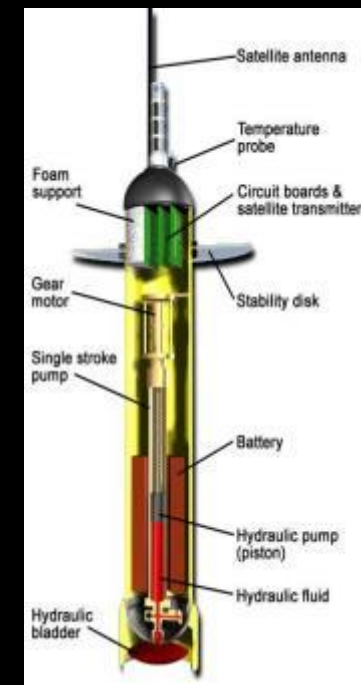
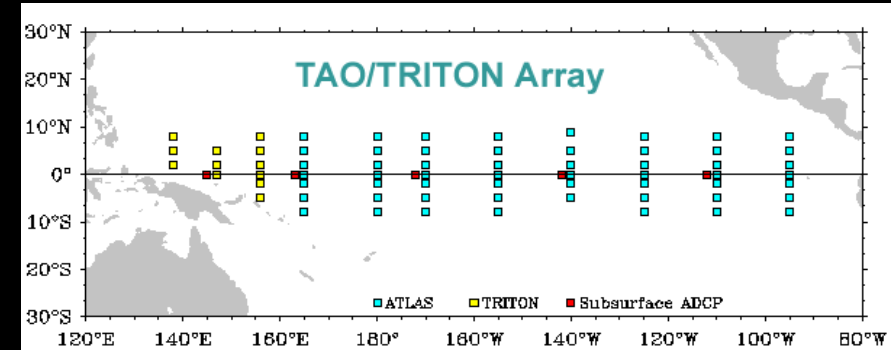
1999-2003: 5 years

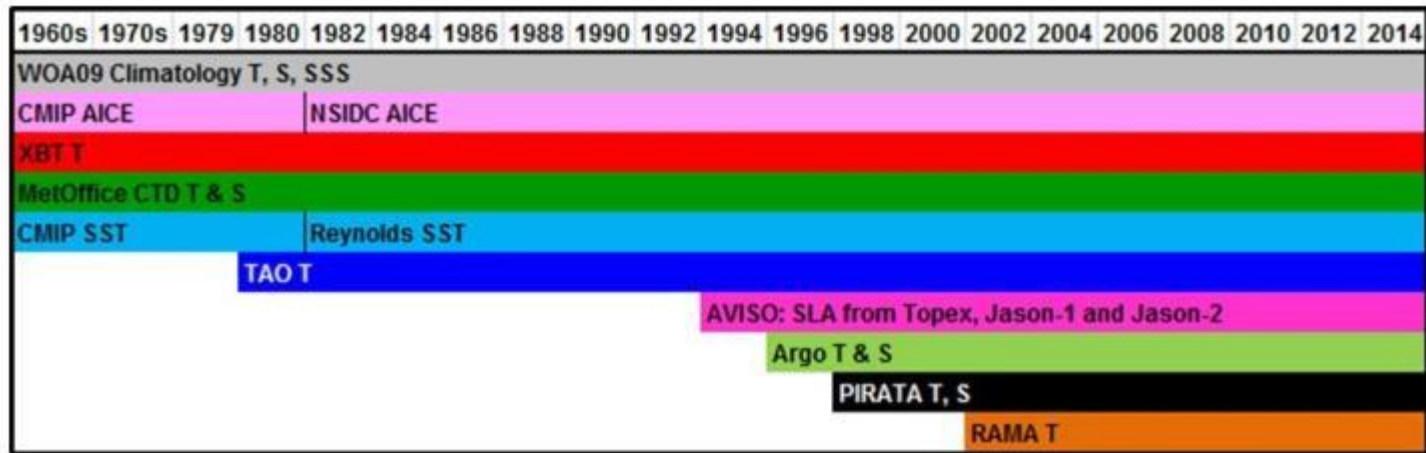


2004-2008: 5 years



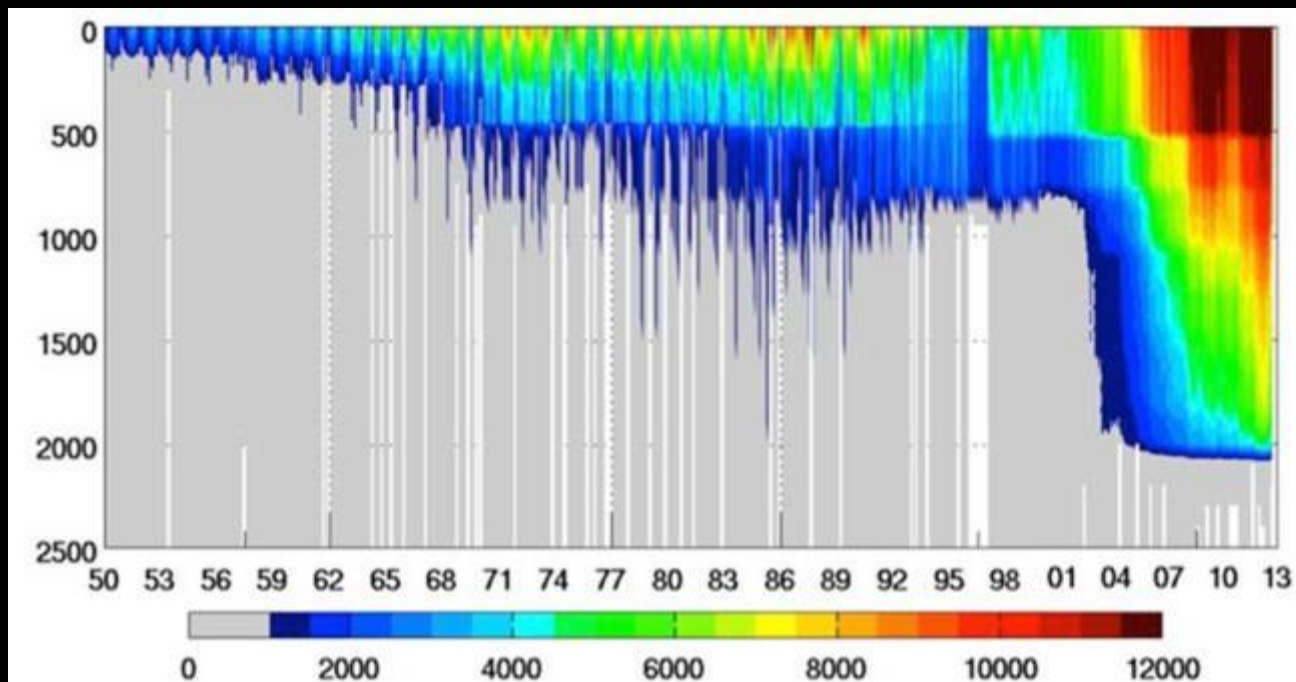
In-situ observing systems





surface
only

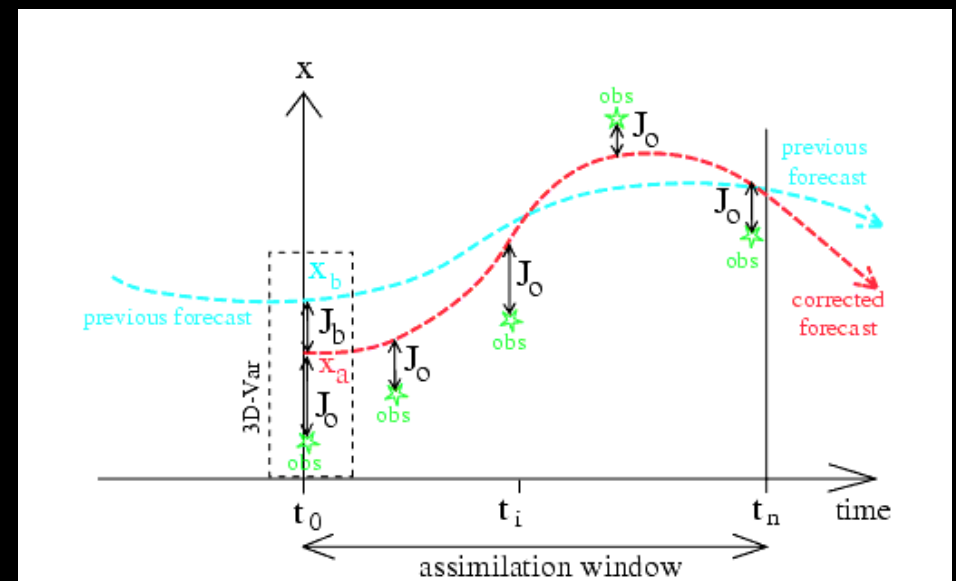
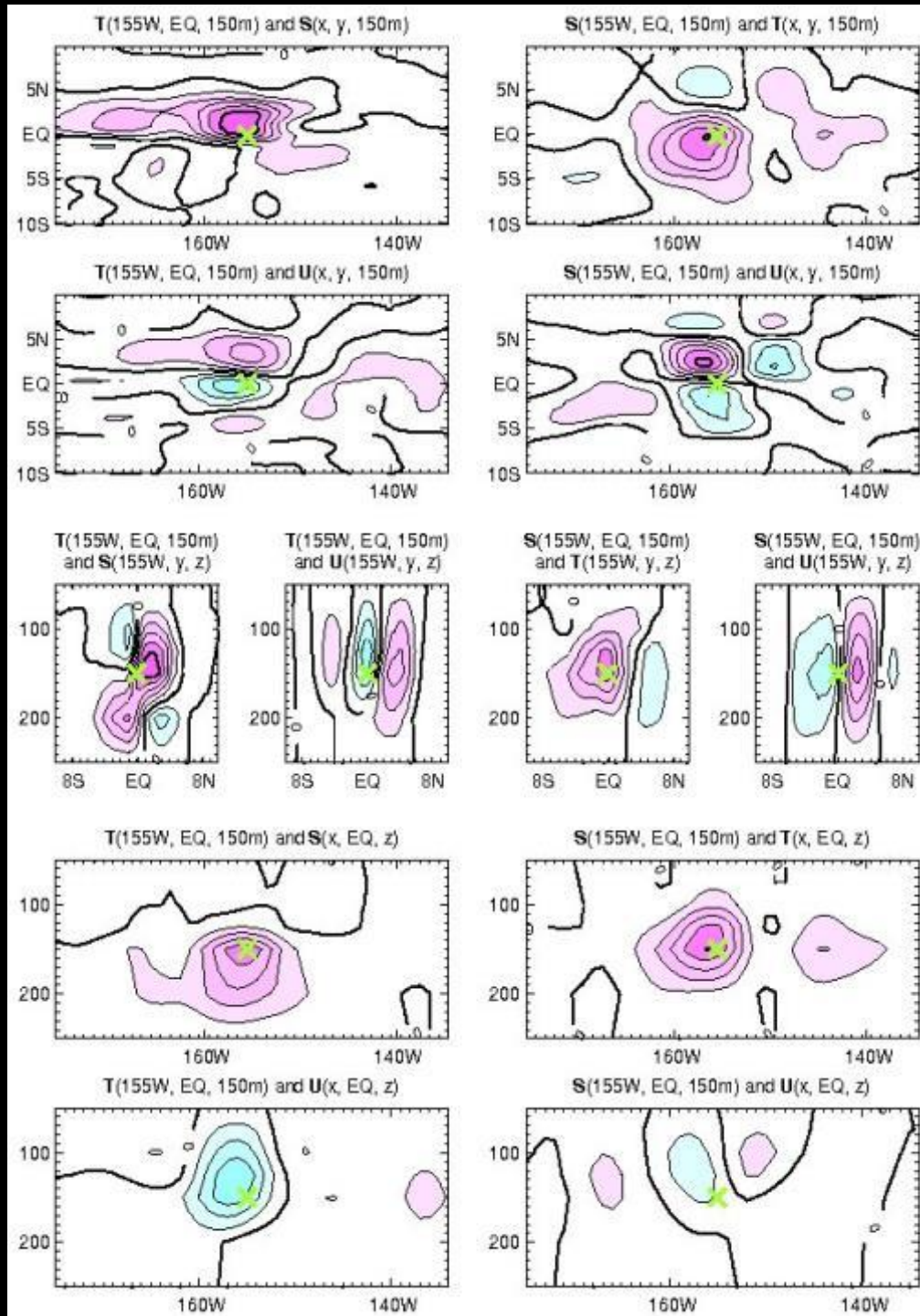
Evolution of the Observing System in iODAS



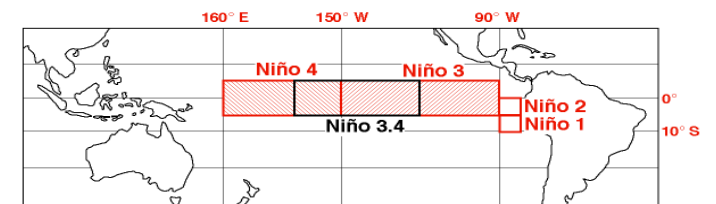
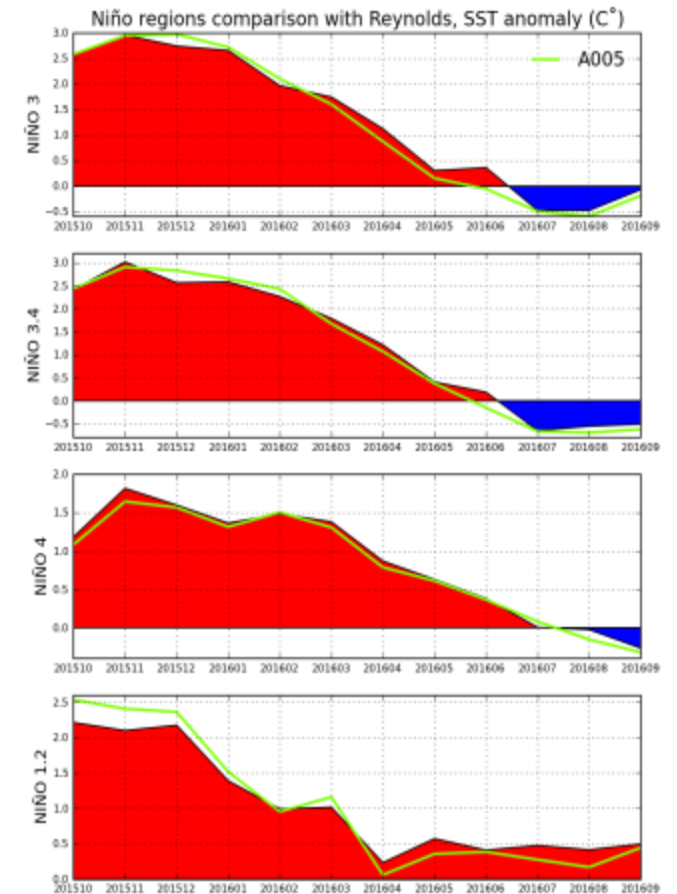
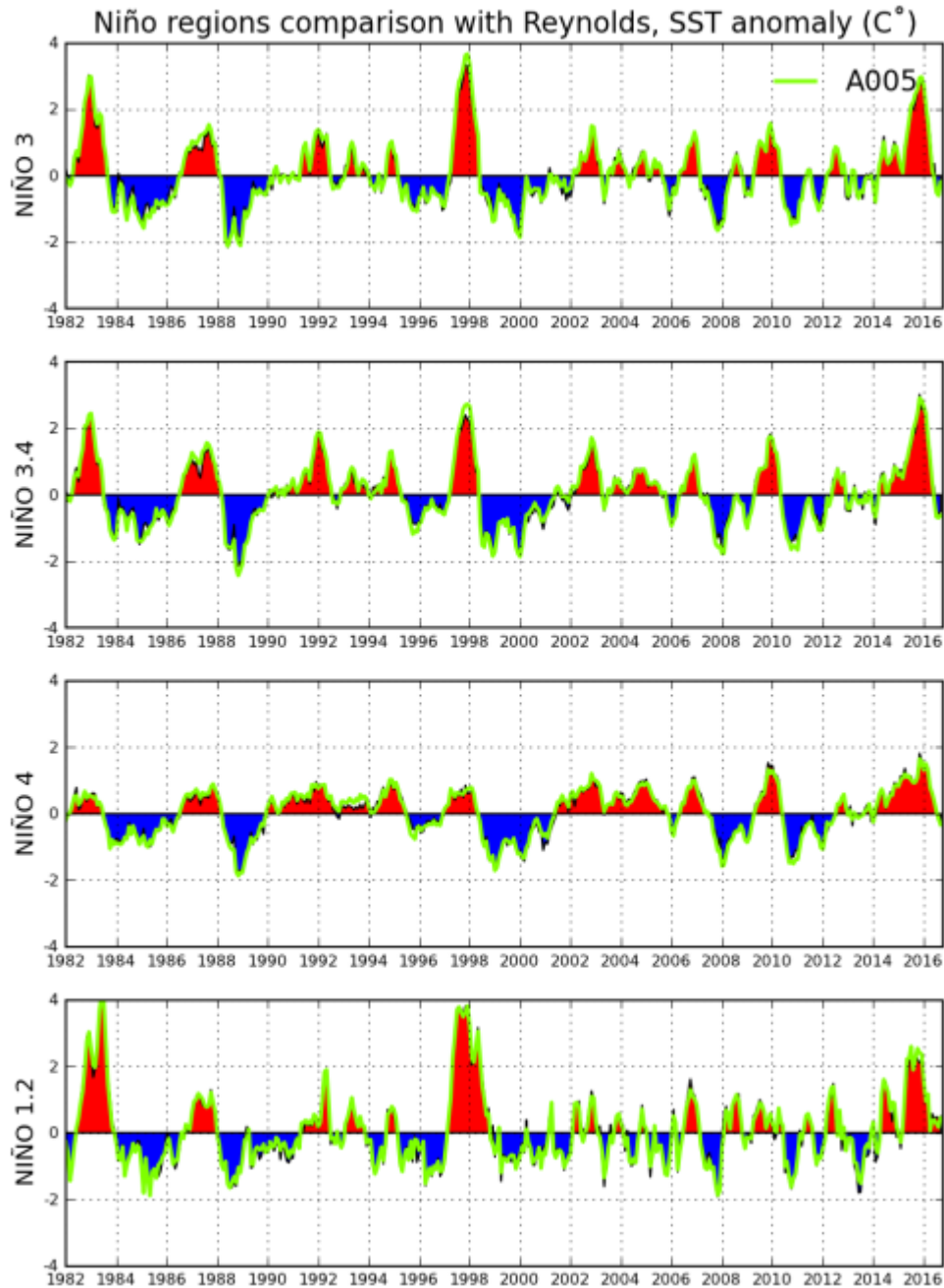
tens of
thousands
per month

Time-series of the number of *in-situ* temperature profiles per month as a function of depth

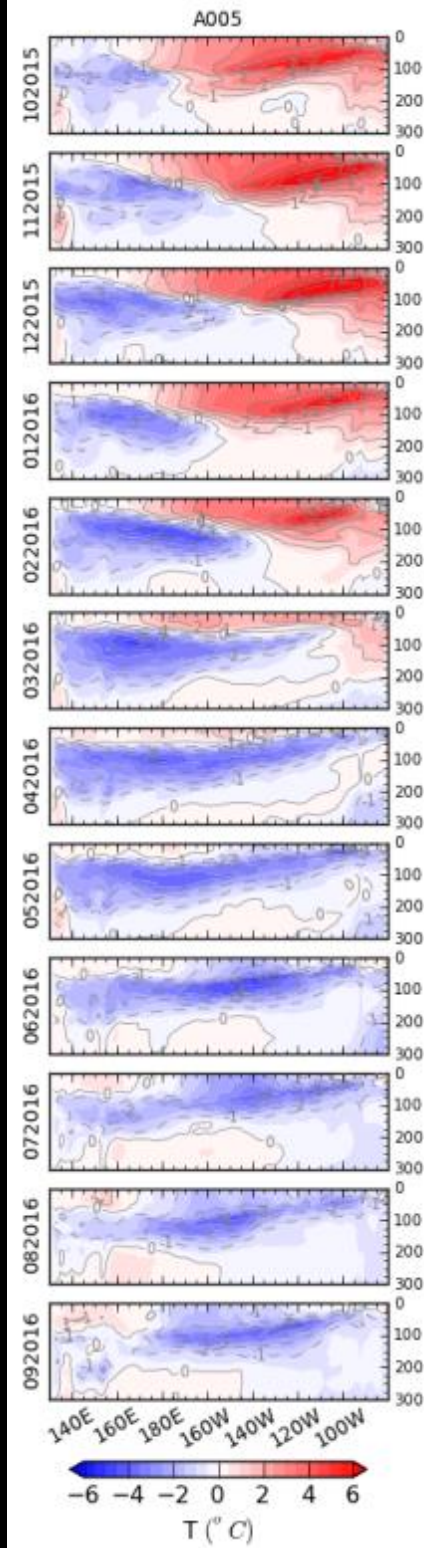
Data assimilation



Current El Niño conditions

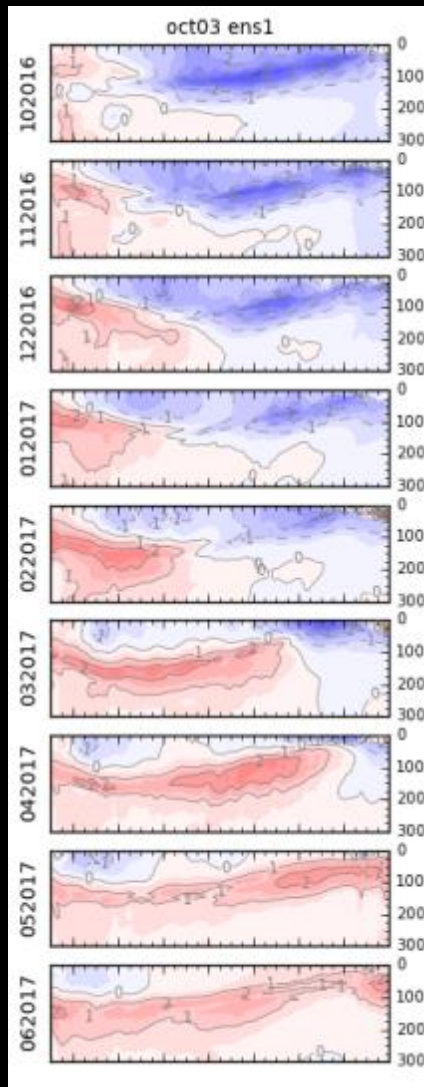


time

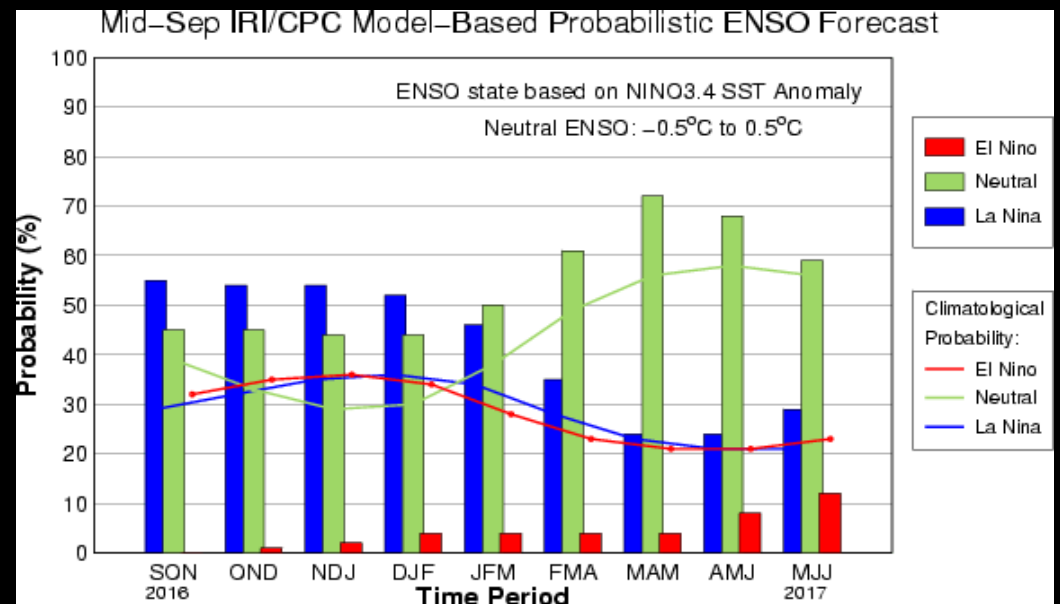
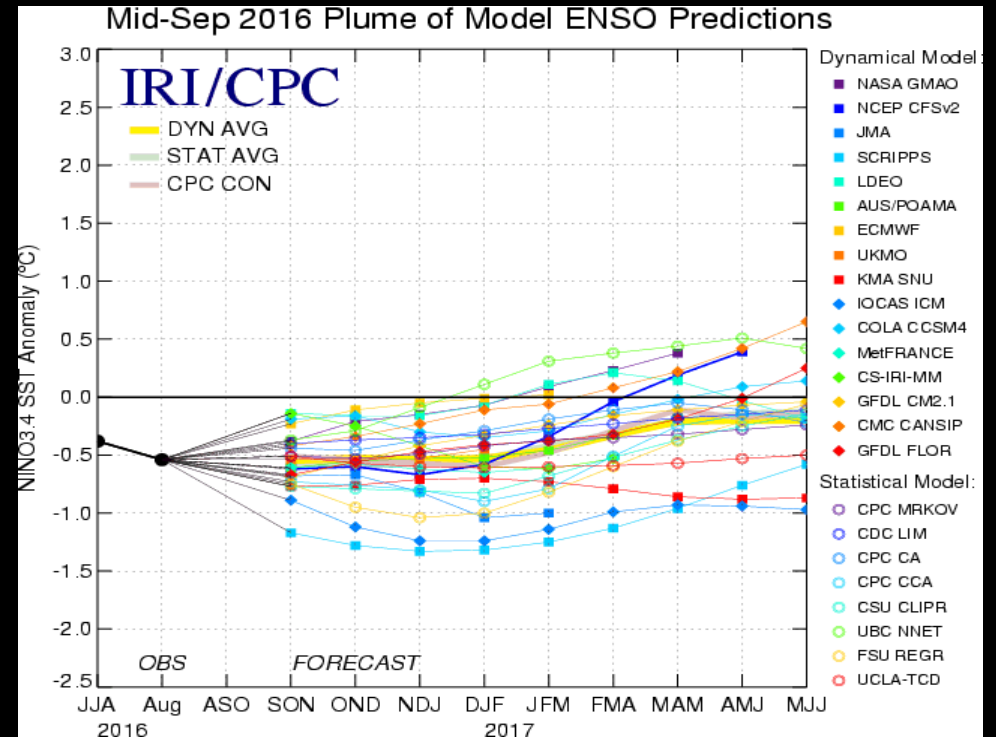


analysis

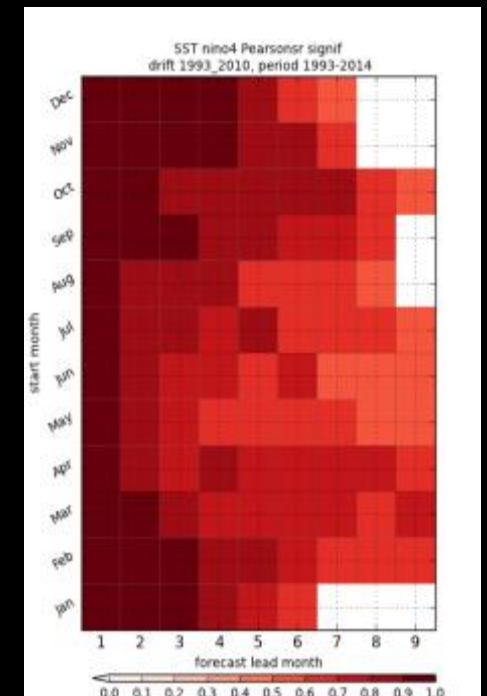
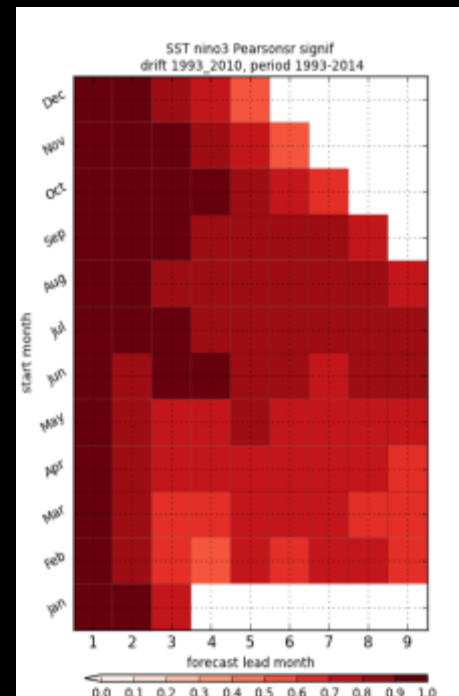
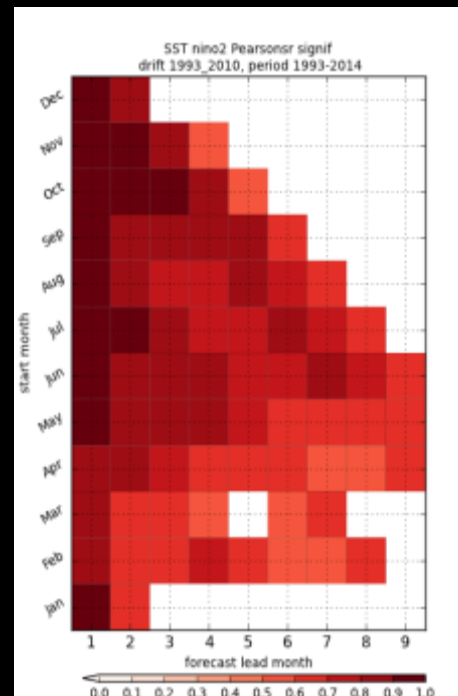
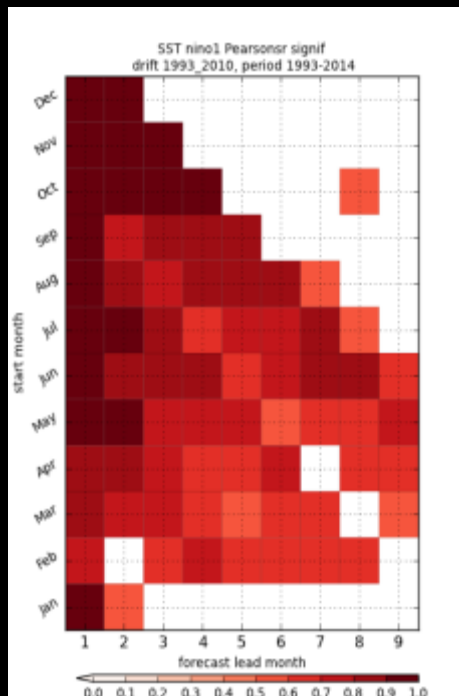
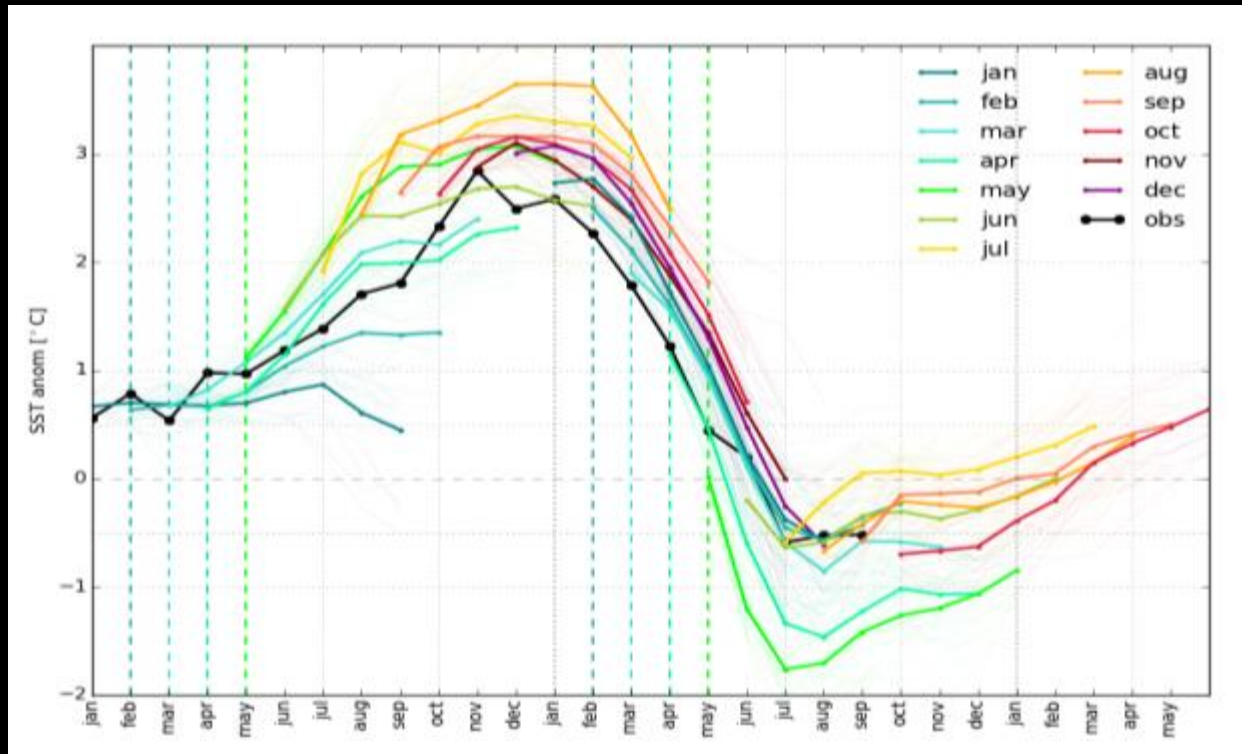
forecast

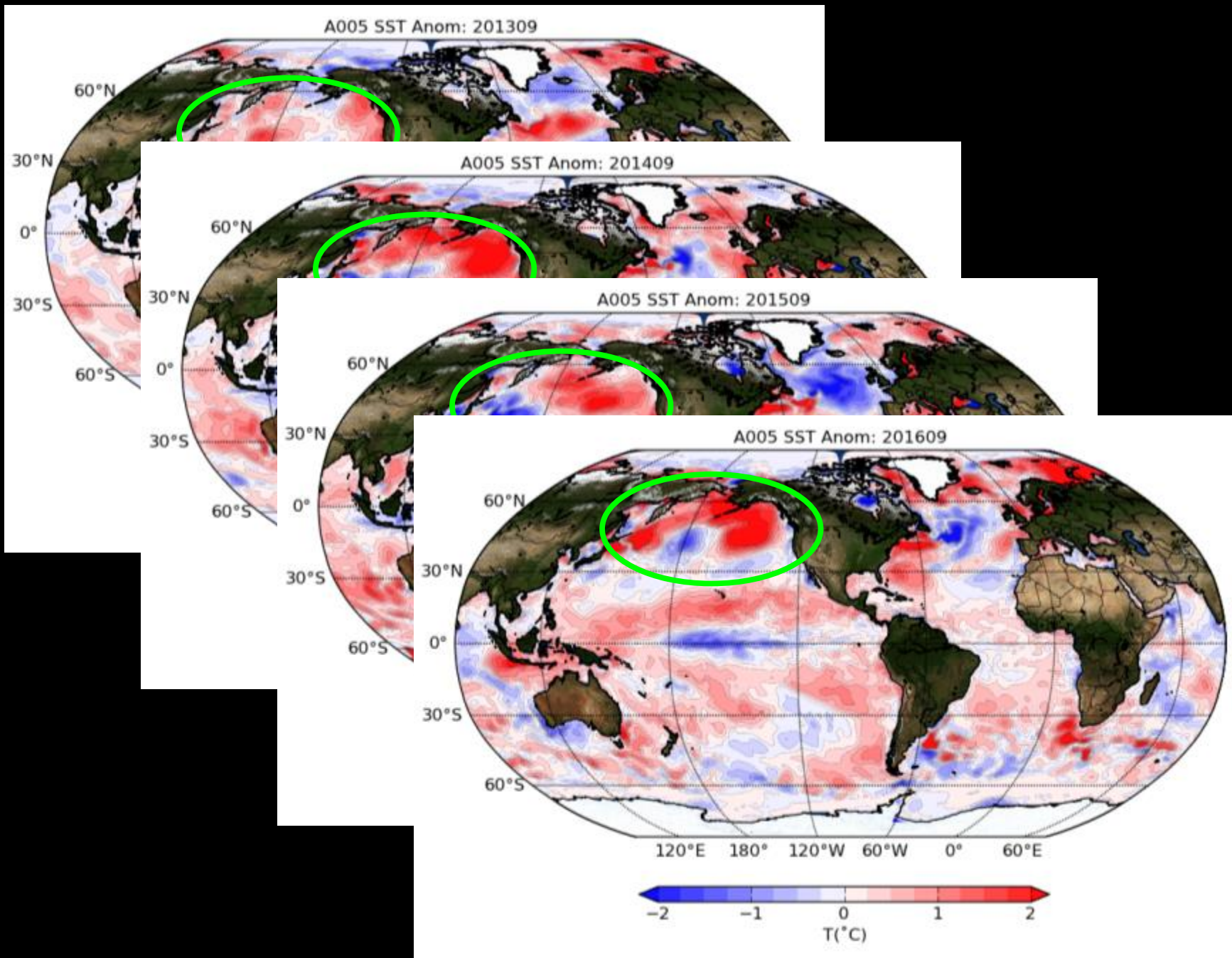


El Niño forecast



El Niño forecast







<https://gmao.gsfc.nasa.gov/>